March 1982
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80 microcomputing™

the magazine for TRS-80 users*

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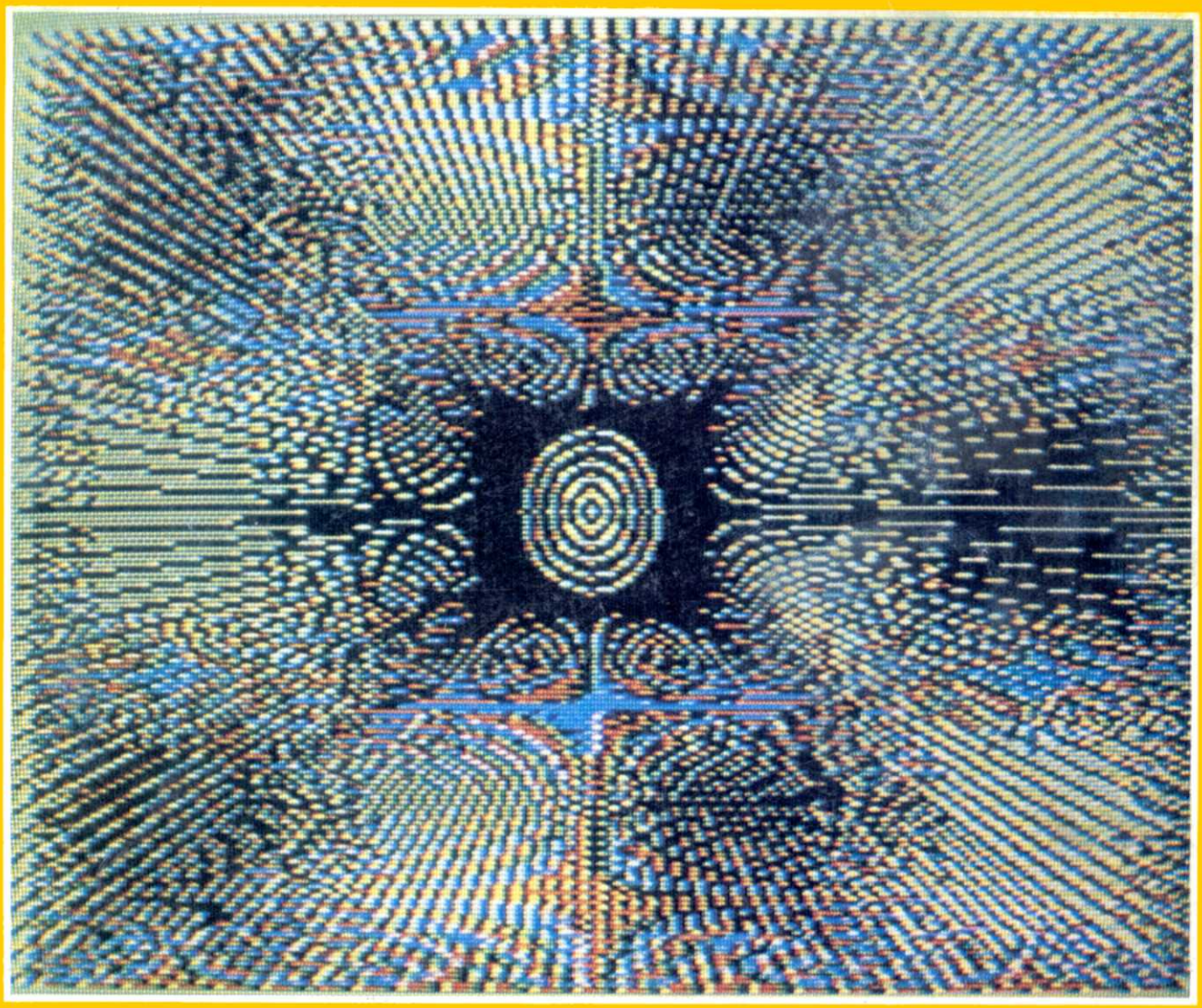

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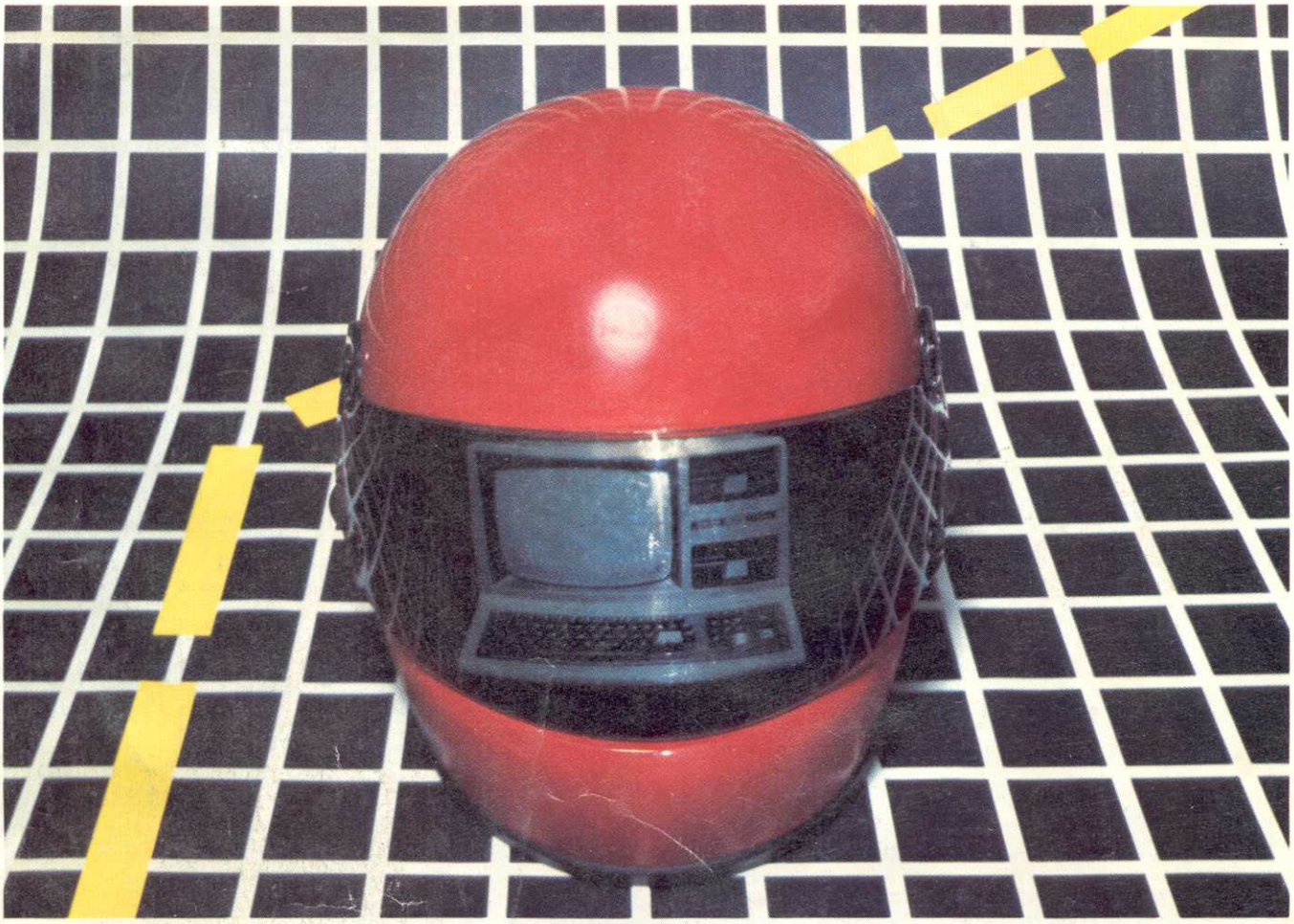

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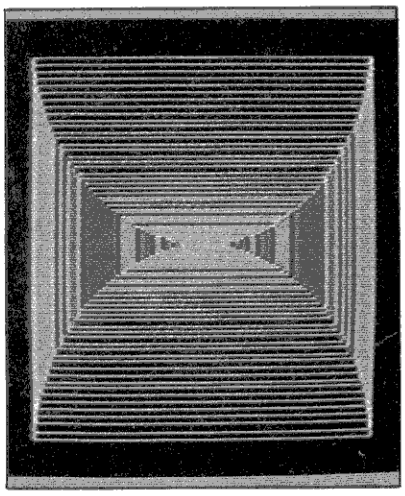

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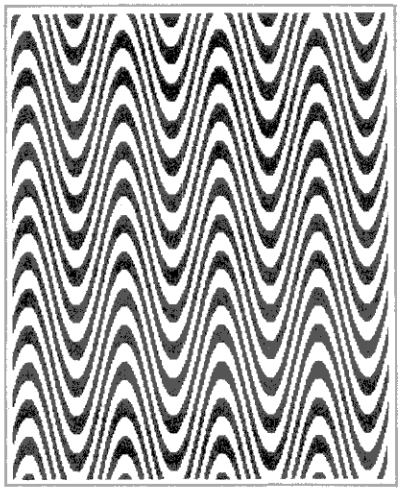

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Paid Audited Circulation

80 Microcomputing (ISSN -0199-6789) is published monthly by 1001001 Inc., 80 Pine St., Peterborough NH 03458. Phone: 603-924-9471. Second class postage paid at Peterborough, NH, and additional mailing offices. Subscription rates in U.S. are $25 for one year and $53 for three years. In Canada, $27—one year only, U.S. funds. Canadian distributor: Micro Distributing, 409 Queen St. West, Toronto, Ontario, Canada M5V 2A5. BC Canadian distributor: Graymar Data Services, Ltd., #4 258 E. 1st Ave., Vancouver, BC V5T 1A6. Foreign subscriptions (surface mail), $35—one year only, U.S. funds. Foreign subscriptions (air mail), please inquire. In South Africa contact *80 Microcomputing*, P.O. Box 782615, Sandton, South Africa 2146. All U.S. and Canadian subscription correspondence should be addressed to *80 Microcomputing*, Subscription Department, P.O. Box 981, Farmingdale, NY 11737. Please include your address label with any correspondence. Postmaster: Send form -3579 to *80 Microcomputing*, Subscription Services, P.O. Box 981, Farmingdale, NY 11737.

Cover Photo by Charles H. Freiberg
Graphics design by Kalvos Gesamte.

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80 REMARKS

by Wayne Green

". . . the main problem is prying the kids away from the computers long enough to do other activities."

Computer Camps

One of the first computer camps, started in Connecticut, was a roaring success last summer. Another is getting going in Vermont this coming summer. This seems to be an idea whose time has come.

As soon as our crew here at *80* heard about the camp idea there was a good deal of enthusiasm for starting our own camp this summer. After all, here we are in one of the top vacation areas of the country, with rivers, lakes and mountains on every side. Here, too, is a wealth of computers. In the Instant Software lab alone I found 25 different microcomputer systems which could be used for a camp.

Ah yes, but where do you house, feed, and keep campers busy with recreational activities in addition to immersing them in computer study? I found our two local colleges to be most interested in the idea. With two-week curriculums the colleges could handle up to 10,000 campers over a summer. That's a bit boggling, even for someone (like me) who thinks big thoughts.

Our New Hampshire lakes and mountains can handle 10,000 extra vacationers with no problem. Vacationing is the number one industry of New Hampshire. If you've ever been here you know why—the beauty is almost beyond description. In the summer temperatures remain relatively cool, particularly at night, so it's always pleasant.

Both colleges are ideally situated. One is on a 500-acre campus and the other on 800 acres. Both have lakes nearby, dormitory buildings and restaurants on campus.

While the camp's main purpose will be intensive computer study, there will be plenty of regular camp activities to keep the teenagers busy.

If you have any children 12-17 years old, two weeks at our New Hampshire camp could be the high point of their summer vacation. They'll be surrounded with computers and their fellow campmates will be computer fanatics. The cost of the two weeks is not yet firm, but it should be around $400 per week.

With microcomputers proliferating, if you have a son or daughter of camp age, this is a great opportunity to let them go on a two-week computer learning spree. While most camps organize games and sing-alongs to keep the kids out of trouble, at a computer camp the main problem is prying the kids away from the computers long enough to do other activities.

There will be courses in the fundamentals of computers, in Basic, Assembly and machine language, as well as in the use of utilities. Campers will be able to get a certificate of competence in the use of 25 different computers. This is an opportunity for them to learn the differences between the many systems.

Campers will, if they are interested, be able to work with the Instant Software crew evaluating programs for possible publication. Programs written during the camp can be submitted to Instant Software for publication. Who knows, royalties could easily pay the cost of the camp many times over.

"Anyone who can come up with a good diagnostics package . . . will find Instant Software exceptionally receptive."

Programs not quite up to par for Instant Software can be considered for publication in any of our five monthly magazines, the monthly Encyclopedia, or any of the 36 books scheduled to be published during 1982, with the income going to the camper. Our editors and the Instant Software people know what is needed so they can offer guidance on what programs should be written.

If you have a teenager interested in the Green Computer Camp, drop me a line and let me send you full information on it. The camp, not far from Peterborough, NH will be a blast. Note: no smoking, alcohol or drugs. This is a computer experience, not the usual teenage bash.

There will be swimming, hiking, mountain climbing, and other physical activities. There will also be benchmark tests of computers as word processors and evaluations of well known game programs. This is the experience of a lifetime! ■

A Half Million Here

The gravy train—you can be on it if you come up with a program that every TRS-80 owner needs. Now what kind of a program would *every* owner want to buy? The idea is simple (as are so many of the really big money makers).

What we all need is a set of diagnostic programs for the TRS-80. Every now and then something either goes wrong or may have gone wrong. When you aren't sure, a program to let you know that your system is okay would be worth its weight in gold. If the program could identify the more common problems that would be a plus.

Anyone who can come up with a good diagnostics package for checking out our TRS-80s will find Instant Software exceptionally receptive. The program should test the memory and report on any bad chips. It should check out the peripherals, as well as the CPU. Such a program should sell around a half million copies if it is well-written, and marketed by a publisher with the resources to really get it spread around.

If you have something along this line or can write such a program, you can do worse than contact Instant Software. ■

Tandy Boosts Industry

While many people seem to be critical of the Radio Shack folk for some of their service and sales policies, if you put these into a long-range perspective, they are certainly pro-microcomputing. Tandy marketing policies, which at first glance often appear to be self-serving and protective, are in reality most beneficial to the entire industry.

←Reader Service for facing page ✓30

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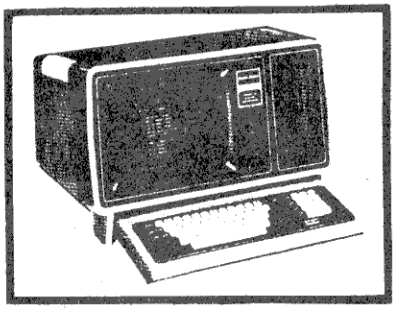

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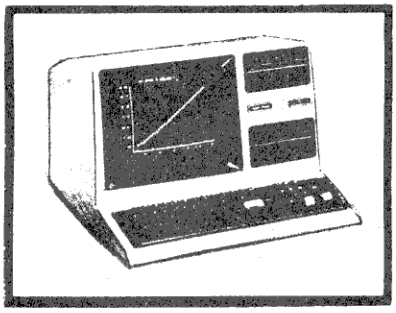

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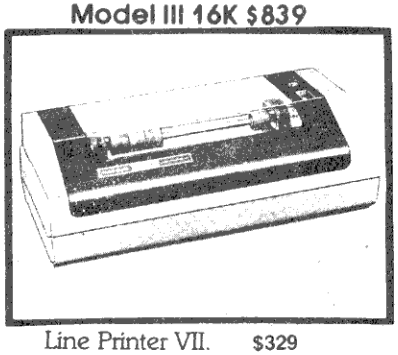

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For instance, rather than force TRS-80 owners to buy anything more than the basic unit at Radio Shack stores, Tandy has arranged it so over 99 percent of the software available for their system must be purchased from independent computer stores or mail order firms. What could be fairer than that? And, by keeping the choice of accessories and peripherals in Radio Shack stores to a minimum, again they are working to the advantage of non-Radio Shack stores.

Take the matter of books—with only a tiny fraction of the published material available in their stores, they are forcing their customers to seek the information and help they need from neighboring computer stores. You want a magazine? None whatever are available at Radio Shack, so for up-to-date computer information and programs the Tandy owner must go to an independent computer store. Even this publication, which takes up Radio Shack documentation where their own documentation leaves off, is *only* available outside of Radio Shack stores.

"While many people are critical of the Radio Shack folk for their service and sales policies, put into long-range perspective, they are certainly pro-microcomputing."

By keeping the Radio Shack produced programs to a minimum, owners have no choice but to look around for other sources. They quickly find local computer stores which provide the program and peripheral support not available from Radio Shack. They also discover Apple computers and other systems, which may to some extent explain the incredible increase in Apple sales in proportion to TRS computer sales in recent months (and this despite the Apple III debacle).

The Instant Software ads often list the independent computer stores which carry programs, magazines, books, and peripherals. These stores are often a valuable source of information as well, since they are in the computer business 100 percent, not just carrying a small shelf of computers in amongst hi-fi, auto sound, CB and so forth like most Radio Shacks.

With around 6,000 stores, Radio Shack does have a serious problem finding technically expert people to sell and service computers. Computers are still a minor item for most stores, so it is often difficult to get the help most businessmen need to make relatively expensive buying decisions. Few Radio Shack store people ever see this magazine and other supporting publications, or the wealth of books on the TRS computers, so they are understandably short on information about their product.

Is this all a short-sighted not-invented-here policy? Or is it a long range strategy to keep Radio Shack from getting into some of the problems IBM has had in the past? By forcing TRS-80 owners to go outside Radio Shack for more and more of their purchases, Radio Shack certainly is making it difficult for any competitor or the government to claim they are monopolistic. With only about one percent of the software support for the TRS-80 available from Radio Shack, how can any firm sue for restraint of trade?

By the time you add in the computer sales via mail order from Radio Shack stores which are not factory owned, the outside sales of computers, programs, peripherals, magazines and books, you have a substantial part of the total potential Tandy income going via this outside route.

Will this Radio Shack policy pay off in the long run? Independent computer store owners are hoping so, for this provides them with a way of cashing in on the Radio Shack onslaught—a way which may eventually allow them to make much more than Radio Shack from every computer sale as customers discover the wealth of programs and information available outside of Radio Shack.

Another big plus for Radio Shack is the change in attitude which their largess has brought about in many independent computer stores. When Radio Shack was perceived to be trying to keep all the income to themselves, the stores reacted with anger and harsh words. The TRS-80 was called the Trash-80 and sneered upon. Today you don't hear that much. Today you hear the dinging of the cash register as TRS-80 programs are sold by the bag full. You see satisfied smiles as customers walk out with magazines and books on the TRS-80. You see printers, memory, modems and so forth being fitted to systems by happy customers. Indeed, the wealth of plug-in accessories for the computers is beginning to rival those for the S-100 bus, with virtually none available through Radio Shack stores. Trash-80? No, it's the Cash-80. . .and huzzahs for the enlightened Tandy policies. ■

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Judging from the response we've had from our readers in the past, computer graphics holds a fascination all its own. It's reckoned that 95 percent of human sensory input to the brain comes in through the eyes, providing a plausible explanation for why so many people derive so much pleasure from graphics displayed on a video monitor. Not that the video monitor has much to do with it; after all, television stations use the same output device, but in nearly all cases (and on nearly all channels), the computer can be more useful and entertaining.

Computer graphics are being used to create some of the most stunning visual effects you're ever likely to see. These visual effects range from cross-sections of machinery such as the space shuttle, to a simulated journey through the Star Gate in the movie "2001, A Space Odyssey." The landing sequence in which the spaceship Nostromo lands on the surface of an unknown planet during the movie "The Alien" is another fine example of computer-generated graphics.

The TRS-80 Color Computer users amongst us are lucky—we get a hands-on feel for these exciting new graphics techniques to a greater degree than other TRS-80 users. Some will argue that computer-aided graphics is not so new, but compared with the art of hand-drawn graphics, it has only just arrived. We have eight colors and a matrix of up to 256 by 192 pixels in varying combinations at our disposal. That's a total of 49,152 video dots, enough for anyone to get their feet wet in the world of computer graphics, either to design a new piece of machinery or create a work of art.

In this issue we'll be presenting plenty of graphics-related topics. Be sure to look at "The Editor's Choice," an offering of color graphics from our editors which are sure to entertain you for many hours, and perhaps inspire you to new heights of creativity. "Conversion Diversion" by Roy Oreen puts Bob Boothe's wonderful Mod I graphics on the Color Computer. And for those of you who haven't yet taken the plunge into color, we have several black-and-white graphics offerings, most notably "Mirror Imagining" by the master himself, Bob Boothe. Anyone with any inclination towards graphics and programming should find plenty of active inspiration.

One of the more interesting aspects of any graphic art is the technique an artist uses to create an effect by overcoming the limitations of the medium he's using. For instance, there's no way a painter can make light shine forth from a canvas (short of using luminous paint), but glorious painting techniques have evolved from surmounting this problem. Similarly, computer graphics has inherent limitations, such as a two-dimensional static display comprised of a grid of dots or lines. Yet, we see successful attempts to represent three-dimensional images which move in time and space.

Some of these attempts are so astounding that even the most mundane graphics subjects take on a strange new aesthetic appeal. A three-dimensional model of a crystalline molecular structure becomes a fascinating visual experience as it revolves before your eyes. An unbuilt city, still on the drawing board or yet in the mind of its designer, appears as if truly on the monitor in front of you. Buildings and skyscrapers dance before your eyes, as nothing less than a computer program analyzes and displays the scene from your imaginary point of view. These are not just flights of fancy—they exist now in the field of computer-aided design as implemented on some minicomputers. The challenge for many will be to achieve similar results with microcomputers.

Graphics are not only being used in the kind of modeling situations I've just described, but in purely artistic situations where it's a case of art for art's sake. We have a few examples in this issue, but don't just read the articles. Try the examples and see for yourself how your computer can be a futuristic art gallery. *This* is where the field offers exciting possibilities. New techniques are being uncovered in the synthesis of video art; for instance, using a combina-

Continued on page 387

The left bracket, [, replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in *80 Microcomputing*, you should make this change.

80 formats its program listings to run 64-characters wide, the way they look on your video screen. 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: Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include a SASE for a copy of our writers' guidelines. Payment for accepted articles is made prior to publication, at a rate of approximately $50 per printed page; all rights are purchased. Authors of reviews should contact the Review Editor, 80 Pine Street, Peterborough, NH 03458.

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  - Example: Select records representing those sales made to XYZ COMPANY that exceed $25.00, between the dates 03/15 and 04/10.

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BELOW ARE TESTIMONIALS from owners of AIDS systems. These are absolutely authentic statements and are typical of the comments we receive.

"This program will do more for my business than all the other programs I have, combined."
David Wareham, Vice President (EDP), National Hospital and Health Care Services Inc.

"We have 32 different Data Base Management packages for the TRS-80. AIDS-III is easily the best. It also makes it easier for us to step up to our Model II since the package is available for both computers."
Jack Bilinski, President, 80 Microcomputer Services

"Your AIDS program is far and away the finest information management system that I've ever seen. I am currently using it to maintain a clear picture of the demographic data on all the kids in our residential treatment program and it is working for me superbly."
Frank Boehm, Director, Front Door Residential Treatment Program

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80 INPUT

"We all know the golden rule with computers is, 'make backups, backups and more backups.' "

Winged Samurai

Thanks for the favorable review of our game Winged Samurai (*80 Reviews*, August 1981). The review leaves the impression, however, that Winged Samurai is only for the Model I. Since July all of our Squadron Leader series games have been compatible with both TRS-80 Models I and III, as well as eight other computer models.

The response to the review has been very gratifying. It is clear that *80 Microcomputing* has a large influence in the marketplace. We will certainly keep you informed of any new releases.

David A. Wesely
Discovery Games
Saint Paul, MN

Accel2 vs. Microsoft Compiler

In his review on page 38 of the November 1981 issue of *80 Microcomputing*, Mr. Douglass mentioned a problem of the execution of Read statements when using Accel2-compiled programs. The solution is to use the entire Accel2 compiler as the run time package.

Also, it is necessary to compile and run a dummy Basic program before trying to run the compiled program (I use the Basic program to set the USR addresses for this). This information was in the documentation I received with the compiler.

I would like to make four additional comments on the Accel2 compiler as compared to the Microsoft compiler:

Accel2 is much more difficult to use. For a non-trivial program (current version of my Word Processor, *80 Microcomputing*, May 1980), Microsoft required a few minor changes, adding a half-dozen lines to the program. Accel2 required complete rewriting and restructuring, adding over a hundred lines to the program. In addition Accel2 will hang or give meaningless error messages (for example, syntax errors in non-existent line) if changes from normal Basic are not made.

Accel2 expands a program more than does Microsoft. My Word Processor held 420 text lines as a Basic program on a 48K disk system. This was reduced to 155 lines with Microsoft, and to 130 lines with Accel2.

Accel2 does not speed up a program as much. It compiles about 30 Basic statements, leaving about 50 plus all disk statements uncompiled. It does not speed up the time-consuming string garbage collection pauses, as does the Microsoft compiler.

Accel2 compiles slowly. My Word Processor required about 30 minutes, compared to about 10 minutes with Microsoft. On the plus side, all compiling is done in memory, without the disk snuffling needed by Microsoft.

Accel2 does have two advantages: Its compiled programs will run under the improved disk operating systems (such as NEWDOS80) if they are compiled under that system, while Microsoft requires TRSDOS for proper disk file handling. Also, Accel2 does not have the Microsoft royalty problem.

In my opinion, for compiled programs for your own use, Microsoft is generally superior.

Delmer D. Hinrichs
Washougal, WA

Snapp's XBasic

I read with great interest the review of Snapp's XBasic by Mr. Rick Lederman. Mr. Lederman missed one vital aspect of XBasic (as well as other Snapp Programs) that I believe *must* be pointed out to any prospective buyer. The original disk (called the distribution disk *cannot be backed up*! If you should destroy this disk, you need to go to Snapp for a new distribution disk to implement Snapp on any new disks.

Currently, I believe, the cost for a new distribution disk is $10. But, after spending $200, why should you spend an additional $10, or even 1¢ for that matter? What happens to the buyer who destroys the original disk after (if) Snapp goes out of business? If Snapp stays in business, how much will a replacement cost next year—$15? $20 the year after? What if Snapp decides not to support your "old" program?

We all know the golden rule with computers is, "Make backups, backups and more backups." Well folks, with Snapp, you cannot make any! While Snapp has some very good programs, I will not buy any I cannot backup.

Barry L. Patterson
Farmington, NY

Snapp Responds

I fully agree that a software purchaser should obtain unrestricted use of the product.

There are two distinct types of Snapp Basic disks: distribution masters and working copies. Distribution masters can be used only to create working copies, and working copies can only be created from a distribution master. Given that a distribution master may be used to create an unlimited number of working copies, we feel that our customers do obtain unrestricted use of our products.

If a customer has a serious concern about our ability or willingness to provide him with a replacement distribution master, we normally suggest that he make a large quantity of working copies immediately upon receipt of the distribution master.

Robert F. Snapp,
President
Snapp Inc.
Cincinnati, OH

Centronics 739

Michael Vose's review of the Centronics 739 printer (*80 Microcomputing*, December 1981) missed some items which make this printer incompatible with its earlier version, the Centronics 737 (Radio Shack LPIV). The differences are minor

Continued on page 16

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Balance forward calculations (Ex: Gross sales equals previous gross sales + sale amount + sales tax)

User-specified Columnar Totals

```
==============================================================
CUSTOMER ACTIVITY REPORT                                PAGE 1

CUSTOMER DATE QTY      SALE AMT    SALES TAX GROSS SALES $/UNIT
======== ==== =======  ===========  ========= =========== ======
                                                     0.00
ACME     3/10     100      675.00       37.13      712.13   7.12
                  200     1325.00       72.88     2110.00   6.99
         3/20     400     2475.00      136.13     4721.13   6.53
         4/10     600     3625.00      199.38     8545.50   6.37
         4/20     400     2600.00      143.00    11288.50   6.86
                -------  -----------  ---------
                  1700    10700.00      588.50

META     3/10     200     1345.00       73.98    12707.48   7.09
         3/15     100      674.00       37.07    13418.55   7.11
                  200     1295.00       71.23    14784.77   6.83
         4/05     400     2435.00      133.93    17353.70   6.42
         4/10     150      935.00       51.43    18340.12   6.58
         4/20     600     3585.00      197.18    22122.30   6.30
                -------  -----------  ---------
                  1650    10269.00      564.80

OURCO    3/25     200     1325.00       72.88    23520.17   6.99
         4/10     100      685.00       37.68    24242.85   7.23
                  300     1940.00      106.70    26289.55   6.82
                -------  -----------  ---------
                  600      3950.00      217.25

XYZCO    3/10     150      995.00       54.73    27339.27   7.00
                  200     1345.00       73.98    28758.25   7.09
         3/20      50      355.00       19.53    29132.77   7.49
         4/10     300     1975.00      108.63    31216.40   6.95
         4/15     400     2520.00      138.60    33874.00   6.65
         4/20     700     4175.00      229.63    38279.62   6.29
                -------  -----------  ---------
                  1800    11365.00      625.08

                =======  ===========  =========
                  5750    36284.00     1995.62
                =======  ===========  =========
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80 AID

Circuit Help

I do not understand part of the circuit drawing accompanying Ian Sinclair's article "Hard and Soft Printware" (*80 Microcomputing*, October 1981). His use of the two 680 microfarad, 25V capacitors confuses me. Does the 741 op amp increase voltage or do I need to include a transformer in this circuit? I am not an electronics technician, but I can follow directions. Why a 25V 1 Amp rectifier in a circuit power source of .86V?

Roger W. Wincek

Ian Sinclair Responds

The smoothing capacitors can be any value around 680 μF, because the value is not critical. They should be rated at 25V, and connected the correct way round, however. The reason for using a 25V rectifier is that this circuit obtains its operating voltage from the TRS-80 power lines, which the rectifier rectifies. Mr. Wincek is confusing signal voltage input with supply voltage input.

Incidentally, the software is designed for printers which can be switched to provide line-feed for a carriage return signal. I believe that a few printers of older design do not have this feature. I cannot, unfortunately give a fix for that problem, since I no longer have a TRS-80.

Ian Sinclair
89 Alexandra Road
Sible Hedingham
Halstead, Essex
England C09 3NP

Sporting TRS-80

I have been helping with a sporting event and my biggest problem has been one of entering the times and printing the results.

I am looking for a program, like VisiCalc, into which I can pre-enter the competitors' names, numbers and clubs. I could then enter the time against the name and step down to the next competitor with the cursor.

The next step would be to sort the times into performance order, i.e. with the fastest on top. Competitors who registered but did not compete would have a zero time. Since there is not sufficient time to delete the entry a heavy character would be needed to drop the non-competitors to the bottom of the list. Alternately there should be a way for the operator to select a range for the printout. To print the results efficiently it would be ideal to load the results into a word processor and to format the files as in typesetting.

Most commercial data bases require a large number of keystrokes to alter one field in a record and this takes time. The ones that allow the files to be put into word processors are especially slow for single field entries.

Microfiles are convenient but they do not handle range or selected records nor will they work with a word processor. Can any sports enthusiast help?

Derek Trayler
88 Grosvenor Drive
Hornchurch
Essex RM11 1PW
England

TRS-80 Answering Machine

I am looking for information regarding using my TRS-80 as a TTY terminal and answering machine. I am profoundly hard of hearing, and like other hearing-impaired and deaf people, use a TTY for telephone communications.

In California, telephone companies must provide free TTY devices to all qualifying individuals, and I am able to take advantage of this law. However, answering machines for TTY are very expensive, and since I already have a TRS-80, I would like to use it to serve these functions.

Pacific Telephone has been less than helpful when I have inquired about interfacing my computer to TTY. They told me that information such as baud rate, modem frequencies and the Baudot coding was proprietary information! And so far, I have not found the answer to my problem in the microcomputer magazines.

"Answering machines for TTY are very expensive."

According to the U.S. Government, there are nearly 20 million people in this country with hearing disabilities, of which only two million are considered "deaf." However, even people with moderate hearing losses have difficulty with the telephone, and the market for a device or program which allows the use of a personal computer as a TTY device would appear to be a large one.

By the way, my TRS-80 is 48K, with two disks and printer. I am a professional computer systems consultant with over 22 years in the data processing business, so I could write the necessary programs, if I could get the basic information. But like many other programmers, I am not interested in reinventing the wheel; if there are products available that already do the job, I would rather buy what I need "ready-made."

Dick Burkhalter
Diverse Developments
2203 West Olive Avenue
Burbank, CA 91506

Pure CHR$

I do not have a patch for Rolf Roethlisberger ("Model II Tabs", *80 Aid*, December 1981), and others who cannot send CHR$(9) to their printers through their Model IIs, however the solution may have been given to me by David L. Miller, Radio Shack Marketing

Continued on page 16

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Apparat's long-awaited successor to NEWDOS+ is here! This is not an enhanced version of NEWDOS, but a completely new product. Simplified DOS commands can be instantly executed from BASIC, even within a program, without disturbing the resident code. System options, such as password protection, number and type of disk drives, BREAK key enable/disable and lowercase modification recognition, can be quickly and easily changed. Five new random-access file types allow record lengths of up to 4096 bytes, and no FIELDing! A powerful CHAIN facility allows keyboard INPUTs to be read from a disk file. An improved RENUMBER facility permits groups of statements to be relocated within program code. Diskettes may even be designated as RUN-ONLY! Features all NEWDOS+ utilities (SUPERZAP 3.0, etc.) and much more! One MTC technical staff member said having NEWDOS/80 is "better than sex" (you'll have to judge for yourself!).

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80 AID

Continued from page 14

Representative, Paramus, NJ.

Use CHR$(137) rather than CHR$(9). By adding 128 to 9, 10, 13, or any other CHR$ value Model II inhibits or translates, I am able to cause my Diablo 1640-RO to respond as though it had received the original value. This solution may not be effective for all printers, especially those which normally use values greater than 128.

Dale A. Swenson
2264 East 4000 South
Salt Lake City, UT 84117

Card Reader Wanted

I am looking for a card or optical reader that allows me to enter data into my TRS-80 Model III. Which companies make such a product?

Fred E. Singer
220 N.W. Eighth Street
Evansville, IN 47734

Bulletin Board for Model II

I am using a Radio Shack Model II, and would like to run a bulletin board, however, I cannot find a bulletin board program written for the Model II. I would appreciate hearing from anyone who is running a bulletin board system with a Model II or who could give me a lead on getting a program.

Roger Schechter, Esq.
54 Park Avenue A10
Verona, NJ 07044

Quebec Users Group

I wish to contact all TRS-80 owners (any models) living in the Montreal area who would be interested in forming a users group. Please contact me at the following address.

Alain Poisson
4250 Des Roses, C.P.1050
Lachenaie, Quebec
Canada J6W 3T8

Continued from page 12

but vital and Centronics should be severely chastised for them.

The deeper cover means that the tear-bar is eight lines ahead of the 737 position. Before each page printing command, you must add a statement such as:

```
FOR N = 1 to 8: LPRINTCHR$(27) CHR$(138);:NEXT
```

This will back up the paper eight lines in the printer.

Note that the manuals of both 737 and 739 are in error as to the codes required from a TRS-80 for forward and backward spacing.

There is a difference of one line in the line counting required. For a 66 line page, the TRS-80 Models I and III are correct for the 737. For the 739 it is necessary to POKE 16424,66 for accurate paging (67—the default value of the TRS-80—is correct for the 737). With this POKE in place, the 739 will page correctly on receipt of LPRINTCHR$(12) (no semicolon required), and will advance one line on LPRINTCHR$(11) (with or without semicolon). The 737 with its default POKE of 67 will page correctly on LPRINTCHR$(11); (with semicolon), or LPRINTCHR$(12) (with or without semicolon). However, the 737 will be one line too many on LPRINTCHR$(11) alone! If in doubt, change your programs to use only LPRINTCHR$(12) and use the right POKE. (Don't forget to change the POKE if double sized printing is used).

PEEK (14312) returns a number depending on the printer status. Four numbers are returned for each printer, and each printer returns the same numbers. It is therefore not possible by software to determine which printer is connected, and to adjust the line and page counts accordingly. The numbers returned are three higher in each case for a Model I TRS-80 than for a Model III (see Table 1). Watch out for the different numbers returned from initial and subsequent Local/On Line switches!

Considering that the 739 contains a selector switch for various accent sets, it is a pity that Centronics did not see fit to use one position to make the 739 look like a 737.

Incidentally, the Centronics 739 is also now available with a two-color print head.

	Model I	Model III
AC power off	239	236
Power on—1st time—LOCAL	159	156
ON LINE	31	28
2nd time—LOCAL	63	60
ON LINE	31	28

Table 1.

Ribbon life with one color is about equal to one box of fanfold paper; it will be less with the two-color head.

M. Barlow
Supervising Engineer
Studio Systems Department,
Engineering Headquarters
Canadian Broadcasting Corp.
Montreal, Quebec

Profile Precautions

My October issue of *80 Microcomputing* arrived a few days ago. As usual, I dropped everything else I was doing to look through the magazine as quickly as the mailman had delivered it. As I glanced through it the heading "The greatest program Radio Shack has released" jumped out at me. When I saw that the program being reviewed which had received such a glowing description was "Profile" my first reaction was disbelief. I was astounded when I saw that seven pages had been devoted to a review of the program. I have purchased many programs since becoming involved with the TRS-80 Model I several years ago. In all that time I have only returned one program in utter disgust. The program? Profile.

"I have only returned one program in utter disgust—Profile."

Mr. O'Brien is to be commended on a very thorough description of the program in terms of what the program purports to accomplish. I am certain that no press agent for Radio Shack could have done a better job. It is not really what Mr. O'Brien said that I take issue with, it is what he did not say. In my opinion his review was grossly incomplete in that he did not reference several items which would be of great interest and importance to anyone who contemplates purchasing Profile. These items include:

- The sort program, although machine language, is painfully slow. It took me well over two hours to sort about 400 records. I am not a knowledgeable programmer, but the sort program appears to read records, compare them, and then write them right back to disk. One can only speculate as to the ultimate effect such heavy usage would have on a disk system. Radio Shack says in their Bulletin 1562-1 dated June 10,

Continued on page 23

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80 DEBUg

Sound Generator

In my article "Polyphonic Sound Synthesis" *(80 Microcomputing,* June 1981), there is an error on page 168, Table 2. The table is correct for older models of the TRS-80 but on newer models without the buffered cable, pin 39 is not ground but +5 volts. Therefore, *do not* connect pin 39 to ground as shown.

Richard L. Brocaw
1850 Pearl Loop
Bosque Farms, NM 87068

Chess Tutor Fix

Lines 1620–1710 were missing from the listing of my chess tutor program (*80 Microcomputing,* December 1981). There were also typographical errors in lines 660 and 670. The corrections listed in Program Listing 1 should resolve any problems you encounter with the program.

Bob Dowd
326 Porter Drive
Lynn Haven, FL 32444

Pay Up

There are several typos in Program Listing 9, the "Loan Amortization Schedule", of Brian Honess' "Investment du Jour" article *(80 Microcomputing,* November 1981). The program in Program Listing 2 makes it run correctly and cleans up the spacing for appearances.

Don Picard
321 Riverwoods Lane
Burnsville, MN 55337

Printer Spooler Bug

My "Print Spooler" article in the December 1981 issue has a serious bug in it. Apparently, under some circumstances the character print section is entered with an unexpected value in the IX register. When the print driver updates what it thinks is the lines printed storage location, it is changing something else. This causes the DOS to move the disk input buffer until disk input overwrites the Basic program. This only seems to happen when the Spooler prints long disk files.

The solution is to force the correct IX

Continued on page 22

```
660 IFYM$ = "O – O"ORYM$ = "O – O – O"THENCA = 1:GOTO740
670 IFLEN(YM$) = 5 AND MIS$(YM$,3,1) = " – "THEN710
1620 DATA9,2,1,3,3,0,3,7,8,6,6,0,10,3,1,7,5,0,3,2,8,4,7,0
1630 DATA7,5,2,5,3,0,4,6,8,5,7,0,9,7,1,6,3,0,0,0,0,0,0,55
1640 DATA8,1,1,3,1,0,1,3,7,3,6
1650 DATA99
1660 DATA7,4,2,4,4,0,3,7,8,6,6,0,7,3,2,3,4,0,1,5,7,5,6,0
1670 DATA9,2,1,3,3,0,4,6,8,2,4,0,11,4,1,3,2,0,1,4,7,4,5,0
1680 DATA7,3,4,4,5,0,5,4,8,4,5,0,9,7,1,6,3,0,1,3,7,3,5,0
1690 DATA10,3,1,4,2,0,4,2,4,3,3,0,10,4,2,3,3,0,1,4,5,4,4,0
1700 DATA9,6,3,4,4
1710 DATA99
```

Program Listing 1

```
5 REM THIS A REVISION OF THE LOAN AMORTIZATION SCHEDULE
6 REM PRINTED IN "80 MICROCOMPUTING" MAGAGZINE
10 CLS:PRINT:PRINT TAB(20) "LOAN AMORTIZATION TABLE":PRINT
20 INPUT "LOAN PRINCIPAL =";P
30 INPUT "INTEREST RATE =";R
40 INPUT "TOTAL PAYMENT =";M
50 INPUT "STARTING MONTH =";MO
60 INPUT "STARTING YEAR =";YR
70 PRINT
80 A$=" ## #### ### ####.## #####.## #####.##"
90 PRINT" MO YEAR    N     INT.     PRIN.  REMAIN."
100 PRINT
110 N=1
120 I=P*(R/12)
130 PR=M-I
140 P=P-PR
150 PRINT USING A$;MO, YR, N, I, PR, P
160 IF P+(P*(R/12))<=M THEN 250
170 N=N+1
180 MO=MO+1
190 IF MO=13 THEN 210
200 GOTO 120
210 MO=1
220 YR=YR+1
230 PRINT
240 GOTO 120
250 N=N+1
260 MO=MO+1
270 IF MO<=12 THEN 300
280 MO=1
290 YR=YR+1
300 I=P*(R/12)
310 PR=P+I
320 P=0
330 PRINT USING A$;MO,YR,N,I,PR,P
340 PRINT
350 END
```

Program Listing 2

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value before entering the print driver. The required code changes are:

- Change line 420 to: 420 LD (PRINT + 13),HL.
- Add the following lines:

```
852  DI
854  PUSH IX
856  LD IX,4025H
862  POP IX
864  EI
```

- Change the origins in 260 and 280 to FB78H and FF78H respectively.

I offer my sincere apology to those of you who spent time trying to make this work.

Roger B. Gault
9603 Mount Quail Road
Austin, TX 78758

Missing Messages

My program, TXTWRT, does not assemble correctly when you type it in. The trouble is with the CALL to display program messages. My article, "More Write Stuff" (*80 Microcomputing*, December 1981), was published without the accompanying message prompts. Program Listing 3 contains the missing lines for the program. Insert these lines between lines 2940 and 3190 of the program. The slash marks are for spacing purposes only and should not be typed in.

Lynard Barnes
320 South Whipple Street
Chicago, IL 60612

Missing Programs

Somewhere in your cutting room there is an eccentric with a pair of scissors. Once again, the programs in my series of articles "Alternate Course" have been tampered with. This time, the programs referred to as Fig. 1 and Fig. 2 in the October issue do not appear at all.

Figure 3 contains an additional

Continued on page 23

```
M1      DEFM   'TEXTWRITER// – //OPTIONS'
        DEFB   ODH
        DEFB   ODH
        DEFM   '1 – ADD//////2 – LOAD'
        DEFB   ODH
        DEFM   '3 – SAVE//////4 – PRINT'
        DEFB   ODH
        DEFM   '5 – BASIC//////6 – KILL BUF'
        DEFB   ODH
        DEFM   '7 – 1ST 1020 BYTES'
        DEFB   ODH
        DEFB   0
M6      DEFM   '(ENTER) TO SAVE BUFFER. . . .'
        DEFB   0
M7      DEFM   '(ENTER) TO LOAD BUFFER. . . . .'
        DEFB   0
PRNT1   DEFM   'WILL SEND BUFFER TO LINE PRINTER ON KEY'
        DEFB   0
```

Program Listing 3

```
12 B=2:W(1)=1: W(2)= -1: W(3)=64: W(4)= -64: Y=16379
2999 REM SUBROUTINE FOR USER CONTROLLED SAUCER
3000 A$=INKEY$
3010 IF A$="" THEN GOTO 3040
3020 B=ASC(A$)-64
3030 IF B>4 OR B<=0 THEN B=1
3040 POKE Y,32: POKE Y+1,32: POKE Y+2,32
3050 Y=Y+W(B)
3060 IF Y+2=16383 THEN Y=15361
3070 IF Y=15360 THEN Y=16379
3080 IF Y+2>16383 THEN Y=Y-1023
3090 IF Y<15360 THEN Y=Y+1023
3100 POKE Y,187: POKE Y+1,157: POKE Y+2,140
3110 RETURN
```

Fig. 1

```
12 B=2:W(1)=1:W(2)=-1:W(3)=64:W(4)=-64:Y=16379
100 GOSUB 3000
110 GOTO 100
3000 IF Y>X+64 THEN B=4: GOTO 3040
3010 IF Y>X THEN B=2:GOTO 3040
3020 IF  Y-128  < X THEN B=3: GOTO 3040
3030 B=1
3040 POKE Y,32: POKE Y+1,32: POKE Y+2,32
3050 Y=Y+W(B)
3060 IF Y+3=16383 THEN Y=15361: GOTO 3100
3070 IF Y-1=15360 THEN Y=16378: GOTO 3100
3080 IF Y+3>16383 THEN Y=Y-1023: GOTO 3100
3090 IF Y-1<15360 THEN Y=Y+1023
3100 POKE Y,187: POKE Y+1,157: POKE Y+2,140
3110 K=Y+3
3120 IF B=2 THEN K=Y-1
3130 FOR T=1 TO 15
3140 POKE K,42
3150 IF K=X OR K=X+1 OR K=X+2 OR K=X+3 OR K=X-1 OR K=X-2 OR K=X-3 THEN GOTO 4000
3160 POKE K,32
3170 K=K+W(B)
3180 IF K<15361 THEN GOTO 3220
3190 IF K>16382 THEN GOTO 3220
3200 NEXT T
3220 RETURN
4000 PRINT@ 530,"YOU LOSE!!!"
4010 INPUT "DO YOU WANT TO PLAY AGAIN";A$
4020 IF A$="YES" THEN RUN
4030 END
4040 REM SUBROUTINE FOR COMPUTER CONTROLLED SHIP
```

Fig. 2.

Continued from page 16

1980, "Profile uses an 'on-disk' sorting method which requires a large number of disk read/write operations. We have discovered that disk life is a significant factor in system failures, especially in long sorts of large or multiple drive systems. Users should use new backup copies regularly." About half way through the fifth pass of a nine pass sort I got a disk read error. Unfortunately I had not yet obtained the Service Bulletins with their caution and, contrary to good practice, I had not made a copy of my file before sorting it.

- The Basic program given in the manual for access to Profile files will not work as written. Bulletin 1562-4 gives the corrections for the program. Again, I did not have the advantage of seeing the Bulletin in advance and spent many wasted hours trying to use the Basic program to salvage my file.
- Bulletin 1562-5 gives corrections for another Basic program listed in the manual.
- Bulletin 1562-6 gives further corrections.
- Bulletin 1562-2 says that if Basic is used to access files built by Profile then "the LRL must be a number evenly divisible into 256 minus one."

I originally chose Profile since I needed the capability of maintaining a file of over 1,000 records, each of which consisted of four fields. While the program may function perfectly with a test file of several dozen records, I would encourage the serious user with a large file to think twice before using Profile. As previously stated, I returned my copy to Radio Shack and obtained a refund. It is interesting to note that *after* I had my copy of Profile returned, the salesman ran me off a copy of all Customer Service Bulletins issued on Profile. If, ever again, I purchase any Radio Shack software I shall make it a point to ask for copies of any bulletins which pertain to the software. Other users might want to follow the same procedure.

Charles K. Bridges
Sacramento, CA

Software Buyer's Tips

It seems that of all the articles I have written for 80 the one on Profile drew the most active attention.

The article, in context, was an attempt at a comparison between Profile and Microfile and a bit of an expansion on some of the features of Profile. To this day I stand by my statement that it was the best program released by the Shack up until that time. I do not understand the problem you were having with the two-drive sort, but again, as you point out, I had only entered about 120 or so pieces of data so the second drive was never really utilized. I can only conjecture that in as much as a year or so ago a system with more than one drive was atypical, the program was never functionally paced through a multidrive exhaustive test. Software authors do have a tendency to accept certain things for granted when others seem to work right.

The Shack, and I know the ground will quiver when I write this, had not, up until

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listing which shows the code to get the ships to chase each other around a bit.

I have only one question. As many of your readers know, the gremlins that cause errors to be created in programs are known as "bugs." The gremlins that cause errors in networks are known as "worms." What are the gremlins in cutting rooms called?

Michael A. Duffin
1507 East Avenue
Berwyn, IL 60402

```
5 CLS
12 B=2:W(1)=1:W(2)=-1:W(3)=64:W(4)=-64:Y=16378
13 D=2: V(1)=1: V(2)= -1: V(3)= 64: V(4)= -64: X=15365
100 GOSUB 2000
110 GOTO 100
2000 A$=INKEY$
2010 IF A$="" THEN GOTO 2040
2020 D=ASC(A$)-64
2030 IF D>4 OR D<=0 THEN D=1
2040 POKE X,32: POKE X+1,32: POKE X+2,32
2050 X=X+V(D)
2060 IF X+2=16383 THEN X=15361
2070 IF X=15360 THEN X=16379
2080 IF X+2> 16383 THEN X=X-1023
2090 IF X<15360 THEN X=X+1023
2100 POKE X,187: POKE X+1,157: POKE X+2,140
2105 GOSUB 3000
2110 RETURN
3000 IF Y>X+64 THEN B=4: GOTO 3040
3010 IF Y>X THEN B=2:GOTO 3040
3020 IF  Y-128  < X THEN B=3: GOTO 3040
3030 B=1
3040 POKE Y,32: POKE Y+1,32: POKE Y+2,32: POKE Y+3,32
3042 REMPRINT "Y= "Y
3050 Y=Y+W(B)
3060 IF Y+3=16383 THEN Y=15361: GOTO 3100
3070 IF Y=15360 THEN Y=16378: GOTO 3100
3080 IF Y+3>16383 THEN Y=Y-1023: GOTO 3100
3090 IF Y-1<15360 THEN Y=Y+1023
3100 POKE Y,176:POKE Y+1,190: POKE Y+2,189: POKE Y+3,176
3110 K=Y+4
3120 IF B=2 THEN K=Y-1
3130 FOR T=1 TO 15
3140 POKE K,42
3150 IF K=X OR K=X+1 OR K=X+2 OR K=X+3 OR K=X-1 THEN GOTO 4000
3160 POKE K,32
3170 K=K+W(B)
3180 IF K<15361 THEN GOTO 3220
3190 IF K>16382 THEN GOTO 3220
3200 NEXT T
3220 RETURN
4000 PRINT@ 530,"YOU LOSE!!!"
4010 INPUT "DO YOU WANT TO PLAY AGAIN";A$
4020 IF A$="YES" THEN RUN
4030 END
4040 REM SUBROUTINE FOR COMPUTER CONTROLLED SHIP
```

Fig. 3.

80 DEBUg

Here is the long-awaited program listing of Convert which should have appeared with James F. Williams' article "Smart Answers" in the April 1981 issue of 80 Microcomputing.*—Eds.*

```
                00100 ;CONVERT 1.1 (C) 1980 BY JAMES F. WILLIAMS
                00110 ;720 WEST HAVEN BLVD
                00120 ;ROCKY MOUNT, NC 27801
                00130 ;
                00140 ;RESERVE MEMORY AT ORG POINT.
                00150 ;HIT SHIFT C AFTER TYPING IN A NUMBER (USE H AFTER
                00160 ;A HEX NUMBER) FOR A REPLACEMENT CONVERSION ON THE
                00170 ;SCREEN AND IN THE BUFFER. USE SHIFT B TO ACTIVATE A
                00180 ;BACKWARD SEARCH FOR FIRST DECIMAL STRING BEFORE CURSOR

                00190 ;AND PRINT CONVERSION AT CURSOR AND IN BUFFER. CONVERTE
D

                00200 ;NUMBER MARKED WITH @.
                00210 ;
                00220 ;I. INITIALIZATION ROUTINE
7F08            00230          ORG     32520            ;CHANGE IF NOT 16K
7F08 2A1640     00240 INTLZE   LD      HL,(4016H)       ;SAVE PREVIOUS INTERCEP
T
7F0B 22267F     00250          LD      (DECODE+1),HL
7F0E 21177F     00260          LD      HL,MODE          ;SET THIS INTERCEPT
7F11 221640     00270          LD      (4016H),HL
7F14 C3CC06     00280          JP      6CCH             ;RETURN TO BASIC
                00290 ;
                00300 ;II. EXECUTION STATUS CHECK
7F17 3E02       00310 MODE     LD      A,2              ;MODIFIED BY PROGRAM
7F19 ED73DE7F   00320          LD      (STKPTR+1),SP    ;SAVED TO FIX STACK
                00330                                   ; FROM JP'S FROM SUB'S
7F1D B7         00340          OR      A
7F1E CAC27F     00350          JP      Z,BKSPCE         ;AUTO TYPE BACKSPACE
7F21 3D         00360          DEC     A
7F22 CAD07F     00370          JP      Z,BUFPTR         ;AUTO TYPE CONVERSION
                00380 ;
                00390 ;III. REGULAR MODE: CHECK FOR SHIFT C AND SHIFT B.
7F25 CD257F     00400 DECODE   CALL    $                ;SET AT INITIALIZATION
                00410                                   ; DECODE KEYBOARD
7F28 2A2040     00420          LD      HL,(4020H)       ;LOAD CURSOR POSITION
7F2B FE63       00430          CP      'C'+20H          ;SHIFT C?
7F2D 280E       00440          JR      Z,HEXDEC         ;YES, HEX OR DEC?
7F2F FE62       00450          CP      'B'+20H          ;SHIFT B?
7F31 C0         00460          RET     NZ               ;NO, RETURN CHARACTER
7F32 CDEA7F     00470 BKSRCH   CALL    SRCH             ;YES, SEARCH FOR 0-9
7F35 38FB       00480          JR      C,BKSRCH         ;0-9? NO, KEEP LOOKING
7F37 CD497F     00490          CALL    DECM             ;YES, DEC TO HEX CONVER
T
7F3A C3CB7F     00500          JP      CHRFLG           ;TO SET AUTO CHAR FLAG
7F3D 3E48       00510 HEXDEC   LD      A,'H'
7F3F 2B         00520          DEC     HL               ;BACK UP 1 LOC
7F40 BE         00530          CP      (HL)             ;H?
7F41 283D       00540          JR      Z,HEX            ;YES, HEX-DEC CONVERT
7F43 CD497F     00550          CALL    DECM             ;DEC-HEX CONVERT
7F46 C3BE7F     00560          JP      BKMODE           ;TO SET BACKSPACE FLAG
                00570 ;
                00580 ;IV. DECIMAL STRING TO VALUE TO HEX STRING CONVERSION
7F49 23         00590 DECM     INC     HL               ;END OF DEC STRING+1
7F4A E5         00600          PUSH    HL               ;SAVE IT
7F4B 0600       00610          LD      B,0              ;INITIALIZE CHAR COUNT
7F4D CDEA7F     00620 DECSRH   CALL    SRCH             ;FOR NON 0-9
7F50 30FB       00630          JR      NC,DECSRH        ;0-9? YES, KEEP LOOKING

7F52 05         00640          DEC     B                ;1ST CHAR?
7F53 CADA7F     00650          JP      Z,RESET          ;YES, RESET AND RETURN
7F56 D1         00660          POP     DE               ;LAST CHAR LOC+1 TO DE
7F57 AF         00670          XOR     A
7F58 12         00680          LD      (DE),A           ;PUT 0 BYTE AT END OF
                00690                                   ; STRING ON SCREEN
7F59 04         00700          INC     B                ;RESTORE COUNT
7F5A 78         00710          LD      A,B              ;SAVE IT
7F5B 32C37F     00720          LD      (BKSPCE+1),A
7F5E 23         00730          INC     HL               ;FIRST 0-9 CHAR
7F5F CD4F1E     00740          CALL    1E4FH            ;CONVERT TO VALUE IN DE

7F62 21FA7F     00750          LD      HL,BUF           ;BUFFER
7F65 EB         00760          EX      DE,HL
7F66 0E04       00770          LD      C,4              ;DIGIT COUNT
7F68 0604       00780 DIGIT    LD      B,4              ;BIT COUNT
7F6A AF         00790          XOR     A                ;CLEAR A
7F6B 29         00800 SHFT     ADD     HL,HL            ;SHIFT HL
7F6C 17         00810          RLA                      ;INTO A
7F6D 10FC       00820          DJNZ    SHFT             ;4 BITS WORTH
7F6F C630       00830          ADD     A,48             ;ADJ TO ASCII 0-9
```

Program continues

Continued from page 23

then, ever released a program that was error free and good (what a generality!). Look at Scripsit. It had more than a few coding faults but it is still, in my opinion, the best word processor bar one (Wordpro 4+ on the Commodore is equally as simple and as effective), and that includes WordStar, Magic Wand and Memorite III.

And the Shack's fixes are to be taken always with a grain of salt. In many cases they either work half-heartedly, not at all, or lead the way to more fixes. It is almost a law (God forbid you wanted to use a serial printer with Scripsit and it did not conform to Radio Shack's conception of what a serial printer should be—and look at all the corrections that the accounting programs gave rise to!)

Your main problem, you see, was the salesperson who sold you the program and not the program itself (you seem to hint at that, but never come out and say it). In theory, when you buy software or hardware, your salesperson should be like your high school guidance counselor. With all your needs tucked neatly away in the frontal lobes, a salesperson worth his salt should be able to hunt and choose among the sea of software and give you a selection that fits your needs. If there are updates or errors to be corrected, your salesperson should also keep you informed. (Let's be brutally honest, no *piece of software is* ever *totally bug-free or perfect, all of them go through a continual growth process and we all, equally, suffer and benefit from that growth.)*

Unfortunately, many of the times I find myself in a Radio Shack store, I do not see people consulting with the salespeople. Its more a case of "Oh, I will take that." Yes, not every salesperson in every store knows the computer products, but do not make the assumption that none of them do. If you cannot get to the one or ones that do immediately, make an appointment for a later date. That small bit of procrastination can sometimes save a lot of heartache later on. And if a salesperson does mislead you (those little buggers can sometimes get over eager) or fails to do the things they should, then complain.

The image of the Shack, like any computer store, is derived from its employees, their knowledge and their ability to assist a customer—would it surprise you if I told you I am the manager of a computer store in New York and that I will and have *sent customers elsewhere when I know I cannot supply a product that will meet* their *specs? My customers still come back to me first when they need something.*

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Continued on page 26

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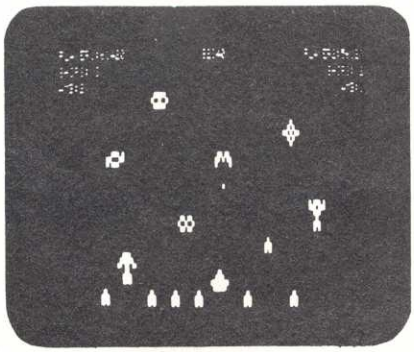

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Big Five has done it again! Now the most popular arcade game of all time has a fascinating new twist. The Invaders are back! You are alone, valiantly defending the all important nuclear fuel cannister stockpile from a convoy of thieving aliens who repeatedly break off and attack in precision formations. An alien passes your guard, swiftly snatching up a cannister and flying straight off. Quick! you have one last chance to blast him out of the sky. Great action and sound!

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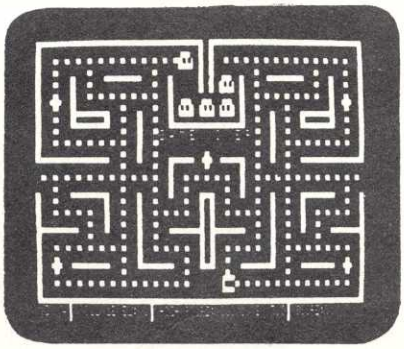
SCARFMAN



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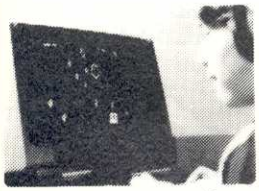

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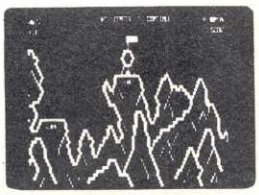
Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones.) Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine.



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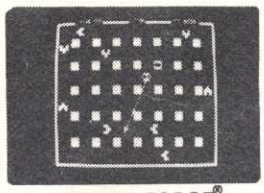

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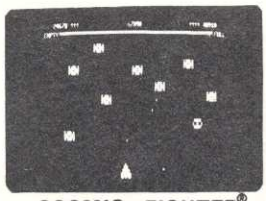

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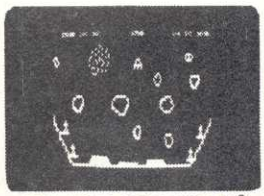

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17

80 DEBUg

Program continued

```
7F71 FE3A     00840          CP      58                ;A-F RANGE?
7F73 3002     00850          JR      C,STORE           ;NO, STORE IT
7F75 C607     00860          ADD     A,7               ;YES, ADJ ASCII A-F
7F77 12       00870 STORE    LD      (DE),A            ;PLACE HEX DIGIT IN BUF

7F78 13       00880          INC     DE                ;BUMP BUF POINTER
7F79 0D       00890          DEC     C                 ;DONE WITH 4 DIGITS?
7F7A 20EC     00900          JR      NZ,DIGIT          ;NO, GET ANOTHER
7F7C 3E48     00910          LD      A,'H'             ;ADD H ON THE END
7F7E 12       00920          LD      (DE),A            ;TO BUFFER
7F7F C9       00930          RET
              00940 ;
              00950 ;V. HEX STRING TO VALUE TO DECIMAL STRING CONVERSION
7F80 0600     00960 HEX      LD      B,0               ;INTIALIZE CHAR COUNT
7F82 CDEA7F   00970 HXSRCH   CALL    SRCH              ;SEARCH FOR 0-9 CHAR
7F85 30FB     00980          JR      NC,HXSRCH
7F87 FE47     00990          CP      'G'               ;GREATER THAN F?
7F89 3004     01000          JR      NC,NOHEX          ;YES, NOT HEX CHAR
7F8B FE41     01010          CP      'A'               ;GREATER THAN A?
7F8D 30F3     01020          JR      NC,HXSRCH         ;YES, HEX:CONTINUE SEAR
CH
7F8F 05       01030 NOHEX    DEC     B                 ;1ST CHAR NON HEX?
7F90 2848     01040          JR      Z,RESET           ;YES, RESET AND RETURN
7F92 04       01050          INC     B                 ;RESTORE COUNT
7F93 04       01060          INC     B                 ;ACCOUNT FOR H CHAR
7F94 78       01070          LD      A,B               ;SAVE IT
7F95 32C37F   01080          LD      (BKSPCE+1),A
7F98 110000   01090          LD      DE,0
7F9B EB       01100          EX      DE,HL             ;HL=0:DE=SCREEN LOC-1
7F9C 13       01110 NEXT     INC     DE                ;BUMP SCREEN POINTER
7F9D 1A       01120          LD      A,(DE)            ;GET CHAR IN A
7F9E FE48     01130          CP      'H'               ;H?
7FA0 2810     01140          JR      Z,DECML           ;YES, END OF STRING
7FA2 29       01150          ADD     HL,HL             ;SHIFT HL LEFT 4 BITS
7FA3 29       01160          ADD     HL,HL
7FA4 29       01170          ADD     HL,HL
7FA5 29       01180          ADD     HL,HL
7FA6 FE3A     01190          CP      '9'+1             ;GREATER THAN 9?
7FA8 3002     01200          JR      NC,LTR            ;YES, A-F
7FAA C607     01210          ADD     A,7               ;NO, 0-9
7FAC D637     01220 LTR      SUB     55                ;ADJUST TO REAL VALUE
7FAE B5       01230          OR      L                 ;MERGE A AND L INTO A
7FAF 6F       01240          LD      L,A               ;MERGED VALUE BACK TO L
7FB0 18EA     01250          JR      NEXT              ;LOOP FOR ANOTHER DIGIT

7FB2 010000   01260 DECML    LD      BC,0              ;MAKES ROM WORK BETTER
7FB5 222141   01270          LD      (4121H),HL        ;INTEGER WORK AREA
7FB8 21FA7F   01280          LD      HL,BUF            ;START OF BUFFER
7FBB CD2F13   01290          CALL    132FH             ;ROM COVERTS VALUE TO D
EC
              01300                                    ; STRING, STORE IN BUFF
ER
              01310 ;
              01320 ;VI. AUTO BACKSPACE GENERATOR
7FBE AF       01330 BKMODE   XOR     A                 ;SET FLAG TO BACKSPACE
7FBF 32187F   01340          LD      (MODE+1),A
7FC2 3E00     01350 BKSPCE   LD      A,0               ;MODIFIED BY PROGRAM
7FC4 3D       01360          DEC     A                 ;SET CONDITION FLAGS
7FC5 32C37F   01370          LD      (BKSPCE+1),A      ;RESET BACKSPACE COUNT
7FC8 3E08     01380          LD      A,8               ;BACKSPACE CHAR
7FCA C0       01390          RET     NZ                ;RETURN BACKSPACE UNLES
S
              01400                                    ; COUNT IS 0
7FCB 3E01     01410 CHRFLG   LD      A,1               ;SET FLAG TO PRINT
7FCD 32187F   01420          LD      (MODE+1),A        ; CONVERTED CHAR'S
              01430 ;
              01440 ;VII. AUTO CONVERTED CHARACTER GENERATOR
7FD0 21FA7F   01450 BUFPTR   LD      HL,BUF            ;MODIFIED BY PROGRAM
7FD3 7E       01460          LD      A,(HL)            ;GET BUF CHAR IN A
7FD4 B7       01470          OR      A                 ;CHECK FOR 0 BYTE
7FD5 23       01480          INC     HL                ;UPDATE BUF POINTER
7FD6 22D17F   01490          LD      (BUFPTR+1),HL     ;SAVE IT
7FD9 C0       01500          RET     NZ                ;RETURN BUF CHAR IF
              01510                                    ; NOT AT END OF BUF
              01520 ;
              01530 ;VIII. RESET TO REGULAR MODE ROUTINE
7FDA 21FA7F   01540 RESET    LD      HL,BUF            ;RESET BUF PTR
7FDD 31DD7F   01550 STKPTR   LD      SP,$              ;MODIFIED BY PROGRAM.
              01560                                    ; FIX STACK FROM
              01570                                    ; JP'S FROM SUB'S
7FE0 22D17F   01580          LD      (BUFPTR+1),HL
7FE3 3E02     01590          LD      A,2               ;RESET MODE FLAG
7FE5 32187F   01600          LD      (MODE+1),A
7FE8 AF       01610          XOR     A                 ;RETURN NULL CHAR
7FE9 C9       01620          RET
              01630 ;
              01640 ;IX. BACKWARD ASCII 0-9 SEARCH SUBROUTINE
```

Program continues

Continued from page 24

ware and hardware, potential, price, performance and support; Profile excels in all of these areas (witness the enhanced version for the Model II). Yes, the problems with it limit its performance under certain conditions, the solution is not to exceed its limits. Unfortunately, without the help of someone who knows what those limits are, that is almost impossible.

I apologize if I gave the impression that Profile was the greatest thing to walk the earth since Chivas Regal. It was meant in the context it was stated in, i.e. in reference to the Shack and the programs it had brought out before that and in comparison to Microfiles. But do not give up on Profile, give up on the person who told you to buy it for your application.

And not backing up your data! Xerox made a fortune on copy machines because everyone indulged in the paranoia of lost information! On so fragile a media as a disk I would assume that no technical bulletin was necessary.

My comments on Profile were centered on its flexibility and the amazing ability it has shown to be used! Something lacking in many of the previous Radio Shack programs. So, I allow you your disdain, since it does fit your application. But I also allow my surprise and enthusiam at such an enlightened program finding its way out of the Shack.

Bill O'Brien
New York, NY

The following is an open letter to Ed Juge of Radio Shack.

TRSDOS Manual Useless

I am sitting in front of one of your Model III machines with dual disk drives. I have your TRSDOS manual open on my lap. I have just saved a Basic program, following your manual's directions. Now, I have tried to load it, I have tried to run it. . . but all I get is "Direct Statement in File".

Swell—but what does *that* mean? What can I do about it? How did it happen? How can I keep it from happening again? What is the status of my program? How can I get at my program to find out? As you probably know, there is not *one* single word in your manual to answer any of these valid questions nor is there any information about any of the 40 other error messages (except a list).

You constantly proclaim the sincere

Continued on page 28

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Now Model III users can take advantage of the ALPHA I/O system too. Our new MOD III/I BUS CONVERTER allows most port based Model I accessories (such as our ANALOG-80, INTERFACER 2 and INTERFACER-80) to connect to the Model III bus. MOD III/I BUS CONVERTER, complete with all connectors, only $39.95.

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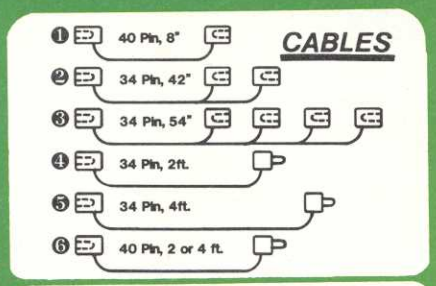

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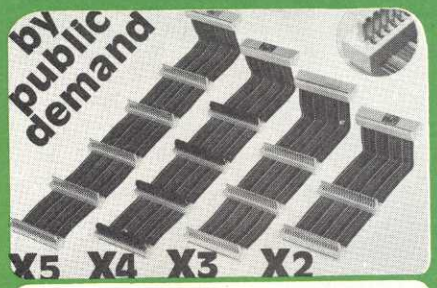

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GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But **WARNING:** all Green Screens are not created equal. Here is what we found:

- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laughs: One ad claims to "reduce screen contrast" Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- It fits right onto the picture tube like a skin because it is the only **CURVED** screen **MOLDED** exactly to the picture tube curvature. It is Cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
- The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.

We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty: try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

A last word: We think that companies, like ours, who are selling mainly by mail should: • list their street address • have a phone number (for questions and orders) • accept CODs, not every one likes to send checks to a PO box • offer the convenicnce of charging their purchase to major credit cards. How come we are the only green screen people doing it?

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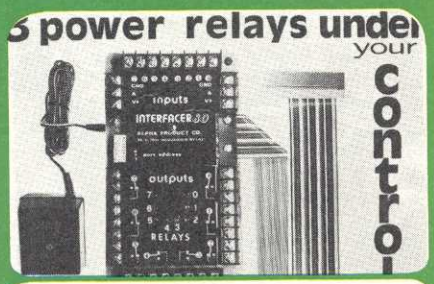

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80 DEBUg

Program continued

```
7FEA 04        01650 SRCH    INC     B                ;BUMP CHAR COUNT
7FEB 2B        01660         DEC     HL               ;DEC SCREEN POINTER
7FEC 11FF3B    01670         LD      DE,3BFFH         ;1ST SCREEN LOC-1
7FEF DF        01680         RST     18H              ;COMPARE HL-DE
7FF0 38E8      01690         JR      C,RESET          ;EXIT IF BEYOND SCREEN-
1
7FF2 7E        01700         LD      A,(HL)           ;SCREEN CHAR INTO A
7FF3 FE3A      01710         CP      '9'+1            ;GREATER THAN 9?
7FF5 3F        01720         CCF
7FF6 D8        01730         RET     C                ;YES, RET W/ CARRY
7FF7 FE30      01740         CP      '0'              ;LESS THAN 0?
7FF9 C9        01750         RET                      ;0-9? NO, RET W/ CARRY
               01760 ;
               01770 ;X. BUFFER FOR HEX AND DEC STRINGS
0005           01780 BUF     DEFS    5                ;SPACE FOR 5 DIGITS
7FFF 00        01790         DEFB    0                ;TERMINATE WITH 0 BYTE
7F08           01800         END     INTLZE

00000 TOTAL ERRORS
```

The program listing that accompanied the article, "Micro Puzzle Box," was incorrect as printed in our January issue. Here is the correct listing.—Eds.

```
5 ' 'RUN 50000' TO SKIP INSTRUCTIONS AND HEADER
10 CLS:GOTO 25000
10000 ' DISPLAY A(3,3)<15-PUZZLE>
10010 ' 0=BLANK SPC
10020 CLS
10030 FOR I=0 TO 3
10040 FOR J=0 TO 3
10045 IF A(I,J)=0 THEN 10100
10090 PRINT@I*6+J*3*64,DR$;A(I,J);
10100 NEXT J,I
10110 RETURN
15000 ' CHECK FOR VICTORY !!!
15010 FOR I=0 TO 3:FOR J=0 TO 3
15020 IF A(I,J)<>B(I,J) THEN RETURN
15030 NEXT J,I
15040 PRINT@32+64,"YOU GOT IT ! ! !";
15050 PRINT@32+128,"WITH ";MO;" MOVES.";
15060 PRINT@32+192,"PRESS ANY KEY TO RESTART:";
15070 IF INKEY$="" THEN 15070 ELSE 50000
20000 ' INIT A(3,3) B(3,3)
20005 DIM A(3,3),B(3,3)
20010 FOR I=0 TO 3:FOR J=0 TO 3:B(I,J)=J*4+I+1:A(I,J)=B(I,J):NEXT J,I
20020 B(3,3)=0:A(3,3)=0
20025 XM=3:YM=3
20027 GOSUB 10000
20030 ' MAKE 100 MOVES, INCREASE LOOP SIZE TO IMPROVE SCRAMBLING
20040 FOR I=1 TO 100
20050 XD=0:YD=0
20060 IF RND(2)=1 THEN XD=RND(2)*2-3 ELSE YD=RND(2)*2-3
20070 IF XD+XM<0 OR XD+XM>3 OR YD+YM<0 OR YD+YM>3 THEN 20050
20080 A(XM,YM)=A(XD+XM,YD+YM):A(XD+XM,YD+YM)=0
20082 PRINT@XM*6+YM*64*3,DR$;A(XM,YM);
20083 XM=XD+XM:YM=YD+YM
20084 PRINT@XM*6+YM*64*3,CL$;
20085 PRINT@32,I;
20090 NEXT I
20100 RETURN
25000 CLEAR 1000:DEFINT A-Z:CLS:PRINT"            15 PUZZLE":PRINT"
  BY DAVID MOEWS"
25010 INPUT"          DO YOU WANT INSTRUCTIONS (Y/N)";YN$
25015 YN$=LEFT$(YN$,1)
25020 IF YN$="N" THEN RUN 50000
25025 IF YN$<>"Y" THEN 25010
25030 PRINT"THE 15 PUZZLE IS MADE UP OF 15 BLOCKS (NUMBERED 1 THROUGH 15) "

25035 PRINT"AND 1 EMPTY SPACE"
25040 PRINT"IN A 4 X 4  FRAME. THE PUZZLE STARTS OUT IN A REGULAR"
25050 PRINT"CONFIGURATION, THEN IT IS SCRAMBLED UP BY THE "
25060 PRINT"COMPUTER. YOUR OBJECT IS TO UNSCRAMBLE THE"
25070 PRINT"PATTERN TO ITS ORIGINAL CONFIGURATION."
25080 PRINT"PRESS ANY KEY TO CONTINUE:"
25090 A$=INKEY$:IF A$="" THEN 25090
25100 CLS:GOSUB 60000
25110 FOR I=0 TO 3:FOR J=0 TO 3:A(I,J)=I+1+J*4:NEXT J,I
25115 A(3,3)=0
25120 GOSUB 10000
```

Program continues

Continued from page 26

desire of Tandy to communicate with your customers. The most necessary form of communication for me is to know how to use the equipment you sell. For my money (which you now have), you have failed miserably with your TRSDOS manual. Your lack of any information about the 41 errors is far overshadowed by the presentation of the main text.

The hopeful (but quickly frustrated) user is told in detail about the syntax of all the commands available without the slightest hint on how these commands are *used.* For example, ATTRIB allows us to make files "invisible" while DIR lets us display them. Would I be prying into Tandy Corporations secrets if I ask what is the *purpose* of an "invisible" file? Is it *really* "invisible" if DIR can call it up? How do I use this feature in my programs?

To a neophyte disk-owner, your manual is as useful as would be a spelling dictionary to a neophyte novelist—lots of words without any hint of meaning. After all the TRSDOS versions, why isn't there something like a "Getting Started With TRSDOS" so that I could use all my hardware?

Nate Salsbury
New Bern, NC

Radio Shack Replies

We do want to communicate with our customers. We try very hard to do just that, but we are human and make mistakes. The fact that we did not include explanations of error codes listed for Model III TRSDOS and Disk Basic is unthinkable. We did miss it and we are now working to correct it. Thank you for bringing it to our attention. (In case you have not yet received an answer to the "Direct Statement in File" error, that means a command is contained in the file without program line numbers preceding it. It should not happen if you are writing a program in Basic and saving it to disk. Where it most frequently occurs is using Scripsit to write your Basic program and forgetting to number a line or adding a direct command at the end of the file.)

I cannot fully agree with your other objections. We do include examples and sample uses. The specific example you mention was not covered because we thought it fairly obvious that an "invisible" file is one that is not normally "visible". How do you view file names? You list them using DIR—if you want to see the invisible files too, use DIR(INV).

Continued on page 29

Continued from page 28

The overall purpose was to enable you to unclutter the directory screen, yet let you see all files when you need or want to.

We will look into your suggestion for a simple, comprehensive book covering TRSDOS. In the meantime, when you have questions like these, give your local Radio Shack store a call. They have an expanded computer department and should be able to answer almost any question you have. Also, remember that Computer Customer Services (1-800-433-1679) is available to you from 8 am to 5 pm central time to answer computer related questions.

I hope that this information helps, but if not, don't hesitate to let me know.

Bill Walters,
Consumer Information Manager
Tandy/Radio Shack
Fort Worth, TX

80 DEBUg

Program continued

```
25130 PRINT@37,"THE PUZZLE STARTS OFF";:PRINT@64+32,"LIKE THIS. THE COMPUTE
R";
25140 PRINT@128+32,"SCRAMBLES IT AROUND";
25150 PRINT@192+32,"LIKE THIS:";
25160 PRINT@256+32,"<PRESS ANY KEY TO CONTINUE>";
25165 IF INKEY$="" THEN 25165
25170 XM=3:YM=3:GOSUB 20040
25180 PRINT@32,"THEN YOU MOVE BLOCKS";CHR$(30);
25190 PRINT@64+32,"AROUND IN THE PUZZLE BY PRESSING";:PRINT@128+32,"THE ARR
OW KEYS.";CHR$(30);
25200 PRINT@192+32,"FOR EXAMPLE, IF YOU PRESSED THE";
25210 XD=0:YD=-1:ST$="DOWN":S1$=CHR$(92):S2$="ABOVE"
25220 IF YM=0 THEN XD=0:YD=1:ST$="UP":S1$=CHR$(91):S2$="BELOW"
25230 PRINT@256+32,ST$;" ARROW KEY";CHR$(30);" (";S1$;")";
25260 PRINT@64*5+32,"THE BLOCK ";S2$;" THE";
25265 PRINT@64*6+32,STRING$(10,32);STRING$(LEN(S2$),131);
25270 PRINT@64*7+32,"EMPTY SPACE WOULD MOVE ";ST$;
25280 PRINT@64*8+32,"LIKE THIS:";
25290 PRINT@64*9+32,"<PRESS ANY KEY TO CONTINUE>";
25300 IF INKEY$="" THEN FOR I=1 TO 30:NEXT:PRINT@256+32+12+LEN(ST$)," ";:FO
R I=1 TO 30:NEXT:PRINT@256+32+12+LEN(ST$),S1$;:GOTO 25300
25310 A=XD+XM:B=YD+YM:M=XM:N=YM:GOSUB 30000
25320 PRINT@64*9+32,CHR$(30);:PRINT@256+32+12+LEN(ST$),S1$;
25330 PRINT@64*9+32,"THE OTHER ARROW KEYS FUNCTION";
25340 PRINT@64*10+32,"IN A SIMILIAR WAY.";
25350 PRINT@64*11+32,STRING$(13,32);CHR$(91);" UP";
25360 PRINT@64*12+32,"LEFT ";CHR$(93);STRING$(15,32);CHR$(94);" RIGHT";
25370 PRINT@64*13+32,STRING$(13,32);CHR$(92);" DOWN";
25380 PRINT@64*15+32,"<PRESS ANY KEY FOR THE GAME>";
25390 IF INKEY$="" THEN 25390 ELSE RUN 50000
30000 ' MOVE <A,B> INTO <M,N> - EMPTY
30010 ' DO NOTHING IF IMPOSSIBLE
30015 L=0
30020 IF A<0 OR A>3 OR B<0 OR B>3 THEN RETURN
30030 IF ABS(A-M)>1 OR ABS(B-N)>1 THEN RETURN
30040 IF ABS(A-M)=1 AND ABS(B-N)=1 THEN RETURN
30050 IF A=M AND B=N THEN RETURN
30060 A(M,N)=A(A,B):A(A,B)=0
30070 L=-1
30150 PRINT@A*6+B*3*64,CL$;
30160 PRINT@M*6+N*3*64,DR$;A(M,N);
30163 MO=MO+1
30165 GOSUB 15000
30170 RETURN
40000 ' KEEP TRACK
40010 TI!=TI!+1:PRINT@32,"TIME: ";TI!;"MOVES: ";MO;
40020 A$=INKEY$:IF A$="" GOTO 40010
40030 XD=0:YD=0
40040 IF A$=CHR$(91) THEN YD=1
40050 IF A$=CHR$(10) THEN YD=-1
40060 IF A$=CHR$(8) THEN XD=1
40070 IF A$=CHR$(9) THEN XD=-1
40080 A=XM+XD:B=YM+YD
40090 M=XM:N=YM
40100 GOSUB 30000
40190 IF L THEN XM=A:YM=B
40200 GOTO 40000
50000 ' DO IT!
50002 CLS
50003 CLEAR 1000:DEFINT A-Z
50005 GOSUB 60000
50010 GOSUB 20000
50020 MO=0:TI!=0
50060 GOTO 40000
60000 ' INIT STRINGS
60020 LN$=STRING$(6,24)+CHR$(26)
60030 L1$=CHR$(151)+STRING$(4,131)+CHR$(171)
60040 L2$=CHR$(149)+STRING$(4,32)+CHR$(170)
60050 L3$=CHR$(181)+STRING$(4,176)+CHR$(186)
60060 DR$=L1$+LN$+L2$+LN$+L3$+STRING$(5,24)+CHR$(27)
60070 CS$=STRING$(6,32)+LN$
60080 CL$=CS$+CS$+CS$
60090 L1$="":L2$="":L3$="":LN$="":CS$=""
60100 RETURN
```

NEC Spinwriter 5530

Wayne Mueller's article "A Driven Printer" (*80 Microcomputing*, November 1981) presents a software solution to a common printer interface problem—the generation of automatic line feeds after carriage returns. However, for the specific printer he is working with, the NEC spinwriter 5530, a special driver is not necessary.

I have successfully used a Spinwriter for almost a year without special software. This is possible because much of the Spinwriter's behavior is determined by 32 internal switches. For example, line feeds are automatically generated after carriage returns when switch 3 (number two on the PC board marked G9BNB) is turned off. Other switches determine default character spacing, buffer size, and response to special characters. While these switches are not easily accessible, you need set them only once.

New purchasers should ask their Spinwriter dealer to set the switches. Make sure you receive a copy of the NEC "Spinwriter Model 5530 Product Description," which describes the functions of the internal switches.

Mr. Mueller's program also solves some special problems arising with particular programs. However for those people who only need automatic line feeds, these switches provide an easy solution.

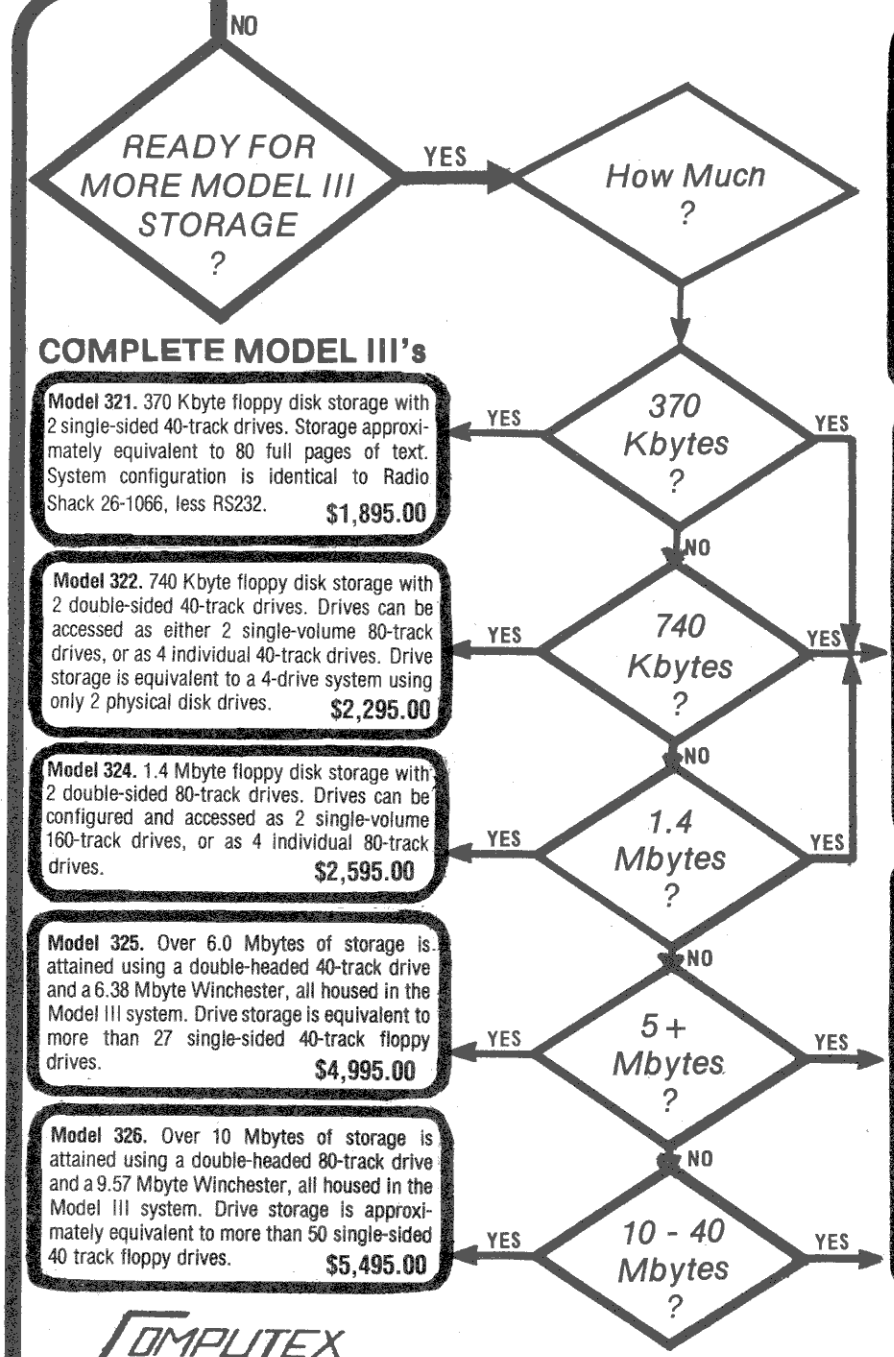
Steven J. Zeil
University of Massachusetts
Amherst, MA

Quit

In regard to the article "In Command" (*80 Microcomputing*, November 1981), there is a much easier way to keep your variables from being cleared than using On Error GOTO.

If you exit the Edit mode using the Q command no variables are cleared; of course, no changes are made in the line. This works whether you enter Edit or the computer automatically enters Edit after a syntax error.

David E. Martin
Kokomo, IN



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80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

"The growing business computer market is drawing software vendors like honey draws bees."

If the past few months are any indication, the new year will provide wonderful opportunities for the business microcomputer user. The growing business computer market is drawing software vendors like honey draws bees. All this talent is having a salutary effect: Almost without exception, microcomputer software is more professional.

The MBS

A good example of the new breed of software is the MicroComputer Business General Ledger (MBS) system distributed by Instant Software, Peterborough, NH 03458. The MBS system represents a new standard in documentation and presentation.

Developed by the MicroComputer Business International Ltd of Surrey, England, MBS is supplied in an attractive plastic binder. Inside the binder is a separate case containing the system disk, file disk and a notebook of meticulously detailed instructions. As an example of proper documentation, the notebook is extraordinary. It contains five sections:

- Technical Specifications
- Guidelines for Use
- Using the System
- Specific Program Operating Instructions
- Appendices

The first section (Technical Specifications) presents program details, describes each file, defines record layouts and specifies system capacities. To aid in understanding processing flow, this section presents a simplified flowchart for each program in the system. Each flowchart contains an input description, a file specification section, an output description and a summary of processing procedures. With this presentation even a data processing novice can understand the processing techniques used.

This ledger system is of the "balance forward" type. This means all details of current transactions are removed from the files when a month is closed. Typical of most microcomputer ledger systems, research into prior period's balances must be accomplished with hardcopy. Although this is cumbersome, there should be no problem—this system generates many printouts. For example, when initializing a chart of accounts, the system prints a logging entry after each account is entered.

Unlike most other ledger systems I have reviewed, MBS has almost no pre-defined reports. Missing are the pre-defined Balance Sheet, Income Statement and other normal financial reports. The user must define reports; up to 99 different ones are possible on a two-drive system. Because report formats take up file space, there is a trade-off between the number of reports, accounts and transactions that can be processed. You should carefully examine the list of report, transaction and count capacities included in the technical specifications before running the system.

"Good code should be protected, and this is a well-protected system."

The designers of this system are obviously familiar with the limitations of the floppy disk. Technical specifications include an interesting section on disk accessing speeds, file handling, sort and merge speeds and transaction file posting times. This is the first time I have seen information of this type in a financial software package. If the posting and sorting time estimates are accurate, this system should be a fast performer. For the limited test data that I posted, performance was quite good.

This same section refers to the modified operating system. The results of the modification became apparent when I tried to PEEK at the system code. Although the system is written in Basic, my attempt to list a program resulted in garbage. To further protect the system, you must enter the warranty code during initialization. This code is then a permanent part of the disk. I am in favor of practices such as this. Good code should be protected, and this is a well-protected system.

Initialization

Initialization procedures are unique. Booting the system results in a message from the designers rather than the familiar Tandy logo. After you comply with initial requests, the system displays an interesting menu. You can purchase this system as a complete accounting system, including a financial planning module. (Because I had only the ledger portion, my attempts to reference other modules brought a message that that portion of the system was not present and it could be purchased from a dealer.)

Referencing the General Ledger module brought me into the G/L menu. Unfortunately I was unable to do any processing. Returning to the manual (it often pays to read the instructions), I found that I had to initialize the files before I could enter data. You select file initialization programs from a utility menu. File initialization procedures allow you to place files on different drives, select disk names, define the system password and create files. Apparently the file initialization program sets up a data base reference system—it is quite time consuming.

Documentation

After learning my lesson during initialization, I decided to read the manual before assigning accounts. The chapter entitled Guidelines for Use contains a detailed discussion of how to design a chart of accounts. Since the account coding structure is not predefined, the system can accommodate any current account coding structure. The designers recommend that you choose a sequence which separates assets, liabilities and P & L accounts. Standard reports such as the Trial

Balance list accounts in low to high order and without a proper sequence, so the resulting reports could be confusing.

This system accommodates both numeric and alphanumeric account codes. To illustrate the coding structure's flexibility a three page account listing is provided. This ledger system could probably accommodate a complicated chart of accounts if account capacity is not a problem. (As a CPA, I appreciate the suggestion in the manual that the chart of accounts selected be reviewed by the firm's accountant.)

The second portion of Guidelines for Use includes an interesting discussion about clerical control. This should be required reading for anyone concerned with installing a computerized system. Almost always ignored by software vendors, this area considers all required control procedures (such as use of input control logs and report retention requirements). In addition this section provides well drawn flowcharts illustrating input and output control concepts. To make the whole thing easier to install, key control forms such as the Security Backup Log, Journal Voucher, Accounts Master Control Log, Input Batch Control Form (among others) are all provided.

This section also discusses backup procedures. Diagrams indicate daily, weekly and monthly file rotation procedures. Because floppy disks are subject to wear, this chapter mentions the need for periodic disk replacement. Concern for disk integrity is also apparent when running the system. The system tests the files to ensure that records are usable. If a bad record is detected, the system indicates a problem and attempts to repair it. If repair is not possible you will have to use a backup. With this technique, a bad or worn disk should be detected quickly so you can replace it before data is lost.

The Report Writer

The balance of the Guidelines section is a tutorial on how to use the report writer. The system has a few pre-defined internal reports (such as a trial balance worksheet and various input control listings). The report writer must define reports designed for external users of accounting data. Because this system contains an enormous amount of accounting information (such as prior period balances and budgets), you can develop very informative reports.

For example, consider a retail firm with many stores located in various cities and states. Each store must produce profit and loss reports for overall control purposes. However, often the same data is also required summarized by a taxing authority for tax planning purposes and again by a district supervisor for bonus calculation purposes. The MBS report writer can extract this data and generate comparative reports to the prior year or budget. Because the report writer allows grouping accounts and definition of total levels, you can prepare either detail reports by account or summary reports. You select the level of detail when you run the report printing program.

A report file maintenance program creates a report format. Reports are defined with six data types. These data types range from the heading of the report (Type One) to the number of blank lines required (Type Six) between totals. Unfortunately no control is available over form layout.

"The system developers have contrived to keep you informed of what the computer is doing at all times."

The only formats accommodated are Actual versus Budget versus Last Year, Actual versus Budget with variance amount and percent and Actual versus History with variance amount and percent. The lack of format control and the insertion of footnote data will be a problem to a CPA who wishes to generate client reports. Retyping will be required to add textual material before you can issue the reports.

In comparison to other programs in the system, the report file maintenance program is not easy to use. Data types are entered by designating a line number and entering each type line by line. After you make the entry, it is erased from the screen. As a result you must keep a manual record of the last line number used and its purpose to avoid confusion. Because reports are executed on a line-by-line basis, you should select line numbers that will permit future insertions. Failure to observe this rule makes later insertions of captions and accounts impossible. If you make an error when entering a data type, you must retype the entire line. It is advisable when preparing a brand new report to lay the whole report out manually in draft form before using the report file maintenance program.

Using the System

Setting the system in operation is covered in two chapters in the manual. The first chapter, quite short, covers start-up procedures and input edit conventions. Even though start-up is conventional, it is advisable to read this short chapter thoroughly. This system, like many of the original Radio Shack systems, uses the F1 and F2 keys to abort incorrect program selections. Unfortunately this option is not listed on any program menu.

This deficiency aside, MBS screen layouts are clean, attractive and informative. The system developers have contrived to keep you informed of what the computer is doing at all times. Most screens have a neat box on the top which contains the program name being executed, a description of the program activity and the current date. Below the box are displayed actions requested. If an entry is not made within 15 seconds, a box appears on the lower few lines of the screen with a request "Waiting for Input".

The system designers use formatted screens well. For example, when you create a new account, all fields in which you can store data are displayed at once. Selecting an appropriate field number moves the cursor to the field's location; the maximum field length is displayed. This procedure makes data entry rather like filling out a preprinted form. This is quite advantageous because account creation requires you to enter an enormous amount of data. You may enter up to 13 periods of history and 13 budget figures, in addition to the current periods and year-to-date activity amounts.

Because initializing a chart of accounts is prone to error, all data entered is logged on the printer as you complete each account entry. In addition, the computer halts data entry after the 50th item to sort the input information and update the files. Use hardcopy log and the pause to control the initialization procedure. You should compare input totals to the account totals batch by batch to prevent incorrect historical and budget detail which may contaminate future reports.

To guide new operators through each program in the system the manual has detailed instructions and screen photographs. With these instructions there should be no difficulty in entering transactions and using each program. In addition, each output routine has error-

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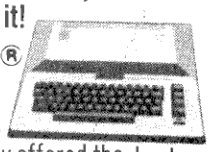

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trapping procedures to help prevent major errors. However, the greatest aid to installation is the hardcopy log printed after every entry that can affect a file. With this log you can track down and correct even the most subtle error.

If you purchase this system as a standalone ledger, you will enter all data through the posting program. The posting program allows you to enter transactions for the current period or the next accounting period. This procedure allows you to enter activity for the next period without being forced into an early closing for the current one, a nice touch.

The transaction entry routine also facilitates accrual entries. If you enter a transaction as an accrual, it is marked for automatic reversal in the next period. During data entry, account validity is verified; however, an automatic balancing requirement is not enforced. The designers of the ledger state that MBS "has its own batch balancing controls which will tell you when a batch of input data is out of balance and by how much." They have elected to give the user the option of posting out-of-balance batches. While I prefer that the system accept only balanced entries, there might be an occasion where a one-sided entry is required. Since the system requires printing of a record of all data input transactions, tracing an out-of-balance condition should be reasonably easy.

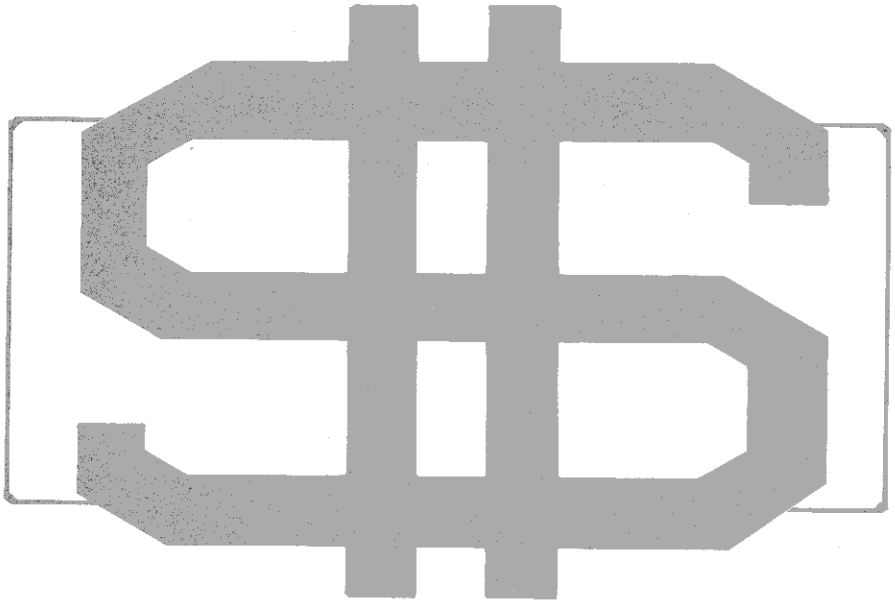
This system has all the characteristics that I expect from a well-written and properly documented general ledger system. A limited test cannot exercise all of the system's features; however, I see no reason why I could not install it for a client's use. Although the report format is too limited for professional use, it should be quite adequate for internal management. If, as indicated by the menu, you can install a fully integrated system, you could automate all elements of accounting/recordkeeping. This would be quite interesting and I look forward to obtaining additional modules in the future.

Integrated Systems

With respect to integrated systems, I have recently received the order entry, sales analysis and accounts payable modules for the three-disk COBOL series of Tandy systems. With the exception of the payroll portion, this represents a totally automated system of accounting/recordkeeping for the Model II. Tandy advises that this system can be transferred to the new hard disk subsystem. When my hard disk system is delivered, I will retest all previously reviewed modules as an integrated system. I expect that this test will prove quite interesting.

The COBOL system represents a substantial achievement—a fully integrated, professionally designed software package. With software such as this there should be no reason for a modest-size business to postpone automating recordkeeping.

The MBS system is in the same league and this increase in the choice of systems will benefit all. The MBS system with its different features and processing speed may prove more suitable for some clients than the more complicated Tandy system. Either way, we professionals will have a greater range of alternatives to help our clients into the computer age. ■



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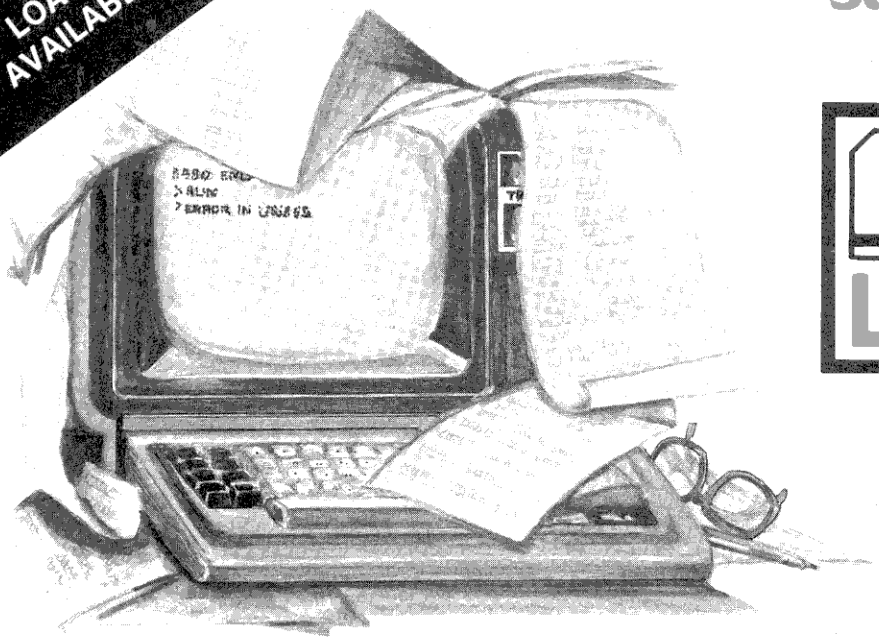

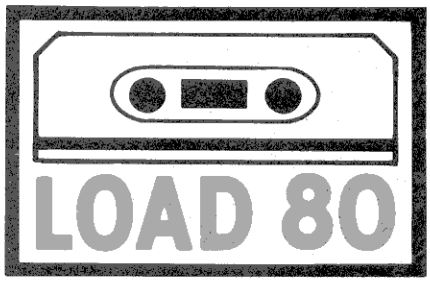

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Wayne Green

Wayne Green
Publisher, *80 Microcomputing*

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SOFT BITS
a basic/assembly column

by Roger Fuller

One of my goals in this column is to provide simple machine code programs which interface with Basic. To this end I will try to keep programs compatible with Models I and III, whether disk or not. While this month's program is considerably longer than 80 bytes, it still meets these criteria.

Scripy is Born

I wrote Scripy because I saw a need for a simple, easy to understand and operate, yet functional word processor. I want to thank Lynard Barnes for his article "More Write Stuff" (*80 Microcomputing*, December 1981) which introduced me to this concept.

Since most letters are only one page long and written on standard 8½ by 11 paper, Scripy holds 66 lines of 64 characters. The screen thus functions as a window on the letter; the program needs only vertical scrolling for you to view the entire page.

Scripy is actually a screen-oriented text editor rather than a word processor. I designed it to do the word processing in Basic. Since it needs only 4,224 bytes of string space, there is ample room for additional coding even in a 16K system.

Dear John

Scripy uses the four arrow keys for nondestructive cursor movement. You may change letters by over-typing. To insert an additional character in a line press the Break key to add a space at the current cursor location; then type the correct character. Press the Clear key to delete the character under the cursor. Pressing Enter moves the cursor to the beginning of the next line. Press all arrow keys simultaneously to exit the input mode when you have finished entering text.

When you add a character the remaining text on that line moves over one position. (The last character is discarded.) When you delete a character the remaining text on that line moves in one position and the program places a space at the end of the line. Text will not automatically wrap around when the end of a line is encountered. You may type a character in the very bottom of the screen without the screen scrolling up because Scripy does not use the video driver to print on the screen.

Scripy uses only one ROM routine, Radio Shack's documented address 002BH. This key scan works just like Basic's INKEY$. On the Model III the key scan provides auto repeat and lowercase. Model I users may use drivers to accomplish the same functions if desired. Such drivers do not interfere with the program's operation.

To load and save text strings with a tape-based system, you must write a special conversion scanner to change quotation marks to some other code (such as CHR$(127)). If you have a disk system you can use Line Input or random access to avoid the same problem.

> "Scripy is actually a screen-oriented text editor rather than a word processor."

The simple initialization routine shown in Program Listing 1 fills the strings with spaces and ensures that they are contiguous in memory. The strings must be in order from lowest to highest for the program to work properly. You can relocate the object code to any place in memory with an assembler. You can assemble the source code in a 16K system.

When modifying the strings in Basic be sure to restore them to correct sequence and position before reentering Scripy. If you have Disk Basic, use the MID$ replacement function to avoid disturbing the strings' lengths or positions. Tape or disk system users can employ the method shown in Program Listing 2 to restore the strings to the correct situation.

The Programs

I wrote Scripy in a top down manner. That is, I first developed the overall concept. Then I broke the main idea into actual functions. Using these functions as subroutines to a main control loop made writing structured code easy. While I did not vigorously structure the assembly code for Scripy it does have many aspects of structured programming:

- The program's core is on the first page.
- Program control centers in a main loop.
- Subroutines (with one exception) are entered at the top and exited at the bottom.
- I assigned meaningful labels.
- Visual separations follow program divisions.
- I used many comments.
- Program parameters are at the start of the code.

You can enter Scripy via a USR call. Other methods are possible, but initialization requires the address of the first character in the text block. Normally, VARPTR generates the address and passes it to Scripy via the USR operand.

Initialization also moves the first screen of text to the display and resets the counter, TOPCNT. (TOPCNT determines which line of text is currently displayed at the top of the screen.)

After initialization control drops to the main loop entry section. Here the cursor pointer is updated by loading the contents of register pair DE into the storage location assigned for this pointer. DE passes the current cursor location to subroutines and back. The cursor flash switch is tested; if it is on the cursor is displayed to the screen.

At last the key scan loop is entered and the screen pointer and the string pointer HL are saved. HL points to the location in memory corresponding to the character at the current cursor location. HL also passes the current text character pointer to subroutines and back.

Next, the flash counter and counter limit value are loaded. A SBC instruction

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compares the two values and branches program execution. The value of the counter DE is not destroyed by a SBC HL,DE operation.

After the program makes this test for a status change it will either change the cur-

```
1000 '*************** LISTING 1
1001 '
1100 ' ASSUMES AT LEAST 4224 BYTES OF STRING CLEARED
1101 ' AND S$() HAS ALREADY BEEN DIMINSIONED
1102 '
1150 IF FRE("")      ' CLOSES UP STRING SPACE
1200 FOR L%=65 TO 0 STEP -1 : S$(L%)=STRING$(64,32) : NEXT
1300 '
1400 ' HERE PLACE YOUR LOAD ROUTINE IF ANY
1500 '
1600 ' HERE DEFINE THE USR CALL ADDRESS AND MAKE THE CALL
1601 ' USE EITHER L%=USR( VARPTR( S$(0) ) )
1602 '     OR     L%=USR1( VARPTR( S$(0) ) )   IF DISK
1700 '
2000 '************** LISTING 2
2001 '
2100 IF FRE("")     ' CLOSES UP STRING SPACES
2101 FOR L%=65 TO 0 STEP -1 : S$(L%) = S$(L%) + "" : NEXT
```

Program Listing 1.

Program Listing 2.

```
                00100 ;*******************************************************
                00110 ;
                00120 ;   S C R I P Y       BY  ROGER FULLER       PUBLIC DOMAIN
                00130 ;
                00140 ;*******************************************************
                00150 ;
                00160 ;
002B            00170 KEYIN   EQU     002BH            ;BASIC'S KEY SCAN
                00180 ;
                00190 ;
F000            00200         ORG     0F000H
                00210 ;
                00220 ;
0002            00230 CURLOC  DEFS    2                ;CURSOR ADDRESS STORAGE
F002 8F         00240 CURSOR  DEFB    143              ;GRAPHIC OF 4 PIXELS
F003 00         00250 ONOFF   DEFB    0                ;0=OFF  FF=ON
F004 0000       00260 COUNT   DEFW    0                ;COUNTER FOR FLASHING
F006 00         00270 TOPCNT  DEFB    0                ;STRING LINE AT SCREEN TOP
0032            00280 MAXCNT  EQU     66-16            ;LIMITS SCROLLING
                00290 ;
                00300 ;************** INITIALIZATION SECTION AND USR ENTRY POINT
F007 CD7F0A     00310 USRADR  CALL    0A7FH            ;GET STRING ARRAY ADDRESS
F00A 23         00320         INC     HL
F00B 5E         00330         LD      E,(HL)
F00C 23         00340         INC     HL
F00D 56         00350         LD      D,(HL)
F00E EB         00360         EX      DE,HL            ;HL => STRING LINES
F00F E5         00370         PUSH    HL               ;SAVE STRING POINTER
F010 11003C     00380         LD      DE,3C00H         ;HOME CURSOR LOCATION
F013 D5         00390         PUSH    DE               ;SAVE IT
F014 010004     00400         LD      BC,1024          ;ONE SCREEN OF STRINGS
F017 EDB0       00410         LDIR                     ;DISPLAY IT
F019 AF         00420         XOR     A
F01A 3206F0     00430         LD      (TOPCNT),A       ;ZERO TOPCNT
F01D D1         00440         POP     DE               ;RESTORE SCREEN POINTER
F01E E1         00450         POP     HL               ;RESTORE STRING POINTER
                00460 ;
                00470 ;************** MAIN LOOP ********************************
F01F ED5300F0   00480 SCRIPY  LD      (CURLOC),DE      ;UPDATE CURSOR LOCATION
F023 3A03F0     00490         LD      A,(ONOFF)        ;GET CURSOR FLASH SWITCH
F026 B7         00500         OR      A                ;TEST IT
F027 2804       00510         JR      Z,KYLOOP         ;IF CURSOR IS OFF
F029 3A02F0     00520         LD      A,(CURSOR)       ;  ELSE GET CURSOR
F02C 12         00530         LD      (DE),A           ;  AND PUT IT ON SCREEN
F02D D5         00540 KYLOOP  PUSH    DE               ;SAVE SCREEN POINTER
F02E E5         00550         PUSH    HL               ;SAVE STRING POINTER
F02F ED5B04F0   00560         LD      DE,(COUNT)       ;GET COUNT
F033 13         00570         INC     DE               ;BUMP COUNT
F034 219001     00580         LD      HL,400           ;GET LIMIT VALUE
F037 ED52       00590         SBC     HL,DE            ;TEST COUNT
F039 3019       00600         JR      NC,BLINKX        ;IF COUNT NOT OVER LIMIT
F03B 3A03F0     00610         LD      A,(ONOFF)        ;GET CURSOR FLASH STATUS
F03E B7         00620         OR      A                ;TEST IT
F03F 2F         00630         CPL                      ;CHANGE STATE
```

Program Listing 2 Continues

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Program Listing 2 Continued

```
F040 3203F0   00640          LD      (ONOFF),A        ;UPDATE SWITCH
F043 2805     00650          JR      Z,PUTCUR         ;IF CURSOR IS OFF
F045 E1       00660          POP     HL               ;RESTORE STRING POINTER
F046 E5       00670          PUSH    HL               ;  AND SAVE IT AGAIN
F047 7E       00680          LD      A,(HL)           ;  GET CHAR
F048 1803     00690          JR      $+5
F04A 3A02F0   00700 PUTCUR   LD      A,(CURSOR)       ;GET CURSOR CHAR
F04D 2A00F0   00710          LD      HL,(CURLOC)      ;POINT TO SCREEN
F050 77       00720          LD      (HL),A           ;DISPLAY CURSOR/CHAR
F051 110000   00730          LD      DE,0000H         ;RESET COUNTER
F054 ED5304F0 00740 BLINKX   LD      (COUNT),DE       ;UPDATE COUNT
F058 CD2B00   00750          CALL    KEYIN
F05B E1       00760          POP     HL               ;RESTORE STRING POINTER
F05C D1       00770          POP     DE               ;RESTORE SCREEN POINTER
F05D B7       00780          OR      A
F05E 2008     00790          JR      NZ,KEYCK         ;IF A NEW KEY TYPED
F060 3A4038   00800          LD      A,(3840H)        ;ARROW KEYS ROW ADDRESS
F063 FE78     00810          CP      120              ;ALL ARROWS PRESSED
F065 20C6     00820          JR      NZ,KYLOOP        ;IF NOT EXIT CONDITIONS
F067 C9       00830          RET
              00840 ;
              00850 ;-------------- SUBROUTINES ----------------------------
              00860 ;
F068 F5       00870 KEYCK    PUSH    AF               ;SAVE CHAR
F069 7E       00880          LD      A,(HL)           ;GET CHAR UNDER CURSOR
F06A 12       00890          LD      (DE),A           ;PUT ON SCREEN
F06B 3EFF     00900          LD      A,0FFH           ;CURSOR ON STATUS VALUE
F06D 3203F0   00910          LD      (ONOFF),A        ;UPDATE SWITCH
F070 E5       00920          PUSH    HL
F071 210000   00930          LD      HL,0000H
F074 2204F0   00940          LD      (COUNT),HL       ;RESET FLASH COUNTER
F077 E1       00950          POP     HL
F078 F1       00960          POP     AF               ;RESTORE CHAR
F079 FE5B     00970          CP      5BH              ;        T
F07B CAC2F0   00980          JP      Z,UP             ;        E
F07E FE1B     00990          CP      1BH              ;        S
F080 CAC2F0   01000          JP      Z,UP             ;        T
F083 FE0A     01010          CP      0AH              ;
F085 CAE1F0   01020          JP      Z,DOWN           ;        A
F088 FE1A     01030          CP      1AH              ;        R
F08A CAE1F0   01040          JP      Z,DOWN           ;        R
F08D FE08     01050          CP      08H              ;        O
F08F CA01F1   01060          JP      Z,BACK           ;        W
F092 FE18     01070          CP      18H              ;
F094 CA01F1   01080          JP      Z,BACK           ;        K
F097 FE09     01090          CP      09H              ;        E
F099 CA0BF1   01100          JP      Z,OVER           ;        Y
F09C FE19     01110          CP      19H              ;        S
F09E CA0BF1   01120          JP      Z,OVER           ;
F0A1 FE1F     01130          CP      1FH
F0A3 CA3CF1   01140          JP      Z,DELETE                  ;CLEAR KEY
F0A6 FE0D     01150          CP      0DH
F0A8 CA17F1   01160          JP      Z,ENTER                   ;ENTER KEY
F0AB FE01     01170          CP      01H
F0AD CA65F1   01180          JP      Z,INSERT                  ;BREAK KEY
F0B0 FE20     01190          CP      20H
F0B2 38ØB     01200          JR      C,KEYCKX         ;IF NOT PRINTABLE ASCII
F0B4 12       01210          LD      (DE),A           ;  ELSE PUT ON SCREEN
F0B5 77       01220          LD      (HL),A           ;  AND IN STRING
F0B6 7B       01230          LD      A,E              ;LSB OF CURSOR LOCATION
F0B7 E63F     01240          AND     63               ;ADJUST TO TAB POSITION
F0B9 FE3F     01250          CP      63
F0BB 2802     01260          JR      Z,KEYCKX         ;IF AT END OF LINE
F0BD 23       01270          INC     HL               ;  ELSE BUMP STRING
F0BE 13       01280          INC     DE               ;  AND SCREEN POINTERS
F0BF C31FF0   01290 KEYCKX   JP      SCRIPY
              01300 ;
              01310 ;--------------------------------
F0C2 7B       01320 UP       LD      A,E
F0C3 FE40     01330          CP      64
F0C5 3010     01340          JR      NC,UP2           ;NOT TOP ROW
F0C7 7A       01350          LD      A,D
F0C8 FE3C     01360          CP      3CH
F0CA 200B     01370          JR      NZ,UP2           ;NOT TOP ROW
F0CC 3A06F0   01380          LD      A,(TOPCNT)
F0CF B7       01390          OR      A
F0D0 280C     01400          JR      Z,UPX            ;IF CAN'T SCROLL DOWN
F0D2 CD89F1   01410          CALL    SCRNDN           ;SCREEN DOWN
F0D5 1807     01420          JR      UPX
F0D7 01C0FF   01430 UP2      LD      BC,-64
F0DA EB       01440          EX      DE,HL
F0DB 09       01450          ADD     HL,BC            ;MOVE UP ON SCREEN
F0DC EB       01460          EX      DE,HL
F0DD 09       01470          ADD     HL,BC            ;MOVE UP IN STRINGS
F0DE C31FF0   01480 UPX      JP      SCRIPY
              01490 ;
              01500 ;--------------------------------
F0E1 7B       01510 DOWN     LD      A,E
F0E2 FEC0     01520          CP      0C0H
F0E4 3811     01530          JR      C,DOWN2          ;NOT BOTTOM ROW
F0E6 7A       01540          LD      A,D
F0E7 FE3F     01550          CP      3FH
```

Program Listing 2 Continues

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(*Ed. Note:* See "OS-80®: Bridging the TRS-80* software compatibility gap" elsewhere on this page.)

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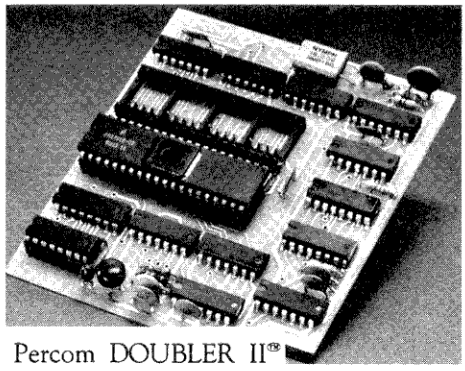

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OS-80™ Bridging the TRS-80* software compatibility gap

Compatibility between TRS-80* Model I diskettes and the new Model III is about as genuine as a gold-plated lead Krugerrand.

True, Model I TRSDOS* diskettes can be *read* on a Model III. But first they must be converted and re-recorded for Model III operation.

And you *cannot write* to a Model I TRSDOS* diskette. Not with a Model III. You cannot add a file. Delete a file. Or in any way modify a Model I TRSDOS diskette with a Model III computer.

Furthermore, your converted TRSDOS diskettes cannot be converted *back* for Model I operation.

TRSDOS is a one-way street. And there's no retreating. A point to consider before switching the company's payroll to your new Model III.

Real software compatibility should allow the *direct, immediate* interchangeability of Model I and Model III diskettes. No read-only limitations, no conversion/re-recording steps and no chance to be left high and dry with Model III diskettes that can't be run on a Model I.

What's the answer? The answer is Percom's OS-80™ family of TRS-80 disk operating systems.

OS-80 programs allow *direct, immediate* interchangeability of Model I and Model III diskettes.

You can run Model I single-density diskettes on a Model III; install Percom's plug-in DOUBLER™ adapter in your Model I, and you can run double-density Model III diskettes on a Model I.

There's no conversion, no re-recording.

Slip an OS-80 diskette out of your Model I and insert it directly in a Model III.

And vice-versa.

Just have the correct OS-80 disk operating system — OS-80, OS-80D or OS-80/III — in each computer.

Moreover, with OS-80 systems, you can add, delete, and update files. You can read *and write* diskettes regardless of the system of origin.

OS-80 is the original Percom TRS-80 DOS for BASIC programmers.

Even OS-80 utilities are written in BASIC.

OS-80 is the Percom system about which a user wrote, in Creative Computing magazine, "... the best $30.00 you will ever spend."†

Requiring only seven Kbytes of memory, OS-80 disk operating systems reside completely in RAM. There's no need to dedicate a drive exclusively for a system diskette.

And, unlike TRSDOS, you *can* work at the track sector level, defining and controlling data formats — in BASIC — to create simple or complex data structures that execute more quickly than TRSDOS files.

The Percom OS-80 DOS supports single-density operation of the Model I computer — price is $29.95; the OS-80D supports double-density operation of Model I computers equipped with a DOUBLER or DOUBLER II; and, OS-80/III — for the Model III of course — supports both single- and double-density operation. OS-80D and OS-80/III each sell for $49.95. ✓3

Circuit misapplication causes diskette read, format problems.
High resolution key to reliable data separation

GARLAND, TEXAS — The Percom SEPARATOR® does very well for the Radio Shack TRS-80* Model I computer what the Tandy disk controller does poorly at best: *reliably* separates clock and data signals during disk-read operations.

Unreliable data-clock separation causes format verification failures and repeated read retries.

CRC ERROR–TRACK LOCKED OUT

The problem is most severe on high-number (high-density) inner file tracks.

As reported earlier, the clock-data separation problem was traced by Percom to misapplication of the internal separator of the 1771 drive controller IC used in the Model I.

The Percom Separator substitutes a *high-resolution* digital data separator circuit, one which operates at 16 megahertz, for the low-resolution one-megahertz circuit of the Tandy design.

Separator circuits that operate at lower frequencies — for example, two- or four-megahertz — were found by Percom to provide only marginally improved performance over the original Tandy circuit.

The Percom solution is a simple adapter that plugs into the drive controller of the Expansion Interface (EI).

Not a kit — some vendors supply an untested separator kit of resistors, ICs and other paraphernalia that may be installed by modifying the computer — the Percom SEPARATOR is a fully assembled, fully tested plug-in module.

Installation involves merely plugging the SEPARATOR into the Model I EI disk controller chip socket, and plugging the controller chip into a socket on the SEPARATOR.

The SEPARATOR, which sells for only $29.95, may be purchased from authorized Percom retailers or ordered directly from the factory. The factory toll-free order number is 1-800-527-1222.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty. ✓2

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®Trademark of Percom Data Company, Inc. *TRS-80 and TRSDOS are trademarks of Tandy Corporation which has no relationship to Percom Data Company. †Creative Computing Magazine, June, 1980, page 26.

✓See List of Advertisers on page 402

Program Listing 2 Continued

```
F0E9 200C       01560          JR      NZ,DOWN2          ;NOT BOTTOM ROW
F0EB 3A06F0     01570          LD      A,(TOPCNT)
F0EE FE32       01580          CP      MAXCNT
F0F0 280C       01590          JR      Z,DOWNX           ;IF CAN'T SCROLL UP
F0F2 CDB2F1     01600          CALL    SCRNUP
F0F5 1807       01610          JR      DOWNX
F0F7 014000     01620 DOWN2    LD      BC,64
F0FA EB         01630          EX      DE,HL
F0FB 09         01640          ADD     HL,BC             ;MOVE DOWN ON SCREEN
F0FC EB         01650          EX      DE,HL
F0FD 09         01660          ADD     HL,BC             ;MOVE DOWN IN STRINGS
F0FE C31FF0     01670 DOWNX    JP      SCRIPY
                01680 ;
                01690 ;-------------------------------
F101 7B         01700 BACK     LD      A,E
F102 E63F       01710          AND     63
F104 2802       01720          JR      Z,BACKX           ;IF AT START OF LINE
F106 1B         01730          DEC     DE                ;  ELSE BACKUP ON SCREEN
F107 2B         01740          DEC     HL                ;  AND IN STRINGS
F108 C31FF0     01750 BACKX    JP      SCRIPY
                01760 ;
                01770 ;-------------------------------
F10B 7B         01780 OVER     LD      A,E
F10C E63F       01790          AND     63
F10E FE3F       01800          CP      63
F110 2802       01810          JR      Z,OVERX           ;IF AT END OF LINE
F112 23         01820          INC     HL                ;  ELSE MOVE OVER ON SCREEN
F113 13         01830          INC     DE                ;  AND IN STRINGS
F114 C31FF0     01840 OVERX    JP      SCRIPY
                01850 ;
                01860 ;-------------------------------
F117 7B         01870 ENTER    LD      A,E
F118 FEC0       01880          CP      0C0H
F11A 381A       01890          JR      C,ENTER2          ;IF NOT ON BOTTOM ROW
F11C 7A         01900          LD      A,D
F11D FE3F       01910          CP      3FH
F11F 2015       01920          JR      NZ,ENTER2         ;IF NOT ON BOTTOM ROW
F121 3A06F0     01930          LD      A,(TOPCNT)
F124 FE32       01940          CP      MAXCNT
F126 2811       01950          JR      Z,ENTERX          ;IF CAN'T SCROLL UP
F128 CDB2F1     01960          CALL    SCRNUP
F12B 01C0FF     01970          LD      BC,-64
F12E 09         01980          ADD     HL,BC             ;MOVE UP IN STRINGS
F12F EB         01990          EX      DE,HL
F130 09         02000          ADD     HL,BC             ;MOVE UP ON SCREEN
F131 EB         02010          EX      DE,HL
F132 ED5300F0   02020          LD      (CURLOC),DE       ;UPDATE CURSOR'S POSITION
F136 CDD6F1     02030 ENTER2   CALL    NXLINE
F139 C31FF0     02040 ENTERX   JP      SCRIPY
                02050 ;
                02060 ;-------------------------------
F13C 7B         02070 DELETE   LD      A,E
F13D 2F         02080          CPL
F13E E63F       02090          AND     63                ;A = REMAINING LINE LENGTH
F140 4F         02100          LD      C,A
F141 0600       02110          LD      B,0               ;NOW BC = REMAINING LENGTH
F143 2812       02120          JR      Z,ENDSPS          ;IF AT END OF LINE
F145 D5         02130          PUSH    DE
F146 E5         02140          PUSH    HL
F147 62         02150          LD      H,D
F148 6B         02160          LD      L,E
F149 23         02170          INC     HL                ;HL => NEXT SCREEN CHAR
F14A EDB0       02180          LDIR                      ;MOVE UP LINE ON SCREEN
F14C 4F         02190          LD      C,A               ;RESTORE MOVE COUNT
F14D E1         02200          POP     HL                ;RESTORE STRING POINTER
F14E E5         02210          PUSH    HL                ;THEN SAVE IT AGAIN
F14F 54         02220          LD      D,H
F150 5D         02230          LD      E,L
F151 23         02240          INC     HL                ;HL => NEXT STRING CHAR
F152 EDB0       02250          LDIR                      ;MOVE UP LINE IN STRINGS
F154 E1         02260          POP     HL
F155 D1         02270          POP     DE
F156 4F         02280          LD      C,A               ;RESTORE LENGTH COUNT
                02290 ;---------------
F157 E5         02300 ENDSPS   PUSH    HL
F158 09         02310          ADD     HL,BC             ;HL => END OF STRING LINE
F159 3620       02320          LD      (HL),' '          ;PUT A SPACE THERE
F15B D5         02330          PUSH    DE
F15C EB         02340          EX      DE,HL
F15D 09         02350          ADD     HL,BC
F15E 3620       02360          LD      (HL),' '          ;AND AT END OF SCREEN LINE
F160 D1         02370          POP     DE
F161 E1         02380          POP     HL
F162 C31FF0     02390          JP      SCRIPY
                02400 ;
                02410 ;-------------------------------
F165 7B         02420 INSERT   LD      A,E
F166 2F         02430          CPL
F167 E63F       02440          AND     63                ;A = REMAINING LINE LENGTH
```

Program Listing 2 Continues

sor/character and the status switch (ON-OFF) or not. If the cursor/character requires changing, a CPL instruction flips the switch, updates it and displays the appropriate cursor/character. Line 650 chooses the cursor or character since a CPL does not disturb the results of the OR A test at line 620. If the cursor is not to be displayed, the string pointer is restored and JP $+5 skips the get cursor instruction.

This jump counts from the address of the current instruction to the address of the instruction at line 710, or five bytes. This saves creating another label for just this short jump. (I do not use this technique very often, and only for jumps under 10 bytes.) The program flow merges again and either updates or resets the flash counter, depending on the value of DE.

Now the program scans and tests the keyboard for a character. If there was no new key, the program examines the address of the arrow keys for the exit condition. If all four keys are not pressed, control (which is just another name for the program counter of the Z80) passes back to the main loop scanner.

"Put any text processing routines. . . just before the Return instruction."

(Put any text processing routines like the conversion scanner mentioned earlier just before the Return instruction. If you do use such a scanner you will need to add a PUSH HL with its corresponding POP HL to save and restore the string pointer.)

If you press a key, control is sent to an input key processor. This routine turns off the cursor and resets the flash counter so that the cursor moves without leaving the cursor at the old address. Resetting the counter makes the cursor visible instantly when moved. If I did not reset the counter I would be unsure of the cursor's position until it blinked on again. If you type a key that is not a control key or a printable character, control is sent back to the reentry point of the main loop.

If you type a printable key the program displays it at the current cursor location and puts it into the current text character location. The program then tests for the end of the screen line. If the end of the line has not been reached it updates the cursor location pointer and the current text character pointers and sends control back to the reentry point of the main loop.

Reader Service for facing page ✓29→

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by Jeff Zinn

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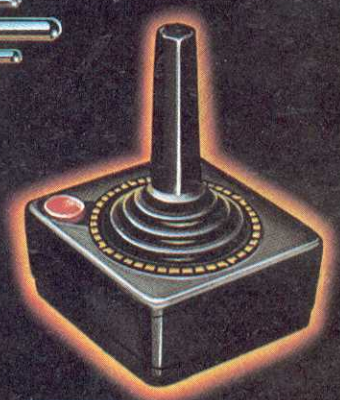

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Program Listing 2 Continued

```
F169 4F          02450          LD      C,A
F16A 0600        02460          LD      B,0                ;BC = REMAINING LINE LENGTH
F16C 28E9        02470          JR      Z,ENDSPS           ;IF END OF LINE
F16E D5          02480          PUSH    DE
F16F E5          02490          PUSH    HL
F170 EB          02500          EX      DE,HL
F171 09          02510          ADD     HL,BC
F172 54          02520          LD      D,H
F173 5D          02530          LD      E,L                ;DE => END OF SCREEN LINE
F174 2B          02540          DEC     HL                 ;HL => NEXT TO LAST CHAR
F175 EDB8        02550          LDDR                       ;OPEN UP LINE ON SCREEN
F177 4F          02560          LD      C,A                ;RESTORE MOVE COUNT
F178 E1          02570          POP     HL
F179 E5          02580          PUSH    HL
F17A 09          02590          ADD     HL,BC
F17B 54          02600          LD      D,H
F17C 5D          02610          LD      E,L                ;DE => END OF STRING LINE
F17D 2B          02620          DEC     HL                 ;HL => NEXT TO LAST CHAR
F17E EDB8        02630          LDDR                       ;OPEN UP STRING LINE
F180 E1          02640          POP     HL
F181 D1          02650          POP     DE
F182 3E20        02660          LD      A,' '
F184 12          02670          LD      (DE),A             ;PUT A SPACE ON SCREEN
F185 77          02680          LD      (HL),A             ;PUT A SPACE IN STRING
F186 C31FF0      02690          JP      SCRIPY
                 02700 ;
                 02710 ;-----------------------------
F189 D5          02720 SCRNDN   PUSH    DE
F18A E5          02730          PUSH    HL
F18B 01C003      02740          LD      BC,960             ;15 ROWS TO MOVE
F18E 11FF3F      02750          LD      DE,3FFFH           ;DE => END OF SCREEN
F191 21BF3F      02760          LD      HL,3FBFH           ;HL => END 2nd LAST ROW
F194 EDB8        02770          LDDR                       ;MOVE THE ROWS DOWN
F196 E1          02780          POP     HL
F197 E5          02790          PUSH    HL                 ;RESTORE STRING POINTER
F198 CDD6F1      02800          CALL    NXLINE
F19B 01C0FF      02810          LD      BC,-64
F19E C5          02820          PUSH    BC                 ;SAVE FOR LATER USE
F19F 09          02830          ADD     HL,BC              ;MOVE UP IN STRINGS UNTIL
F1A0 09          02840          ADD     HL,BC              ;HL => STRING TO BE MOVED
F1A1 11003C      02850          LD      DE,3C00H           ;DE => TOP LINE OF SCREEN
F1A4 014000      02860          LD      BC,64              ;BC = ONE LINE LENGTH
F1A7 EDB0        02870          LDIR                       ;MOVE STRING TO SCREEN
F1A9 2106F0      02880          LD      HL,TOPCNT
F1AC 35          02890          DEC     (HL)               ;ADJUST TOP LINE COUNTER
F1AD C1          02900          POP     BC
F1AE E1          02910          POP     HL
F1AF 09          02920          ADD     HL,BC              ;HL => NEW STRING
F1B0 D1          02930          POP     DE                 ;  AT SAME SCREEN POSITION
F1B1 C9          02940          RET
                 02950 ;
                 02960 ;-----------------------------
F1B2 D5          02970 SCRNUP   PUSH    DE
F1B3 E5          02980          PUSH    HL
F1B4 01C003      02990          LD      BC,960             ;15 ROWS TO SCROLL
F1B7 11003C      03000          LD      DE,3C00H           ;DE => TOP SCREEN LINE
F1BA 21403C      03010          LD      HL,3C40H           ;HL => NEXT LINE DOWN
F1BD EDB0        03020          LDIR                       ;MOVE THEM UP
F1BF E1          03030          POP     HL
F1C0 E5          03040          PUSH    HL
F1C1 CDD6F1      03050          CALL    NXLINE             ;HL => START NEXT STRING
F1C4 014000      03060          LD      BC,64
F1C7 C5          03070          PUSH    BC                 ;SAVE FOR LATER
F1C8 11C03F      03080          LD      DE,3FC0H           ;DE => LAST SCREEN LINE
F1CB EDB0        03090          LDIR                       ;MOVE ONTO SCREEN
F1CD 2106F0      03100          LD      HL,TOPCNT
F1D0 34          03110          INC     (HL)               ;BUMP TOP ROW COUNTER
F1D1 C1          03120          POP     BC
F1D2 E1          03130          POP     HL
F1D3 09          03140          ADD     HL,BC              ;ADJUST STRING POINTER
F1D4 D1          03150          POP     DE
F1D5 C9          03160          RET
                 03170 ;
                 03180 ;-----------------------------
F1D6 ED5B00F0    03190 NXLINE   LD      DE,(CURLOC)        ;GET CURSOR ADDRESS
F1DA 7B          03200          LD      A,E
F1DB 2F          03210          CPL
F1DC E63F        03220          AND     63                 ;A = REMAINING LINE LENGTH
F1DE 3C          03230          INC     A
F1DF 4F          03240          LD      C,A
F1E0 0600        03250          LD      B,0                ;BC = DISTANCE TO NEXT LINE
F1E2 09          03260          ADD     HL,BC              ;MOVE STRING POINTER TO
                 03270                                     ;START OF NEXT STRING
F1E3 EB          03280          EX      DE,HL

F1E4 09          03290          ADD     HL,BC
F1E5 EB          03300          EX      DE,HL              ;DE => NEXT SCREEN LINE
F1E6 C9          03310          RET
                 03320 ;
0000             03330          END
00000 TOTAL ERRORS
```

If you press a control key, control is sent to the appropriate subroutine for action. At the end of each control key subroutine, control returns to the reentry point of the main loop.

Subroutines

The main loop calls only three subroutines: SCRNUP, SCRNDN, and NXLINE. They return with DE, HL, CURLOC, and TOPCNT appropriately updated to reflect modified conditions.

SCRNUP moves the bottom 15 lines up one line and replaces the last screen line with the appropriate line of text. SCRNDN moves the top 15 lines down one line and replaces the top screen line with the appropriate line of text.

NXLINE moves both the cursor position and the text position to the start of the next appropriate line. NXLINE computes the distance on the screen, since the addresses of the end of a line on the screen have the last five bits set. Thus the distance can be added to each pointer. These three subroutines have no error checking, depending on the calling routine for error detection.

The left and right arrows update the pointers, provided that movement is allowed. The program tests for allowability on the cursor address since line addresses for start and end of each screen line have the last five bits either zeros or ones respectively. The AND 63 operation strips off the high three bits and tests for zeros, or allows a CP 63 to test for ones.

The up and down arrows move the pointers unless a screen scroll is required. If a scroll is required the main loop tests for allowability before calling the correct subroutine. Allowability testing is based on fixed screen addresses.

The Enter key moves to the start of the next line and scrolls if required and allowed. When a SCRNUP is required the pointers are backed up one line after scrolling. This allows NXLINE to position the pointers as required.

Delete moves the remaining text in unless there is none. If so, it skips the move section and jumps to the end space section. Remember that everything done on the screen must also be done in the text. Insert moves the remaining text out one position unless there is none. If so it branches to ENDSPS. Delete and Insert are the only routines that do not exit at the bottom.

Feel welcome to use, modify and expand Scripy. Please send me your comments and suggestions on this column. I would appreciate your input in developing this column. My address is 630 East Springdale, Grand Prairie, TX 75051.■

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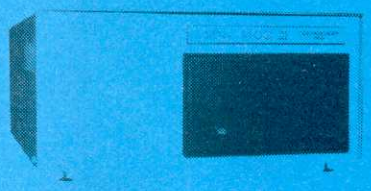

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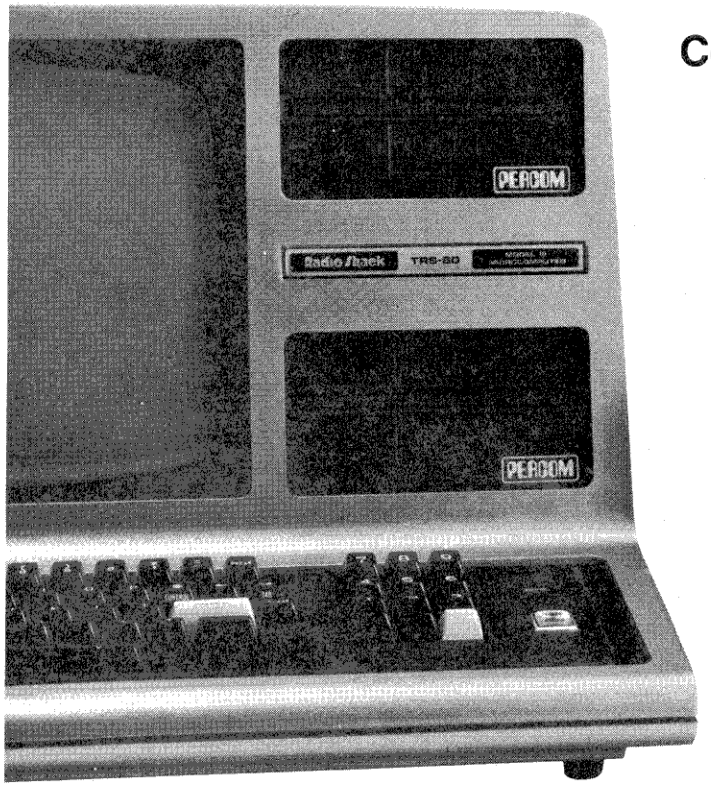

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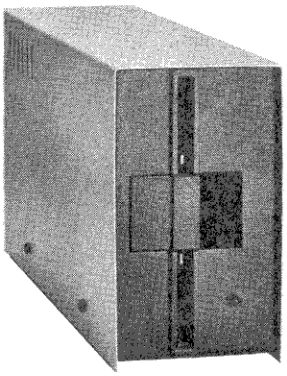

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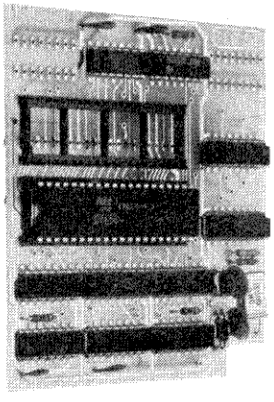

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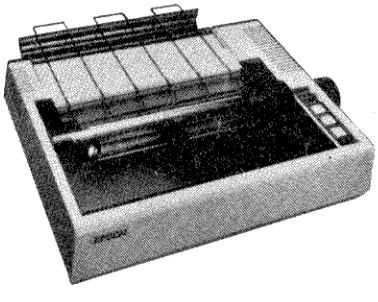

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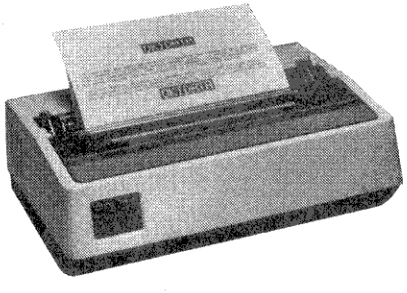

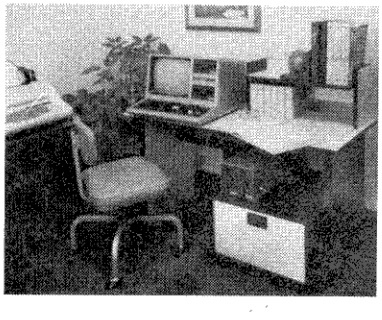

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80 REVIEWS

edited by Michael E. Nadeau

"You better have a good resolution tv to play these games."

Games Trilogy:
Color Space Invaders
Meteoroids
Space War
Spectral Associates
Tacoma, WA
$59.95 cassette

by David G. Bartlett

They've always said that the Color Computer was capable of high resolution graphics. These games prove it. (You better have a good resolution tv to play these games.) All are in machine language and require 16K, but not Extended Basic. Meteoroids and Space War require joysticks.

Color Space Invaders

Color Space Invaders is the same old game that you never get tired of playing, but this time you get the invaders waving their arms (or is it feet?) and blinking at you as they drop their bombs. This game can be played with the joysticks but it seems easier using the arrow keys and space bar.

You do not have to play at all if you want, you can watch the computer play itself, but the computer plays such a lousy game that you soon get frustrated and decide to show it how it is done. You also have a movable defense shield that protects you from falling bombs when positioned over your cannon. The shield is very hard to position and I find it easier to dodge the bombs than to try to use the shield.

A nice feature of the display is the lack of a perceptible border around the edge of the field and the entire screen flashing when you take a hit. The game has 16 skill levels.

"The black hole's gravitation is what makes this game fun."

Meteoroids

Meteoroids is an Asteroid-type game with very good action and speed. It includes most of the features of the popular arcade game including alien spaceships that fire back. Your ship is supposed to be controlled by the joysticks, but in this and the Space War game, the ship is very sensitive and difficult to control and the high resolution makes it hard to tell which way you are aimed. However, all this adds to the skill required and therefore the enjoyment. Another problem I have is holding both joysticks while I try to control the craft's aim and position.

Space War is similar to Meteoroids, but the main object is to destroy a death star which has only one weak spot. When you destroy it you are in for a treat but do not be too close when it goes or you will too. Some of the obstacles are enemy fighters, roving asteroids, space mines and a black hole with strong gravitational effect on you and your missiles.

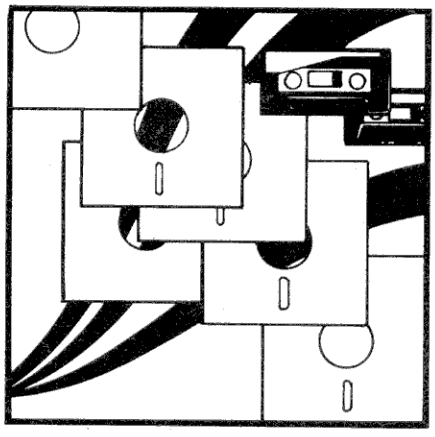
The black hole's gravitation is what makes this game fun. You can simulate the effect on the Voyager spacecraft as it was catapulted past Jupiter and even get into an unstable orbit for short periods. Of course that is not the real object of the game.

These games have sound. I think they are a better bargain than most software for this computer and they provide a good example of its excellent graphics capabilities. ■

Master Control
Soft Sector Marketing Inc.
Garden City, MI
$24.95

by Scott L. Norman

Master Control is a tape cassette program for redefining TRS-80 Color Computer key functions. After reading the advertisement I found two features especially hard to resist: single-keystroke entry



of common Basic commands and automatic line numbering during program entry.

The cassette is accompanied by an instruction leaflet, which is brief (2-½ pages) but sufficient. The keyboard overlay differs from the one shown in the advertisements. Production versions of Master Control use a peel-and-stick foil with black lettering on a dull silver background. The purchaser removes five die-cut slots from the foil (to clear the four rows of keys and the spacebar), and then attaches the overlay to the computer's keyboard surface. I did not want to misalign or permanently wrinkle the large, unwieldy sticker so I mounted it on a thin sheet of clear plastic and cut out the slots using a hobby knife. The result was a fairly rugged, removable overlay to which I have since added a second layer of plastic to protect the foil surface.

Operation

Master Control is written in machine language and is relocatable, a feature which I have used to great advantage. The instruction leaflet gives these command sequences for loading it into the topmost 1,100 bytes or so of a 16K or 32K computer:

```
16K:  CLEAR 25, 15104
      CLOADM "MASTER"

32K:  CLEAR 25, 30200
      CLOADM "MASTER", 16000
```

Although Color Computer documentation does not dwell on the point, the number following the comma in the Clear instruction specifies the highest (decimal) memory address which Basic can use—like the Memory Size command of the Model I. The 16000 in the 32K loading command is a decimal offset, telling the machine to load the program 16K higher than the loading address specified in the program itself.

I resent anything that steals memory from my Basic programs, so I use the following method to relocate Master Control.

My system consists of a 16K machine with a Computerware Power Pack (2K ROM plus 6K RAM) plugged into the cartridge port. The RAM is not contiguous with the memory normally addressed by the Basic interpreter; it starts at decimal 53248 (hex D000). Since the first loading sequence above tells us that Master Control's unadulterated load address is 15104, I can load it into my outboard RAM by giving an offset of 53248 – 15104, or 38144. In other words, the single statement, CLOADM "MASTER", 38144 does the job. This leaves all of the computer's internal memory free for Basic programs. The same procedure will work for the other plug-in RAMs appearing on the market; just check their starting addresses.

No matter how you load it, you invoke Master Control with the EXEC command. The copyright notice comes up on the screen, and the usual flashing block cursor is replaced by a flashing # sign. To use the keyboard normally just type; to use any of the new key definitions, press the down arrow, which serves as the special shift key. The next key you press then performs its Master Control function. Control is not toggled; you must press the down arrow before each use of a redefined key.

Some of the functions of the redefined keys require Extended Color Basic. You can combine them with individual letters to cut down the number of keystrokes for other commands; for example, the right arrow is redefined as Reset, so the sequence P-down arrow-right arrow yields Extended Color Basic's Preset command.

Space constraints make some of the notations on the keyboard overlay rather cryptic. As an example, the LEFT$(and RIGHT$(functions are abbreviated as L$ and R$, respectively. This ceases to be a problem after a very short time.

The control key itself has another meaning; pressing the down arrow twice in succession generates the STRING$(command. A few keys do multiple jobs, making use of the regular shift key. For example, down arrow-8 produces the List command, while down arrow-shift-8, or down arrow-(turns the automatic line numbering feature on or off.

This feature deserves more attention. When it is on each time you press Enter a new number is printed to prepare for the next Basic statement. The default value for both starting line number and increment is 10. To change, you press down arrow-%. The Master Control cursor changes to a non-flashing reverse-video #, and you key in the new starting line number, press Enter, and then key in the increment. If you want to change only the starting line, key in the new starting line number and press Break. This is especially handy if you want to skip a large block of line numbers when keying in program statements.

Setting up the line numbering feature does not bring it into play; you still have to use the down arrow-(sequence. Turning off the automatic numbering in the midst of program entry (for editing a previous line, for instance) does no harm, and numbering resumes at the next line in sequence when it is resumed. In fact, this memory feature extends to the case where Master Control itself is turned off and later restarted.

Why turn it off? Well, Soft Sector claims that Master Control does embarrassing things if left on while running a Basic program which calls for keyboard input. I have left it on while running several programs

"Soft Sector claims that Master Control does embarrassing things if left on while running a Basic program."

and have never seen anything untoward, but I am not anxious to push matters.

Master Control operation is not as cumbersome as it sounds. It takes a little while to get used to the new command positions, just as it takes time to learn the command syntax of a new editor. In return, though, you save considerable time and effort in program entry.

On the subject of saving effort, another feature deserving special mention is the "custom" key, or down arrow-K. You can redefine this key at will to generate a command or group of commands of particular use to you. As received, the custom key prints these statements:

```
FOR I = 1 TO 3: CSAVEM "MASTER", 15104,16380,15104:
FOR Y = 1 TO 1000: NEXT Y: NEXT I: SOUND 128,10
```

This series is followed by a programmed Enter command. In other words, Master Control comes prepared to make three copies of itself. To redefine the custom key press down arrow-& and enter the desired commands. Remember, you can string commands together with colons and can include Enter in your definitions. I have used this feature to set up single-key entry of such things as the setup commands for high-resolution graphics and the PEEKs and POKEs used in merging Basic programs.

I have used Master Control as standard procedure ever since I bought it. The first program I wrote with it was a foreign language drill which made extensive use of data statements for bilingual word lists, and PRINT@s and CHR$s for screen prompts and graphics. I avoided an awful lot of repetitive typing. I would make minor changes, though. Master Control inconsistently include opening parentheses with some commands; I would like to see the "(" included with CHR$, Line, Circle, and PEEK. Similarly, it does not seem especially worthwhile to have included Print in Master Control's repertoire when the Color Basics already have a two-stroke abbreviation (Shift-?) for it.

The best compliment I can pay Master Control is this: On those occasions when I try to do some quick and dirty programming without it, I find myself pressing something like down arrow-5 and wondering why the machine does not switch to Edit mode as it obviously should! ■

C.C. Writer
L.W.C. Dyle
Transformation Technologies
Bloomingdale, IL
$30 cassette

by Paul Grupp

A word processing program for the TRS-80 Color Computer? Many wonder if the TRS-80 Color Computer could ever make a good word processing machine, regardless of the quality of the software. The flaws that immediately come to mind are the toy-like keyboard, the minuscule screen display, and the ridiculous reverse video system Tandy chose to indicate lowercase.

These can all be overcome. The keyboard works a lot better than it looks and machines like the Apple get by with the small display. The lowercase problem is another matter, but by the time you read this, a modification kit should be available that gives the Color Computer true lowercase capabilities—descenders and all. The Color Computer may never be a contender in the serious word processing market, but it could easily fill the needs of thousands of casual writers for an adequate system at a reasonable price, provided good software is available.

C.C. Writer is one of the first word processing programs to be announced for the Color Computer. It is written in Basic with 23 pages of well-written documentation. It will run on a 16K machine, but since this allows you to write only about two pages of text before saving to cassette, 32K is recommended. With 32K of RAM, you will be able to handle 8-12 pages before saving to tape. If you find this limiting, note that the program supports file chaining. You can string several files together to produce one continuous printed document.

Because the program is written in Basic, it cannot compete with more sophisticated word processing systems. C.C. Writer lacks almost all the features that I have come to depend on in the Model I Electric Pencil and Model II Scripsit.

You load the program into the machine and set up the print format parameters. This is an easy task, and this part of the program is very well written. Things get a little rougher when you start typing in your text. C.C. Writer is sentence oriented; you have to hit Enter at the end of each sentence. This program displays a lot of information on the screen at the end of each sentence (number of paragraphs you have used, number of characters left, and so on). This conspires with the small screen size of the TRS-80C to let you see precious little of your polished prose at one time. It is rather frustrating if you want to scan what you have just written before going on.

Word processing is popular because you can make corrections painlessly while typing. When the document is complete, you can correct mistakes that slipped by the first time without retyping the whole thing. C.C. Writer does reasonably well on the last sort of editing, but comes up short on the first.

Once you have entered a sentence, the only way to correct it is to go back to the menu, select one of the edit modes, find the sentence you want to change, and correct the mistake. This is a major hassle.

The author defends his program by suggesting that the best way to write is to sit down and enter your thoughts. Later, when the creative binge is over, you can go back and correct any mistakes you may have made. Great theory, but impractical. If I look up and see a glaring mistake, I can not think about anything else until I have fixed it.

Entering text into C.C. Writer may be frustrating, but printing it once it is in the machine is considerably more satisfying. The author has thoughtfully provided all the important functions. You have complete control over margins, line spacing, paragraph indentation and page length. If you want your finished product to look flashy, you can add headers and page numbers and even justify the text. Most documents produced on C.C Writer will be completely indistinguishable from documents produced on, say, a TRS-80 Model II with Scripsit. I plugged a CPRINT module from Micro Labs into the ROM pak slot on the right side of the computer to provide a parallel printer port. I plugged a NEC Spinwriter with a standard TRS-80 printer cable into that. This arrangement worked perfectly with C.C. Writer.

Is C.C. Writer for you? It depends on your needs. If you are interested in word processing because of the flexibility and speed it can add to your writing, this program will not satisfy you. If you do not have a typewriter, but do have a Color Computer and a printer, you could do a lot worse than C.C. Writer. As the program stands, the finished product looks good, but I rate my old Smith Corona several points ahead in the ease-of-use department. Those who crave true word processing power would do well to wait for something a little more sophisticated to come along. ■

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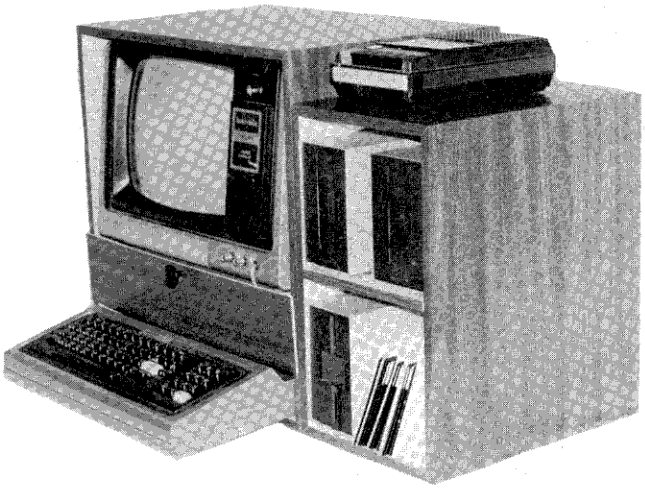

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SECS
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Data Soft, Inc.
Sepulveda, CA
$29.95 each

by Douglas R. Cook

If you are interested in exploring what the color graphics TRS-80 Color Computer has to offer, then you are in for a treat. The Screen Edit Control System, SECS, is one of the most useful tools available for color graphics. SECS is two programs, one in machine language and the other in what I would call Color Graphics Basic. You must learn a few new commands, but nothing wild. They are a little different than ordinary Basic. If you have a reasonably good understanding of almost any Basic, then you should have no trouble adapting to SECS.

With SECS programs you can produce any 8 by 10 dot matrix graphics character you desire. A group of 64 characters may be created and used at any one time. The characters and programs generated may be saved to tape and reload.

Along with the SECS programs comes an Editor program. It allows you to conveniently edit programs or text on the screen. A large number of corrections, additions or deletions may be made with ease, at any location on the screen. Programs or text may be saved to tape and then reloaded later with either Basic or the Editor program.

The SECS and Editor programs are excellent. A large television screen will produce a more detailed graphic character that the SECS program allows.

Sigmon

This is a 6809 machine-code monitor program giving you 18 powerful commands. Dump, List, Disassemble, Assemble, Find, Move, Step, Break, Set, Go, Write, Read, PLOAD, PRT, NOPRT, Mode, Exit and Speed. Sigmon comes with a 14-page instruction booklet and a source listing. The program is written in code that can be relocated. It is 6K long and located at the top of memory and can be protected by Basic's Clear command.

The monitor is easy to use and the instruction manual is well written and informative. DataSoft has noted several addresses used by Basic and by Sigmon as buffered storage areas. There are no Basic entry points noted, but Sigmon does use portions of the operating system for subroutines.

The Dump command displays hex or ASCII and has the option of including the graphic values along with memory values. The List command displays a character representation of memory contents, with a large number of locations displayed per line. The Step command can be very useful in fixing stubborn programs. The Write and Read commands create and load a Basic-compatible (CLOADM) tape file. The disassembler displays address, opcode, mnemonic and next address. The assembler allows entering either numeric values or mnemonics directly into memory. The Move command moves a block of memory from one location to another. These are only a few of the options available, but they give you an idea of the power of Sigmon.

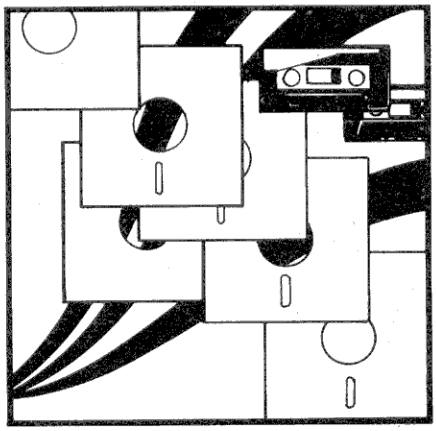
Sigmon is a good monitor program. Even though it is a large program, the capabilities it has are necessary for the serious programmer. ■

Chromasette Magazine
Santa Barbara, CA 93102
$45/year

by Douglas R. Cook WB7SOW

"Most Chromasette Magazine *programs are written in TRS-80 Extended Color Basic. . ."*

Chromasette Magazine is the second-generation magazine of the successful *CLOAD* Magazine. *Chromasette* is dedicated to the Radio Shack TRS-80 Color Computer. Chromasette arrives monthly on cassette containing six to eight programs in TRS-80 Extended Color Basic. The programs are usually long, so 16K of memory is required. Along with the tape are several pages of notes, comments and instructions on running the programs. *Chromasette* points out problems and explains solutions they have developed in programming Color Basic.



The program notes suggest changes to the programs to do slightly different things or improve operation. The modifications help the user explore the programs and understand how they run and what happens when the changes are made. The exercises provide insight for future programming techniques.

The first program on every tape is a graphics display called Cover. Cover is different every month. Besides enjoying the graphic display, by listing this program you can learn how to perform color graphics with the Color Computer.

A few of the programs are instructional. In Jumble you un-jumble letters of various groups to spell a word. How Far computes the distance between two locations on Earth. This program is useful in amateur radio operations for determining the distance between any two radio stations in contact with each other.

Some of the programs are games. The games are entertaining. You will probably not find these games boring after one or two plays. Color graphics and sound are included in the games. Most programs can be run by either keyboard or joystick control.

Most *Chromasette Magazine* programs are written in TRS-80 Extended Color Basic, some use machine-language subroutines. This is a magazine for the advanced, average and beginning programmer. ■

Scarfman
The Cornsoft Group
Indianapolis, IN
Models I & III
$19.95 cassette & disk

by J. L. Latham

Scarfman is like the popular arcade game Pacman.

The instructions advise you to power up under TRSDOS and then insert the disk in drive 0 for Model I and in drive 1 for Model III. However, you can bring up your Model I cold and boot up the Scarfman disk without TRSDOS.

In the arcade version several colored monsters run around a simple maze. You control another creature shaped like a large C. The object of the game is to eat the monsters. It is not just a chase-the-monsters-through-the-maze situation, however. Under special circumstances the monsters change color and should you catch them at the wrong time, they eat you.

Each game begins with your character at the bottom center of the screen and the five monsters at the top center. Arrow keys control your character. Little square boxes dot your path and as you pass each one you gain points. Plus signs occur around the maze and force all the monsters into the safe-to-eat stage. When you have disposed of blocks and pluses the maze fills with them again and the level of difficulty increases. The monsters improve at finding you or hiding and they revert to inedible monsters more quickly.

The action is fast. You have to stay sharp to prevent being devoured. All too often I have sneaked up on a tasty monster only to have him turn into a man-eater and scarf me off the screen. Some people say the arcade version is slower than the TRS-80 version.

And this black and white version is superior to one version written for the Color Computer.

When your game is finally over, pressing Enter starts the monster running again and skips Reboot.

Sound is an extra feature. A speaker amplifier attached to the cassette cord produces sound effects each time a square, plus, monster or you are devoured. The sounds are simple and synchronous with the speed of the action. The Cornsoft Group also states that the program will work with the Alpha Products Joystick. ■

Newscript 6.0
ProSoft
North Hollywood, CA
Models I and III, 48K
$99.95 disk

by Jon Boczkiewicz

My system consists of a Model I, disk drive, 48K of memory, an expansion interface and the Radio Shack's Line Printer IV. I consider Scripsit to be a very useful word processing program, however I dislike not being able to use the high-density proportional type in a justified format. The only company offering what I wanted—a justified proportional font, as well as the other features—was ProSoft.

Newscript has a fantastic documentation. (A friend who works with mainframes claims the documentation alone should cost $80) It runs 150 pages with a table of contents and index. Every bit of it (except the graphics) was done with the Newscript program.

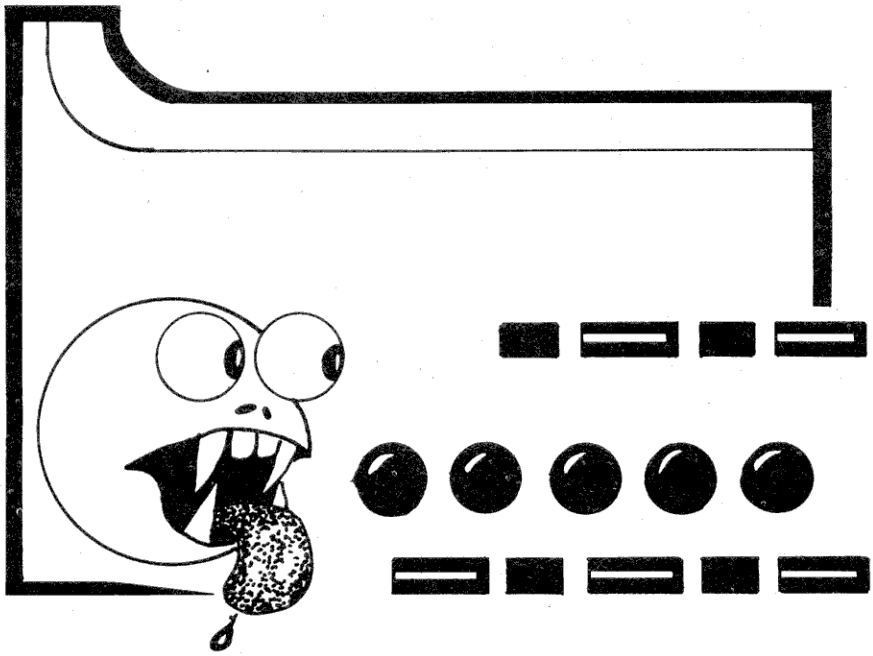
The Format

There are several programs, most of them are written in Basic for easy modification. The program seems to have been written with the Radio Shack LP IV (Centronics 737) printer in mind, but with a strong support for the MX-80, though any printer may be used. There is a section on installation procedures, explaining how to customize the program for the printer and the DOS being used. DOSPLUS, LDOS, NEWDOS and TRSDOS are supported. There is also a section (and a utility program) for purchasers of the earlier ProSoft programs, Subscript/Subedit. A sample letter serves as an example, and the documentation covers some editing.

If you don't like Radio Shack's Level II manual, you probably won't like Newscript's documentation. Most of the manual consists of commands, explanations, and examples. There is no way to look up what you want to do. However, most of the commands are logical (.ce for center, .us for underscore). Even though there is a summary sheet you will probably keep the manual near you for a while.

The two chief programs are Edit and Script. Edit allows full editing of a document, including insert and delete, block copy, move or delete, and global search and change. A convenient feature for me, living on a power line which gets its share of breaks and outages, is Autosave, which allows the document to be saved automatically as often as you desire. It does take a few seconds to record the file, but not nearly as long as would be required to retype even one screen. It also has the ultimate command, Whoops. This restores the screen to its original contents wiping out all changes.

Documents are created as a group of files. You may set file length at the begin-



ning as well as file name, but if you overrun the file length, it extends itself automatically. It is recommended that a series of short files be used rather than a few long ones as they are much faster to save and recall. Since it is possible to put breaks in the document to allow changing the disks, the length of a document is actually unlimited. The greatest page number is 999, but pages do not have to be numbered. Files can be chained during editing or during printing.

In the Edit mode, the top line is the command line, and the lines running down the side are the Line Manipulation Area (LIMA). This allows line-oriented editing, along with character-oriented editing. The lines are 255 characters long, and the screen serves as a window on this line. There is one problem—manipulating material is limited to that shown on the screen. The scale with the Top-Of-File (and End-Of-File) markers is for aligning columns and can be called up at any time. Starting on the third line, you can use Script commands or write text.

The program supports Radio Shack's lowercase modification, and gives typewriter-like reversal. When the end of the line is reached, the program backs up to the last space and pulls any characters after it onto the next line, so lines break only at the end of words. Though the program is in Basic, there is no problem with missed keystrokes, even while the words at the end of lines are being manipulated. The only delays occur when Enter is pressed, any commands in the command line or the LIMA are processed, and the screen is refreshed. This takes about two seconds for refreshing, plus whatever time is required for processing commands

When you create a document, edit signal completion by typing End on the command line. This saves the file in process, and gives you the opportunity to stop, edit another file, or go into Script (default). The file must be saved, as Script is another program 13 grans long. Because the disk must have a minimal DOS on it, as well as the various word-processor programs, not too much can be stored on it. If you have only one disk drive, you must store on another disk and put the main disk back when switching to another program. Here double-sided disks come in handy.

Printing is controlled by a series of command words which must be placed first on a line, though there may be several command words in a single line. Each is two letters long and starts with a period, such as .pp, the indicator for paragraph. Some have parameters which can be varied, others do not. Some have special limitations; for instance, .pp must be the last on a line, if you put several on a line, offering greater flexibility.

Newscript features easily used controls for double-width (expanded) letters, underlining single-sheet printing, overstriking for darkness, double spacing, editing and others.

The print font can be changed and defaults to proportional or high-density print, justified by increasing the space between the letters to fill the space at the end of the line. You can control the amount of fill allowed and the default gives a slightly greater amount of space than the printer ordinarily does. This makes the printout more readable. Changing this is a sophisticated control which requires planning and experimentation.

Formatting controls allow for hanging indents or offsets, variable indentation to set off lines, and skipped lines. Up to six header and footer lines may be used, with a left-justified, centered, and right-justified section on each line. You may merge other files with the file being printed, or use keyboard input where desired. The program has many capabilities and for this reason is slightly complicated.

Newscript differs from earlier ProSoft products with some important changes. Mininit, an extra option on the earlier programs, is now included, which supports Radio Shack's lowercase modification. This also speeds up the keyboard, providing repeat and debounce, both of which can be tailored to the needs of the keyboard and typist. You no longer have to hit Enter with every line and forced spacing is possible.

The program is not perfect. It does not provide any means of hyphenating, and some commands are not convenient. But you get a phone number to call for help, and they provide service for their customers. For those of you who have sophisticated dot-matrix printer and a limited budget, this is definitely a program to consider. ■

Since I wrote this article several things have changed, I moved up to a Model III and needed a new program to run on it. I called and was told that there had been several changes (enough to justify calling the new program 6.1), and that Prosoft would convert and update the program for $6. The new program is available on a TDOS diskette, a subset of DOSPLUS, which gives much shorter transition time between Edit and Script. This costs $12 for Model I, or $10 for Model III, though it is standard for new customers. And the program contains even more capabilities than before. ■

XBUG
Computer Applications Unlimited
Rye, NY
Models I & III
$19.95

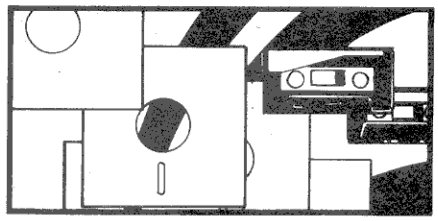
by Alan Burnes

XBUG is an excellent monitor and software debugger with efficient power, clear documentation and low cost. If you are just getting started with machine-language programming, XBUG will fulfill your needs. If you already use an assembler and disassembler as an experienced machine-language programmer, it is a good investment as an interactive debugger.

XBUG has 25 commands and command variations. These commands can be catagorized into memory and register manipulation functions and software development functions.

Memory and Register Manipulation Functions

Display and search memory. Displaying a page of memory is accomplished by entering the command byte and starting address for the memory page. The memory display format for XBUG is 16 lines, 16 bytes to a line, in a split-screen format with the hexadecimal display on the left and the ASCII representation on the right.



Single keystrokes initiate a scroll forward through memory in 256-byte blocks or 128-byte half-blocks, or a scroll backward in full 256-byte blocks.

Searching through memory for bit patterns up to 16 bytes long is also easy. XBUG searches all memory starting at the current page and displays either a page of memory on a find or returns a "no find" message. Memory searching may be re-

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TYPICAL USER AND REVIEWER COMMENTS:

the manual:

"It definitely rates the first '10' given to any documentation reviewed in this column." (A.A. Wicks, COMPUTRONICS, October, 1981)

the software: "An excellent Word Processor" (D.H.); "Absolutely fantastic" (S.E.S.); "You have features that I cannot duplicate on my $14,000 system" (J.B.)

the support: "Your phone information system and the prompt and courteous staff that you provide to help your clients...are worth the cost of the system." (V.H.H.)

REQUIRED CONFIGURATION: 48K TRS-80 with one disk drive. Specify Model I or Model III.

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sumed by two keystrokes since XBUG retains the current search pattern until you enter a new pattern.

Modify memory. XBUG modifies memory either by setting a block to a constant, or by writing hexadecimal data into memory byte by byte.

To set a block of memory to a constant requires you to enter a single letter command, the starting address, the length of the block to set, and the desired hexadecimal constant. If no constant is given, zero is the default value. This function is useful in debugging software that reads or writes to buffers. With the buffer set initially to a known state the exact changes caused by test software can be observed.

To enter hexadecimal code using the keyboard requires a command byte, starting address, and an even number of bytes up to 16, of input data.

Display and modify registers. XBUG supports display and modification of the Z80 registers. The registers are displayed on the left, 16 bytes of memory to which the registers point, are displayed in the center, and the status flag registers are displayed on the right. The registers can be modified with a command byte, the code modified for a register, and a hex byte or hex word can be inserted into the register.

Software Development Functions

XBUG relocates to any address in RAM. Therefore, it can be used with virtually any system program regardless of its location in memory. The only requirement is that you have at least 2,560 bytes of RAM for XBUG either before or after the system program.

XBUG single steps at three speeds allowing careful perusal of tricky portions of code or fast stepping through loops.

Another handy debugging technique is the use of program breakpoints to stop a program at a user-specified place. With XBUG you can set up to 10 program breakpoints and remove them either selectively or globally. When a program hits a breakpoint the last register or memory display is updated and displayed on the screen.

During debug XBUG's display and keyboard monitoring capabilities can be disabled allowing test program access to the keyboard for input and to the screen for output.

I liked XBUG's ability to load and write system tapes. This function is useful to backup or rewrite system tapes at 1,500 baud for my Model III.

If you desire a printout of a screen display XBUG can route a copy of the screen through the parallel printer port, or with the Model III through a serial port.

XBUG Documentation

XBUG's simple manual describes all the commands complete with examples. Its organization is logical and clear and includes several appendices. The first appendix is a hexadecimal-ASCII conversion table. Following that is a full index to the Z80 instruction set including the CB, ED, DD and FD extensions. It is possible to use this index to disassemble some of the screen memory displays, although a disassembler would be preferable.

I am impressed with the quality of this product. The manual, software and examples are excellent.

I found Computer Applications Unlimited to be conscientious when I did have questions on their software. XBUG is a good investment. ■

CPRINT Parallel Printer Interface
Micro Labs, Inc.
Richardson, TX
$49.95

by Bill Dye

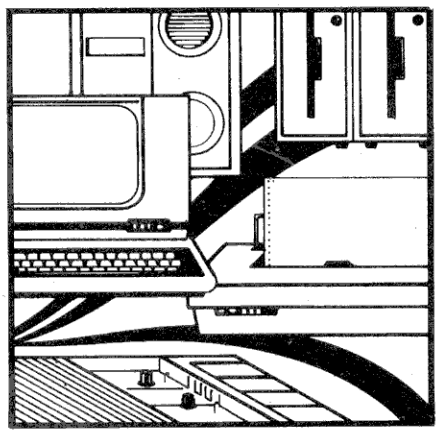
Until recently, owners of the Color Computer were limited to using the serial interface to attach a printer. Radio Shack's only compatible printer was the Line Printer VII with its limited features and marginal print quality. The alternative was a printer that could be converted to the RS-232 interface. Even then, if the serial printer could receive at a higher speed, the Color Computer was limited to a 2,400-baud output. Also, the Color Computer only put out a seven-bit signal unless the PTFX program was loaded first.

CPRINT is an eight-bit Centronics-compatible, parallel printer interface that functions as a bi-directional port. After connecting cables and powering up, EXEC49152 initializes CPRINT; all PRINT#-2s and LLISTs are redirected to the parallel port.

I tried a short LLIST first. Although I was running at 2,400 baud, I was surprised at the increase in speed. CPRINT gives you control of the line and page length and skips over the perforations between pages. To change these values, the excellent instructions give you the locations to POKE.

The benefits of the CPRINT are most apparent for anything beyond straight printing. A serial interface usually loses the first byte if the computer wants to transmit while the printer is busy. After transmitting a line, the computer waits for a ready signal before continuing. A parallel interface does not have that problem; the computer can get the next line ready while the printer is busy with the last.

The eighth bit allows you to use all printer control codes and block or bit graphics. If you have an editor that works with ASCII, fancy print graphics become less of a chore.



CPRINT's screen printer can be activated anytime the cursor is on the screen. Text is printed normally; a period replaces any unprintable characters. After getting a screen print, you must hit Enter to clear the machine or the next entry is ignored. This is handy for saving a screen of code for later reference, but if used to print a program-generated screen, the input variable name is deleted from the program. This makes documentation of program screens time-consuming. Compensating for this, you can turn off the printer and the computer will not hang. This lets you get screen prints while suppressing regular printing.

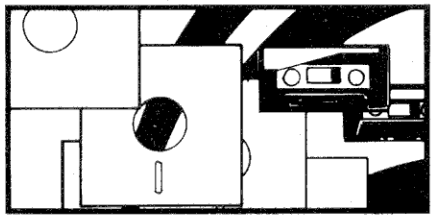
CPRINT creates some radio frequency interference (RFI). Micro Labs recommends using a twisted or shielded printer cable or shortening the cable. If that fails, unplug the cable, when you are not printing.

CPRINT is well made and increases the selection of printers available to the Color Computer owner. ■

(Graphics Editor and Programmer)
G.E.A.P.
J.F. Consulting
Palm Desert, CA
$16.95

by Richard C. McGarvey

One of the most tedious parts of programming is the design and layout of the CRT display. Whether you are drawing and animating a space ship attack or setting up a data form to be filled in by a computer operator, the display programming is time consuming and nerve wracking. For this reason I have often considered writing a program that would let the programmer draw or write on the CRT and manipulate the video contents into proper position and proportion. Once the image was perfect, the computer would generate the program to recreate the screen every time it was needed. This program could then be merged into the main program.



G.E.A.P.

Well, William Mason of J.F. Consulting beat me to it. G.E.A.P. is a Basic program that does all I planned and more.

Any programmer can easily learn to draw a screen of graphics or text and then save the screen as a Basic program merged into the final game or application program.

"You can even create your own modules..."

G.E.A.P. allows the programmer to manipulate all or part of the screen. The programmer can try different layouts without damaging the previously saved screen. If the new way looks better he can permanently update the screen. Otherwise he can recall the old screen layout and try something else.

G.E.A.P. Modes

G.E.A.P. has four modes. Regular mode is signified by a flashing dot cursor. The cursor can be moved in any direction with the arrow keys in any combination. The left arrow moves the cursor left and the up arrow moves it up. Both arrows together move the cursor up and left. If the shift key is held as the cursor is moved, a line is left in the trail of the cursor. Want to erase the line? Go back over it with the cursor without holding the shift key. The Regular mode is active at power up and can be reached from all other modes (except the Print mode) by hitting the period key.

The second mode is the Print mode. The main function is to put text on the screen. Enter the Print mode by hitting the asterisk. Once in this mode the cursor changes to an asterisk. The cursor can be moved with the arrows; anything that is typed appears on the screen. To exit the mode you must first enter the Keypad mode by hitting the Clear key. Once in Keypad mode every other mode is readily available by hitting the appropriate cursor key.

The Keypad mode is available at the touch of the < key or by the Clear key if you are in the Print mode. The cursor, the < symbol, is again positioned by the arrows.

Now look at your keyboard. Note the keys Q, W, A, S, Z and X. These form a graphic block similar to the graphic blocks on the TRS-80. If you want to draw a graphic block position the cursor to the right of the location that you want the graphic. Hit the keys corresponding to the portion you want lighted. If all six keys are hit, in any order, a graphic block equal to CHR$(191) is drawn on the screen. If only the Q is hit only the upper left corner of the graphic block is lit.

Other commands in the Keypad mode are for the advanced user. To exit the Keypad mode, hit the cursor key of the mode you want.

The fourth and final mode is the most interesting. The Designated mode is entered by hitting the - key. A flashing - is used as the cursor. This cursor will not erase as it moves.

The Designate mode is the guts of the G.E.A.P. program. While in this mode you can select any area of the screen, reverse it, move it, tilt or rotate it, multiply the views of it, magnify it, fill it in, shrink or expand it and save it if you like it or cancel it if you do not. You can draw half of a screen, duplicate the half and merge it into an entire screen. The only limit is your own imagination.

"The Designate mode is the guts of the G.E.A.P..."

Saving the Program

There are nine options available while in all modes except the Print mode. These options are entered by hitting the number 9. One of these options, Dump Program, lets you save your creation or reload another for reediting. The Dump option is compatible with disk, cassette or Exatron's Stringy-Floppy. You need only enter CSAVE or CLOAD for cassette, Save"filespec" or Load"filespec" for disk, or @SAVE and @LOAD for Stringy-Floppy. Once done you can reenter G.E.A.P. with simple USR(x) statements.

You are also given the option of saving the screen in compressed or non-compressed code. You can save a designated figure in a Basic string. You can even specify the line numbers for screen storage so you can merge it with a program more easily.

Final Pointer

G.E.A.P. can incorporate input statements with user-specified or default variables. Graphic animation is possible by updating only the moving part of the screen. You can insert delay loops. You can even create your own modules and expand on G.E.A.P. if it does not have a feature that you need. The documentation, 17 pages of intensive instruction, is broken down into three stages so you can gradually master the utility.

The only way to find out how indispensable this program is for the Basic programmer is to buy it and use it. I have seen other programs that claim to do what G.E.A.P. does but no other has lived up to my expectations. ■

Micro Cue Print Buffer
Microcompatible
Atlanta, GA
$299-$599

By G. Michael Vose
***80 Microcomputing* technical editor**

There are few things more frustrating than sitting, watching and waiting while your new 40-characters-per-inch, dot-matrix printer ties up your computer for 15 minutes printing out your latest program. Invariably, you think of an enhancement to add—but forget it by the time the listing is printed out. Wouldn't it be great if you could use your machine while that printer trundles along?

Or you might work in an office with two computers but only one printer. It is a major hassle to unhook the printer cable from one machine and attach it to the other. There is also the problem of having one computer and using a dot-matrix printer for drafts and a letter-quality printer for correspondence—what a pain switching the cable back and forth.

Occasionally, you might need to print out a series of files. If you don't have a spooler program, you have to print each file separately, twiddling your thumbs between typing file names and giving print commands. Wouldn't it be nice to send all those files out at once?

As you may have guessed, there is a solution to these problems. Microcompatible, Inc., with a factory in North Carolina and a marketing department in Georgia, has introduced a printer buffer called the Micro Cue. Available in four different models, the Micro Cue can help you solve your computer/printer interface problems.

80 Checks It Out

The model being tested here at *80 Microcomputing* is the PB322P Print Buffer, containing two parallel transmit ports and two parallel receive ports. The unit contains 32K of memory and a Z80 microprocessor. A 1K ROM contains the software to control the system. All these electronics are driven by a 2.0MHz clock.

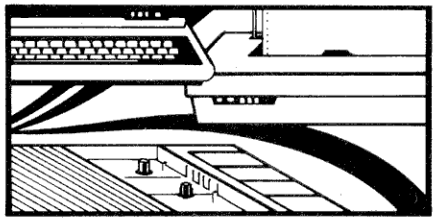
The on-board memory is the buffer's principal claim to fame. It allows a user to transfer files from the computer to the buffer for printing. This transfer operation takes only a few seconds. The computer is then free for other tasks while the buffer drives the printer. The 32K buffer will hold Scripsit files up to 18 pages in length. It would be hard to write a Basic program that could fill the entire buffer.

Micro Cue's other notable feature is its multiple port configuration. With the right model, you can hook up two printers and two computers to the buffer and select any combination of computer and printer with a simple flick of a switch. You cannot send output from both computers to the same printer at the same time, of course, but only Inspector Clouseau would want to do that anyway.

The Micro Cue recognizes all your computer's codes as well as messages from your printer. It lets you know if the printer is not ready and also recognizes out-of-paper signals. The buffer can receive data when the printer is not ready, but it will not send data until the printer is set to go.

The Micro Cue even allows single page output. This is accomplished with some difficulty, however. It is necessary to send an ASCII control character (1E hexadecimal) at the end of each page of text. This causes the buffer to halt the transmission of data, turn on the paper-feed light and wait. After putting a fresh piece of paper into the printer, you press the paper-ready switch down to resume printing. To disable the page-break feature, there is an override position for the paper-ready switch.

There are serial data transfer versions of the Micro Cue and three single port buffers available, as well. Prices start at $299 and go up to $599 for the double-port model reviewed here.

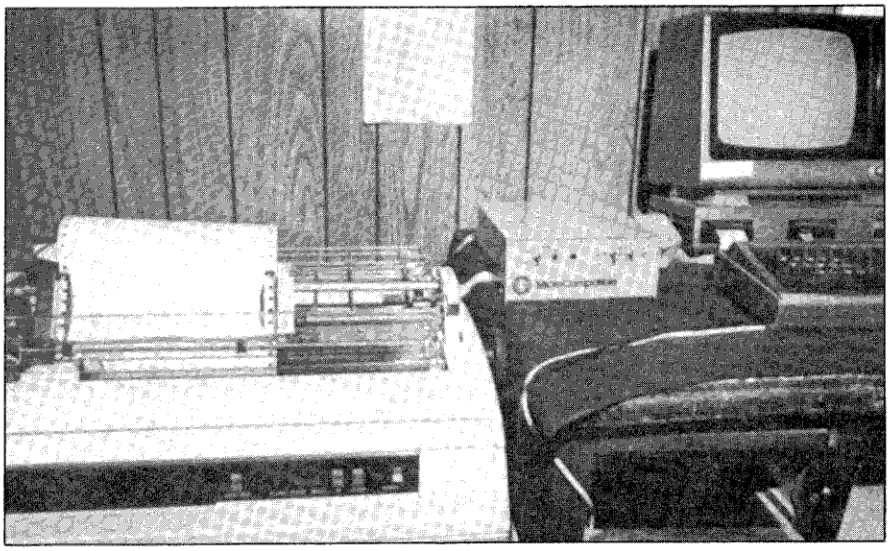


The Acid Test

At the editorial offices of *80 Microcomputing*, we use our Model I to run dozens of program listings every day. Our listings include Basic programs, Assembly-language source files and even the odd Fortran or Cobol listing. The Micro Cue we've been testing interfaces our Models I and III to an NEC Spinwriter and sometimes a Centronics 739 or Radio Shack Line Printer V. In over three months of use, we have not experienced a failure. The only incompatibility detected was with the NEWDOS Zap utility—the output to the printer became garbled using this utility.

The only inconvenient feature we've found with the Micro Cue is the inability to software control the print process once it has begun. For example, if you forget to set the paper in your printer to the top of the page, you cannot stop the printout by entering commands into the computer. The only way to stop the printout is to turn the buffer's power switch off. Then you have to wait 10 to 12 seconds for the memory chips to bleed off their electrical charge, turn the power switch back on and reload the buffer to print the file (after you've corrected your mistake). There is probably no way to get around this problem—it means you must place the unit in an accessible place.

In spite of its healthy price tag, Micro Cue comes with only one cable, a 34-pin edge connector at one end and a DB25 male connector on the other. You must come up with your own additional cables



The Micro Cue Print Buffer in action.

ASYLUM

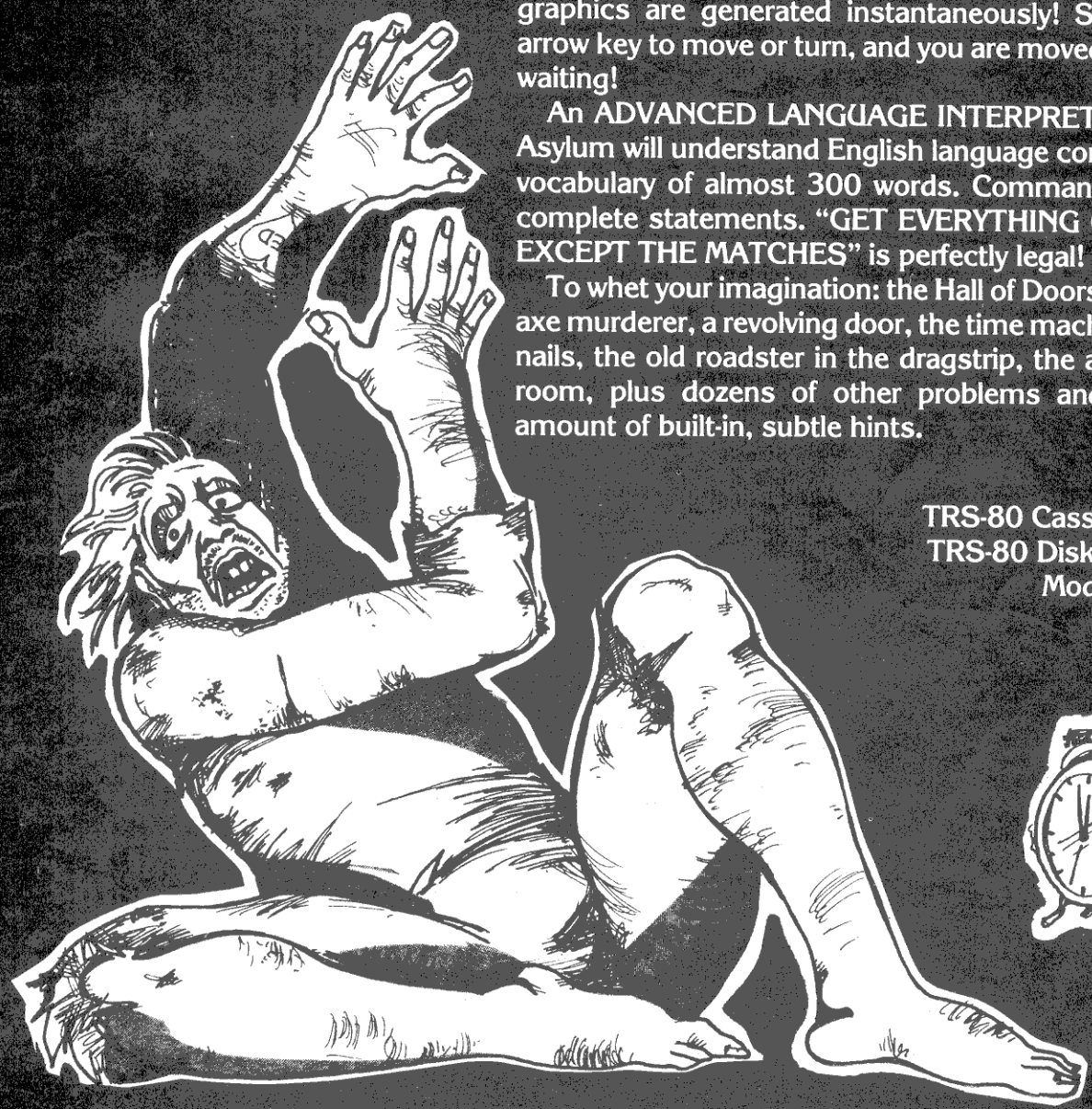
ASYLUM is the most sophisticated, sinister, challenging 3-D graphics adventure ever written! You are placed in an asylum for Deathmaze 5000 survivors. Your only goal: ESCAPE!

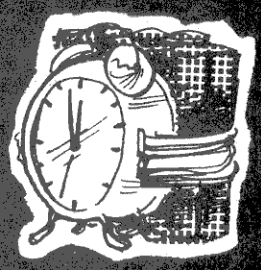
Asylum has 3-D PERSPECTIVE GRAPHICS! And it has over 1200 locations! Hallways recede into the screen, as though you are actually there! Doors open and close! Beds, desks, and even other inmates are drawn on the screen! And graphics are generated instantaneously! Simply press an arrow key to move or turn, and you are moved. Absolutely no waiting!

An ADVANCED LANGUAGE INTERPRETER means that Asylum will understand English language commands from a vocabulary of almost 300 words. Commands may include complete statements. "GET EVERYTHING ON THE DESK EXCEPT THE MATCHES" is perfectly legal!

To whet your imagination: the Hall of Doors, Nicholson the axe murderer, a revolving door, the time machine, the guru of nails, the old roadster in the dragstrip, the ancient catapult room, plus dozens of other problems and a reasonable amount of built-in, subtle hints.

ASYLUM:
TRS-80 Cassette — $19.95
TRS-80 Diskette — $22.95
Model I or Model III





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✓ 279

PRINTED IN USA

for multiple port configurations. We were a little short of cables when we hooked our unit up so we had to press some 40-pin cables into service. I was forced to experiment to get the pins lined up correctly. Until I succeeded, the unit would not work. The documentation never mentioned this potential source of difficulty. This is a serious omission since some buyers of the Micro Cue will likely possess limited technical knowledge.

In fact, the instruction manual is Micro Cue's one major fault. It contains a very limited amount of information; it is poorly laid out (for example, one note refers the reader to "see Configuration below" but this configuration is actually two pages away); and the diagrams are hard to read. Microcompatible offers a detailed hardware description, including schematics, plus a programmer's guide containing the ROM's software listing for an additional $25. I wouldn't be tempted to spring for another 25 bucks, though, after looking at their original manual.

". . . the instruction manual is Micro Cue's one major fault."

The Future

The folks at Microcompatible are an accessible bunch. I talked to them on the phone twice in recent months. They said they are working on new software that will allow software switching between devices using the multiple port Micro Cue. (This is possible now for the Z80 machine language programmer—it is possible to send 256-byte chunks of code into temporary storage in the buffer with an LPRINT CHR$(27) "L" command.) The switches on the front panel will still be usable, according to a development engineer I talked with, but software control of this function will also be available. The company did not indicate what this upgrade will cost existing owners.

The Micro Cue is about the size of a Lynx modem and is housed in a light grey cabinet. It is unobtrusive and quite useful. Depending on your needs and budget, it is another nifty peripheral for your favorite computer. ■

Plug'n Power Controller
Tandy/Radio Shack
Fort Worth, TX
Models I & III, Color Computer
$39.95

by John W. Warne

The Plug'n Power Controller connects to the cassette recorder jack on the Model I keyboard and plugs into an ordinary electrical outlet. The instructions cover use with Model I, Level I and Level II, Model I TRSDOS, Model III and the Color Computer.

Once loaded, the software prompts for the correct time to the nearest minute. It provides a real-time display of hours and minutes in the lower left of the screen. Times must be entered in the 24-hour system (17:00 equals 5 p.m.).

To control a light, radio or other small appliance, you need a BSR-type module for each appliance. The modules are widely available. The device to be controlled is plugged into the module. A one-letter house code and a one-number unit code are selected on the controller module. The module is plugged into any polarized electrical outlet.

The computer awaits instructions in the direct command mode. A screen status display (Fig. 1) indicates the condition of each module. A unit is turned on by entering the house code, the unit code and the desired activity (on/off for appliance modules, on/off, dim and bright for lamp modules). There is no feedback from the controlled module to the software. The status is only an indication of software-issued commands, not the actual condition of the module.

HOME CONTROL SYSTEM

COMMAND? BR8

HOUSE CODE: N

UNIT STATUS

1 OFF	2 OFF	3 OFF	4 OFF
5 OFF	>6 OFF	7 OFF	8 OFF
9 OFF	10 OFF	11 OFF	12 ON
13 OFF	14 OFF	15 OFF	16 OFF

Fig. 1.

Level I machines allow up to 32 lines of programming code, the Color Computer up to 30 and Level II can use 45. The instruction booklet does not state the number of lines for the Model III.

Execution of commands proceeds a step at a time. The number of the next event is displayed at the bottom right of the screen. Once all events are performed, the computer starts again at the first event. Fig. 2 illustrates a typical page from a schedule.

#	TIME	HOUSE CODE	UNIT CODE	COMMAND
13	04:00	N	05	ON
14	04:30	N	05	OFF
15	05:30	N	05	ON
16	06:15	N	16	ON
17	06:15	N	04	ON
18	07:15	N	04	OFF
19	06:30	N	05	OFF
20	07:30	N	05	ON
21	09:00	N	05	ON
22	10:00	N	05	ON
23	12:20	N	05	OFF
24	12:35	N	05	ON

21:52:30 NEXT LINE TO BE EXECUTED: 18

Fig. 2.

"(There is) no automatic restart. . ."

Commands are provided to insert, replace and delete command lines, page the display, jump through the list and exit the programming mode to the command mode. The controller will not operate automatically from the command mode. You must remain in the programming mode for events to be executed by the real-time clock.

Exiting to TRSDOS and using the DOS Dump command transfers the controller file to disk. (The instructions do not explain what, if anything, can be done for the non-disk user). Once the file is saved, the instructions do not tell you when or how to get the file back into operation. The only clue is in the filename used in the example—DATA/CMD. I realized the entire controller system had been saved, not just the programmed event schedule. You reboot the program by typing the filename used.

The instruction manual includes several Basic routines for accessing the controller modules for incorporation in user programs. The real-time clock is not active except while using the full controller software package.

One disadvantage is the lack of any backup in the event of power failure. The software has no automatic restart feature and the clock has to be reset each time the system is rebooted. Those planning to use it for security lighting over weekends or vacation trips are forewarned. ■

Disk-80
Micromint Inc.
Woodmere, NY
$275 kit, $380 assembled

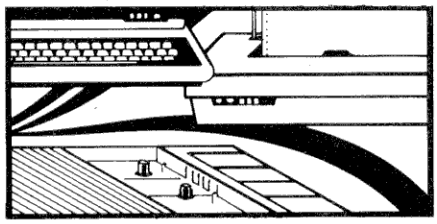
by Dennis Bathory Kitsz

You unpack it, plug it in, turn it on and it works. That's refreshing for a TRS-80 Model I system expansion—and surprising. But Disk-80 is that easy and reliable.

Designed by Steve Ciarcia, Disk-80 is a disk controller interface and memory expansion for the Model I TRS-80. It includes the usual complement of expansion features: floppy disk controller, 32K memory expansion, Centronics-type parallel printer port, and an interrupt-driven real-time clock. It is compatible with all TRS-80 software.

Disk-80 is not unique; in fact, it is mundane. But uniqueness is rarely the criterion for Model I system expansion. Rather, transparent operation and high reliability are essential, and these qualities are admirably present in Disk-80. Two novice TRS-80 users and I used (and abused) the unit for three months and it never exhibited any unpleasantries.

The address and data buses are fully buffered for noise-free operation as well as the power essential to drive peripheral devices. Unlike the Tandy modification or the LNW-80 design, Disk-80 does not use (nor apparently need) passively terminated signal lines. The device is designed very compactly and internal noise is minimal. Only the memory refresh and read/write circuitry is terminated, and as an added bonus, the sensitive refresh circuitry is doubly buffered and reshaped with Schmitt trigger ICs and fed through gates and resistors that stabilize its lines for dramatically reliable upper memory.



Furthermore, all power supply traces to the memories are handsomely bypassed—a technique where capacitors are placed near the parts in question to minimize neighborhood noise during memory use. The memories are located together on the far edge of the board, using by-the-book placement.

The disk control system is a pleasure to use because it is invisible. Disk-80 incorporates a hardware data separator of standard design as standard equipment, and it works with the precision of the Percom add-on for the Radio Shack interface. Disk read errors were common to TRS-80s until designers went back to the drawing board and read Western Digital's recommendations for their own disk controller chip—use an external data separator. Disk-80 does this and again uses Schmitt triggers for signal reshaping on information incoming from disk drives. You can add the usual four drives with Disk-80.

The real-time clock also includes design upgrades, including CMOS integrated circuits to lower power consumption and noise and increase precision. The parallel printer port (incorporated in the power supply board) is standard. The power supply itself is adequate and concisely designed. The entire expansion unit is packaged in a small plastic case less than half the size of the Radio Shack expansion system.

Excellent documentation and full schematics are provided with Disk-80, and the construction article (*Byte*, March 1981) describes details of the circuit operation and unveils many of the mysteries of expansion interface operation.

Reviewing Disk-80 is almost incongruous, because any comments can be summarized with the sentence, "It works." ■

6809 Assembly Language Programming
Lance Leventhal
Osborne/McGraw-Hill
Berkeley, CA
$16.99

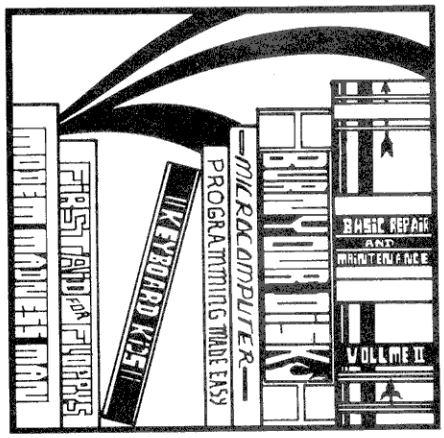
by Phil Saunders

I bought a home computer to learn Assembly language. However Radio Shack has no manual for programming the 6809 microprocessor in the Color Computer. Therefore one of my first purchases was *6809 Assembly Language Programming.*

This is the fifth volume in his series on Assembly language programming. Other books in the series concern programming the Z80 and the 6502.

Leventhal assumes the reader has a basic knowledge of microcomputing principles. *6809 Assembly Language Programming* is divided into five basic sections: Fundamental Concepts, Introductory Problems, Advanced Topics, Software Development, and the 6809 Instruction Set. Following are five appendices and an index.

The Fundamental Concepts section gives an introduction to Assembly language. It gives reasons for using Assembly language and compares Assembly language with high-level languages (Pascal and Fortran). This section describes the functions of an assembler, including special features such as macros and conditional assembly. It goes on to describe the architecture of the 6809 in comparison to the 6800. Also discussed are addressing modes and conversion of 6800 programs to the 6809. The final chapter gives the syntax rules of the standard Motorola assembler. I refer to this valuable section constantly.



The second section starts you programming. First there is a statement of the purpose of the program, a sample program, the source code (with comments) and the object code. An explanation of the instructions and programming methods used in the program follows. The programs, accompanied by text, are followed by problems for the user to solve.

I need to say a word about the programs. All begin at zero—fine for most computers. However, this is part of the mysterious memory used by Basic. Despite what the manual says about this memory being available for machine-language programs, every time I POKE a number into memory location $01, the number changes. This means a monitor is probably necessary for programming or the programs have to be relocated. Actually, the book is designed to be used with an assembler: I strongly recommend using one.

Problems covered in the second section include transferring data, program loops, character codes, and arithmetic

problems. Code conversions and using tables are also covered.

The Advanced Topics section uses the same format as section two. It covers advanced programming methods and gives notes on their use. This section also shows some peripherals for the 6809. Some information, particularly on the 6820 Peripheral Interface Adapter, is useful in interfacing other devices. Also shown is an Analog-to-Digital converter for the 6809. Since this is a full eight-bit device, it could extend joystick range. In addition, interrupts and a real-time clock are both discussed.

The fourth section covers software design: structured programming, modular programming and flowcharting. These chapters also have a thorough discussion of coding, debugging, testing and an often forgotten topic, documentation.

This is followed by the section on the 6809 instruction set. There are details of how each instruction affects memory locations and registers, often shown in several addressing modes. Included in these descriptions are mnemonics, allowable modes, object code, and the number of bytes needed. Also shown are 6800 instructions with their 6809 translations.

In summary, the book is an excellent value. It contains vital information for programming the 6809. Although not written for the Color Computer, most information is relevant. It is not for the absolute beginner; if you are just starting I recommend Ron Bishop's book *Basic Microprocessors and the 6800* or the various volumes of *An Introduction to Microcomputing.* ■

TRS-80 Graphics
Robertson and Grillo
Tandy/Radio Shack
Fort Worth, TX
Softcover, 133 pp.
$7.95

by Bruce Douglass

There are not too many books that deal with a variety of graphics techniques for the TRS-80. This is not surprising, since the graphics are not something to get excited about when compared to, say, the Atari. They have not, however, been utilized to their potential in many programs available on the market. This book is a good, inexpensive introduction for the beginner to this fascinating topic.

"This book is a good . . . introduction to TRS-80 graphics."

The book is in a large format and is easy to read. If you can write a routine to draw a line between two points or draw a circle anywhere on the screen in less time than it takes for you to pour a cup of coffee, then this book is not for you. It does not even mention machine language, and so all the graphics techniques used are implemented in Basic.

This book is a good elementary introduction to TRS-80 graphics. One valuable aspect of the book is the preponderance of example Basic routines, along with example outputs for each routine. For the beginner, this approach should smooth over any fears of dealing with a complex subject.

It begins with a topic not mentioned much in these days of CRTs—printer graphics. Different logos are displayed with short Basic routines to produce them. An example for a line-printer display of Snoopy's friend Woodstock is given. It is done in the classic variable-density printer-character style by actually "drawing" the figure inside LPRINT" " statements, and then simply printing them. This is a simple approach that is easy for anyone to understand. The use of Tab is then explained by example, and some formatted outputs are shown. The next few routines print out variations of sine curves, along with harmonics of the sine function.

There follows a valuable discussion of histograms, or bar-graphs, with routines to generate examples. While certainly a simple topic, it is useful for the end-user.

The graphics dealt with so far have been quite elementary, but Chapter 4 discusses computing pictures. Some of the examples are interesting. One routine generates a sine wave for the CRT display. Some problems and solutions follow—for example, the printer-graphics problem, "What is the distribution of heat in a room as the exterior of a Franklin stove heats up from 70 to 400 degrees?" An interesting and useful routine is one that prints blocks of characters so the user can scan and determine appropriate density characters for printer graphics.

Chapter 5 develops the idea of data statements storing encoded graphics for later display. Some of the graphics used here work acceptably, and some simply do not come off at all. The table-driven silhouette of a witch is not readily recognizable, but it at least introduces the topic to the uninitiated.

So far, all of the graphics have been ASCII-character oriented. Nothing is wrong with that, but it certainly does not exploit the power of the TRS-80 graphics characters. This problem is solved in Chapter 6. STRING$( ) is employed as well as CHR$( ), demonstrating their uses. This discussion includes a short lesson on the graphics codes. Example routines include how to draw a box around a message, and a routine that displays oversized random digits using the graphics characters. There is even a short routine to display an oversized digital clock.

In chapter 7, pixel graphics are introduced. Although it might be thought natural to begin here and later introduce the other topics, this arrangement is logical and is a useful progression. The Set and Reset commands are explained well, and serve as a useful supplement to the Level II manual for the beginner. Example routines do such exciting things as draw lines between two points or draw circles of a given radius around a point on the screen. Other routines draw the state of Massachusetts and a smiling face.

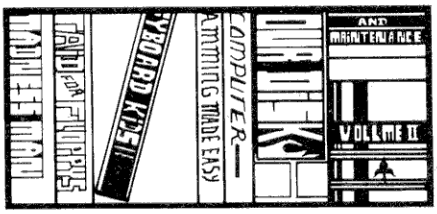
The last chapter deals with motion graphics. It begins with the usual ping-pong ball idea of reflection and uses the idea to generate interesting displays with the inclusion of obstacles for the bouncing pixel. A marquee program fails rather miserably. The authors attempted to make this introduction to graphics as simple as possible, and so greatly limited the animation used. Perhaps it will be effective in exciting the imagination of the readers to develop more intricate displays.

As mentioned, this is a very elementary approach to graphics for the TRS-80. Pixel graphics are not even discussed until the seventh chapter and not very much is done with them after that. However, for the neophyte learning to use his computer, this book may well provide a valuable introduction to the topic of computer graphics. ■

Microcomputer Math
William Barden Jr.
Micro Applications Publishing
Mission Viejo, CA
Softcover, 168 pp.
$9.95

by Bruce Powel Douglass

Barden's new book, *Microcomputer Math*, deals with the structure of computer mathematics on a very elementary level. Although the book is specifically aimed for TRS-80 and Color Computer uses, most of the information applies to all binary coded arithmetic. This book is CPU independent; no CPU instructions are mentioned: Z80, 6809, or otherwise.



Readers of Barden's other literary efforts, such as *TRS-80 Assembly Language Programming*, are aware of (Barden's) loose writing style. His anecdotal writing approach lessens the fears of readers intimidated by the subject. It makes for wordy reading, but for many, a painless approach is worth the verbosity. Readers more at home with academic writing may find it a poor time investment. Barden uses the anecdotal approach with a bit more gusto in the present volume. It neither hinders the presentation of the material, nor does it greatly aid it.

The book is divided into 10 chapters, a glossary and two appendices. The topics range from an introduction to binary numbers to a brief discussion of floating point. Each chapter ends with a few exercises to test understanding, and the uncommented answers can be found at the end of the book. The first appendix is a hex-octal-binary-decimal conversion table, and the second appendix is a two's compliment number conversion chart for decimal to binary and vice versa.

The first chapter introduces the reader to the narrative's main character, Big Ed. Throughout the book, Ed learns more and more about numbers through the help of customers from microcomputer component manufacturers. The topic dealt with an introduction to binary numbers and converting binary to decimal. Once this concept is firmly entrenched, Barden introduces the reader to a green creature with eight fingers on each hand. The topics of position-dependent numerical value are covered well from a simple standpoint (although it is not referred to as such). Certainly, anyone with a high school degree has seen this topic before, and so it does serve to begin on a common ground.

Chapter 3 begins the real information with the subject of two's compliment and signed numbers. This excellent chapter presents the information very understandably and simply. Addition and subtraction of eight-bit operands is covered well, and the discussion includes the necessary topic of "carries" and "borrows." The algorithms are presented well, although it might be useful here to present Z80 or 6809 instructions in the examples to accustom the reader to Assembly language and how they manipulate numbers.

Chapter 4 is a brief chapter and covers overflow, carries, and flags that inform you of such occurrences. The chapter shows and describes the flags for both the TRS-80 Model I and for the Color Computer. Chapter 5 presents logic and shifting operations. The logic operations discussed include OR, AND, XOR and NOT. Rotates, logic shifts and arithmetic shifts round out the chapter.

Now that the preliminary work is out of the way, Barden approaches multiplication and division algorithms. Barden uses two methods to introduce multiplication: successive addition and the "shift and add." He also discusses signed multiplication and uses the XOR to get the sign bit, performing the multiply on the absolute value of the numbers, and then if the sign is negative, set the MSB. The remainder of the chapter deals with division algorithms, and Barden presents two methods, successive subtraction and restoring division. People performed division using this latter approach before machines appeared to do it for them. A very brief mention of what to do with signed operands ends the chapter.

Chapter 7 discusses multiple-precision arithmetic. It presents additions and subtractions, complete with borrows and carries in algorithmic form. Of course, these are relatively simple to implement compared to multiple-precision multiplies and divides. Barden presents an algebraic factoring method. The concept is simple enough, and the discussion is straightforward. Barden dismisses the problem of multiple-precision division with a comment that it is difficult to implement (he returns to it later in the chapter on floating point numbers).

Chapter 8 discusses binary fractions and lays the groundwork for the topic of floating-point numbers (to be discussed soon). The chapter presents binary number scaling as an alternative approach to dealing with binary fractions. These techniques work on fixed-point numbers, and so serve as an introduction to a topic and often discussed in the current microcomputer literature.

Chapter 9 deals with the problem of converting numbers into ASCII representations for display. It includes conversion of fixed-point binary fractions as well as integers to ASCII. Again, the information is presented in a clear, if not concise, manner.

Barden begins floating point with a discussion of scientific notation, introducing the ideas of exponents and mantissas. He briefly discussed the format for single and double-precision numbers. Unfortunately, Barden did not mention floating-point arithmetic except to mention that it is a difficult topic.

It is unfortunate that Barden did not spend another 20 pages discussing implementation of floating-point arithmetic on the microcomputer. In my opinion, it seriously undermines the utility of the book. I purchased this book to learn about the number formats used by the TRS-80 to aid the writing of some complex matrix operations in machine language, and I am disappointed that it is not helpful in this regard.

"Barden begins floating point with a discussion of scientific notation. . ."

This book is an excellent introduction to the elementary aspects of computer mathematics, provided you enjoy Barden's writing style. It fails in that it does not cover any topics of interest for the reader who has a good grasp of the elementary concepts and wishes to know more. ■

Radio Shack Model III Service Manual
Tandy/Radio Shack
Fort Worth, TX
Softcover, 125 pp.
$10.95

by Jerry P. Turpin

Radio Shack recently released its most important piece of Model III documentation: *The Service Manual*. It is a *service* manual. To use it you need a basic knowledge of digital electronics and microprocessor technology.

The Model III is a self contained computer system which when fully equipped, contains 48K RAM, dual internal disks capable of double density, a self-contained video monitor, RS-232 interface, cassette I/O ports, an eight-bit parallel I/O port, real-time clock and an internal power supply. Obviously, this is not a piece of equipment to be serviced, or modified without extensive documentation.

Model I's technical manual went into great detail to explain the workings of the Z80 microprocessor and how its various signals are used on the CPU board. The writers of the Model III manual expect the reader to already possess a working knowledge of Z80 architecture. Most of the manual consists of schematics, circuit traces, wave-forms and parts lists.

The Service Manual falls short in the video monitor section. Although it includes a schematic, it does not provide the kind of detailed service information usually found with commercial televisions and monitors. The monitor is a modified RCA 12-inch black and white television, similar to the KCS-206. Anyone seriously considering servicing the video section should obtain KCS-206 service data, file 1981, B-1.

Another shortcoming is the omission of three important tables: A pin-out of the 50 connector bus I/O connector; a pin-out of the 34-connector parallel printer port; and a pin-out of the RS-232 port. Although the information is available on the appropriate schematics, a table listing each would be helpful. The manual provides advanced experimenters with the needed information for interfacing an unlimited variety of devices.

The manual explains almost everything. Going abroad and want to convert your Model III to 50-cycle current? It is a simple matter of changing a few jumpers and is explained on page 18. Do you have a 4K machine and want to expand to 16K? This is also explained on page 18. Need to align the disk drives? Step-by-step procedures are on page 109. Purchase your own 4116 RAMs and save a bundle by installing them as per the schematic on page 33.

For the independent service shop technician or the advanced experimenter, *The Service Manual* is a must. ■

CPM/Primer
Stephen M. Murtha and Mitchell Waite
Howard W. Sams & Co. Inc.
Wirebound, 96 pp.
$11.95

by J.C. Hassall

At last there is a definitive book on CP/M (Control Program for Microcomputers).

This book introduces the CP/M operating system (including version 2.0) in a clear, concise fashion. It was written for all levels of experience. The book is written so well the reader does not need access to a computer running CP/M to understand much of the operating system. The book is illustrated using a video monitor outline to show how the user's screen will look.

The first two chapters introduce the CP/M operating system in general and specifically to a CP/M microcomputer in terms of hardware and software concepts. The first chapter gives the reader an overview of CP/M and the characteristics of an operating system in general. An item I found interesting was the history of how CP/M was developed. The second chapter covers hardware and software concepts of a CP/M microcomputer. Of interest to newcomers is an explanation of logical and physical I/O (Input/Output) device assignments, and the software hierarchy in a CP/M system.

If the reader is already familiar with microcomputers, skip the first two chapters. But be sure not to skip any of the excellent drawings by Bob Gumpertz. His humorous drawings add to the enjoyment of the book.

Starting up and first using a CP/M system is covered in chapter three. The basic philosphy of the book is that the reader has a system for which CP/M is available with the BIOS (Basic Input/Output System) module already modified for that computer; an explanation of the steps required to modify BIOS is beyond the scope of this book. The manner in which CP/M is booted into the system memory is discussed, along with an explanation of where the bootstrap program resides on the disk. Disk and memory organization is just enough detail for the reader to understand how the system operates, without being overwhelmed by unnecessary details. The three functional modules of CP/M and how they interact are discussed.

System initialization is the topic in chapter four beginning with disk formating and an explanation of common disk formats. The chapter continues with copying a CP/M system disk and the procedure to generate a system disk (called SYSGEN). Since the amount of available system memory may vary, the user needs to know how to reconfigure the system image—MOVCPM is the command used.

Chapter five speaks to the STAT (Status) and PIP (Peripheral Interchange Program) utility programs (or transient commands). The chapter starts with an explanation of why the commands are necessary at all. Various forms of the two commands are illustrated. The commands have multiple uses. Numerous examples are given to illustrate the power of the commands.

Chapter six deals with ED, the CP/M editor. Some people can make ED do a dance, I cannot.

The CP/M assembler ASM is covered in chapter seven. I liked the coverage given to the various ASM directives and pseudo-operations. Most books either gloss over or ignore them entirely.

The last chapter is devoted to DDT. The Dynamic Debugging Tool allows real-time debugging of a program from the keyboard. In the course of the chapter, all DDT commands are used and explained.

Appendix A gets to the heart of CP/M detailing the general system and I/O call procedures, the I/O status byte and a host of other features. Particularly handy is a disk allocation and extents chart.

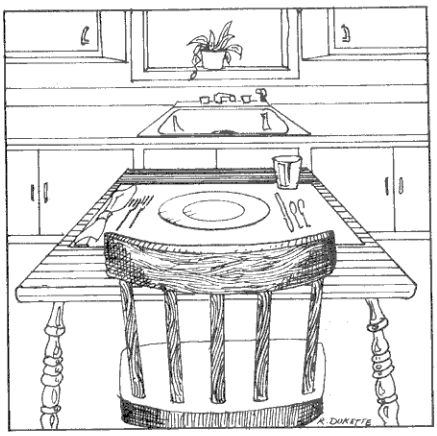
Appendix B is a comprehensive list of CP/M compatible software. The list is divided into five program categories. Each category is subdivided for clarity's sake.

The last appendix is a CP/M reference. All commands are listed by command type with a brief description of what each command does. ASM and DDT commands are included.

A handy pocket reference card provided recapitulates Appendix C. ■

News From KITCHEN TABLE SOFTWARE, INC.

by David Busch



Those of you who still haven't found a practical use for the nifty Radio Shack pocket computers you snapped up during the sale last May need worry no longer. The innovative crew at Kitchen Table Inc.—the world's foremost fictitious manufacturer of space age products—has introduced a complete word processing package for the TRS-80 Pocket Computer.

The system includes a lowercase modification kit for the single-line liquid crystal display, a pocket-sized daisy-wheel printer and interface, and a sophisticated software adaptation of KTI's best-selling Word Whacker program.

Because the TRS-80 Pocket Computer has no string handling capabilities, there are a few limitations. For example, all word input must be seven characters or less. The system is perfect for sportswriters or television scriptwriters, while less than ideal for attorneys or insurance underwriters.

KTI has also introduced a miniature programmable device, dubbed the TLS-8E Pockets Computer. The Federal Trade Commission has reportedly insisted on the plural designation because KTI could not find a single pocket which could hold computer, cassette interface, tape recorder, and printer all at once.

Because the KTI Pocket Word Whacker (PWW) will work with either the Tandy or KTI micro-micro computers, let's look at that package first, before delving into the features of the Pockets Computer.

Pocket Word Whacker is an extremely powerful package. The lowercase modification is simple to install. Kitchen Table provides complete instructions so the user can carry out the modification himself. To keep the cost of the kit as low as possible, several changes are made to existing integrated circuits in the pocket computer. If you're a bit rusty at micro-soldering, KTI will provide you with IC's which have already been adapted for a modest fee.

A few rarely-needed parts in the pocket computer must be de-soldered and discarded, and the tiny IC chip supplied by KTI placed in any convenient nook or cranny. I couldn't make up my mind where to put the device, and so called KTI for advice. I found nooks are preferred over crannies, because of the reduced chance of static electricity buildup.

Once the mod is in place, the pocket computer will produce the full lowercase character set in unshifted mode (no descenders, however), and uppercase when "shift" is pressed.

This poses one possible problem—how does one obtain the "normal" shifted character set, such as the apostrophe, quotation mark, dollar sign, etc? Kitchen Table has come up with a clever solution. With the lowercase mod, the space key (SPC) becomes a second shift, or control key.

Some may object to the subsequent loss of the SPC key caused by the above solution. Not to worry. "Space" may still be obtained by hitting SHFT + SPC + "equal sign". I felt that the elimination of the shifted equal sign (lowercase equal sign is still operative) was a minimal price to pay for this elegant kluge.

Pocket Word Whacker is a short program, well within the memory limitations of both the Pocket and Pockets computers. The computer must be nestled in its cassette interface, and properly connected to a suitable recorder prior to entering word processing mode. Kitchen Table recommends several reel-to-reel tape recorders which can be used for optimal results at 15-inches per second tape speed. The company will even sell you a remote pause kit allowing these units to be turned on and off by the pocket computer. A battery pack and ac/dc inverter are optional.

However, we had our hearts set on using a good-quality battery powered cassette recorder. Since these are expensive, we settled for our existing CTR-80A instead.

". . . the world's foremost fictitious manufacturer of space age products—has introduced a complete word processing package for the TRS-80 Pocket Computer."

Once the software is run, the user simply types normally on the keyboard, that is, assuming he or she has very, very tiny fingers. Normal people may prefer to set the computer on a hard surface, and whack away with two fingers. Kitchen Table supplies Velcro tabs which may be placed on the bottom of the cassette interface and the typing surface to hold the computer in place.

Limitations of the computer itself have been overcome admirably. The user simply types in a word, and hits Enter as each word is completed. The program stores the word in a string array, and, as memory fills, dumps the memory contents to the

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```
10  : REM WORD PROCESSING FOR POCKETS COM-
      PUTER
20  : PAUSE "BE CERTAIN CASSETTE RECORDER
      CONNECTED"
30  : PAUSE "ARE YOU SURE RECORDER IS CON-
      NECTED?"

40  : PAUSE "THIS IS YOUR LAST CHANCE"
50  : PAUSE "YOU WERE WARNED"
60  : BEEP 5
70  : REM        ****** MENU ******
80  : INPUT "(L)OAD, (C)REATE, OR (S)PACE IN-
      VADERS";B$
90  : IF B$ = "C" GOTO 220
100 : IF B$ = "L" GOTO 140
110 : IF B$ = "S" PAUSE "YOU IDIOT, THERE IS NO
      CRT"
120 : GOTO 80
130 : REM        ****** LOAD FILE FROM TAPE
      ******
140 : INPUT "ENTER FILENAME";F$
150 : INPUT #1,F$;A$(27)
160 : INPUT "(E)DIT , (P)RINT, (A)NDROID NIM";B$
170 : IF B$ = "P" GOTO 360
180 : IF B$ = "E" GOTO 480
190 : IF B$ = "A" PAUSE "YOU NEVER LEARN, DO
                                        YOU?"
200 : GOTO 160
201 : REM        ****** CREATE TEXT ******
220 : N = 27
230 : INPUT A$(N)
240 : IF A$(N) = " = " GOTO 260
250 : IF N□100 GOTO 310
260 : INPUT " SEE TEXT FILE (Y/n)";B$
270 : IF B$ = "N" GOTO 310
280 : FOR G = 27 TO N
290 : PAUSE A$(G)
300 : NEXT G
310 : REM        ****** SAVE TO TAPE ******
320 : INPUT "ENTER FILENAME";F$
330 : PRINT #1,F$;A$(27)
340 : GOTO 80
350 : REM        ****** EDIT ******
360 : PAUSE "HIT ' = ' AFTER LINE TO EDIT"
370 : N = 27
380 : IF A$(N) = " = " GOTO 440
390 : PRINT A$(N)
400 : INPUT B$
410 : IF B$ = " = " GOTO 320
420 : N = N + 1
430 : GOTO 370
440 : PAUSE "ENTER NEW WORD"
450 : INPUT A$(N)
460 : GOTO 420
470 : REM        ****** PRINT ******
480 : FOR G = 27 TO N
490 : LPRINT A$(G)
500 : NEXT G
```

Program Listing

cassette tape. To edit the text, the user loads the text file, which is displayed one word at a time. Hitting a key after the display of the word allows that word to be changed. Though this system could conceivably be rather tedious if whole sentences must be altered, it works extremely well for changing one or two words in an otherwise fine sentence.

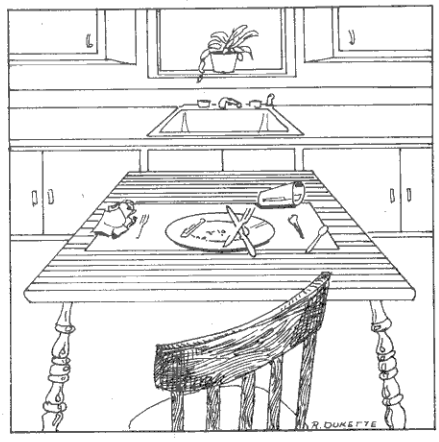
The TLS-8E Pockets Computer is deceptively similar in appearance to the Radio Shack version, although close inspection reveals the case is made of plastic, the keys of wood, and the display of only semi-liquid crystal. Instead of expensive mercury batteries, the unit operates from rechargeable cells kept at peak by a tiny electric generator inside. I cracked open my sample (the case appeared to be heat-welded much like a cheap tape cassette) and looked at this wonder of miniaturization. I found a mainspring-powered generator wound by the movement and jostling of the owner of the computer. A KTI spokesperson explained this particular module is built for the company in Switzerland by Timex.

I tested the Pockets Computer extensively, and found it to operate nearly identically to the Tandy model built by Sharp. One extra feature I liked was the built-in travel alarm feature. The main complaint was using SHFT + Y as the snooze button. Who can think clearly enough early in the morning to take advantage of that feature?

The final piece of the word processing package, the tiny five-by-nine-by-three-inch daisy-wheel printer, was not available for testing at press time. Prototypes could only print out in the Sri Lankan language (KTI officials were not sure what it is called. Ceylonic?). However, because of the importance of a printer in any word processing system, the company promised the printer will be forthcoming.

Rumors that a version of the printer will be built into all future models of the Osborne I microcomputer (boosting the price of that machine by $75), are untrue.

As a public service, KTI has supplied an early version of Pocket Word Whacker for the use of *80 Micro*. A listing of this limited-capability program is reproduced with this article. It has not been entirely debugged (that's why it's free), but should be usable for any documents of 100 words or less. ■



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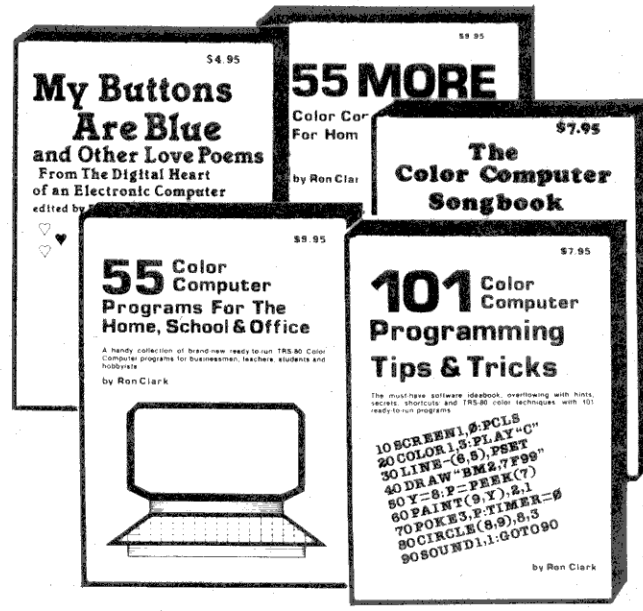

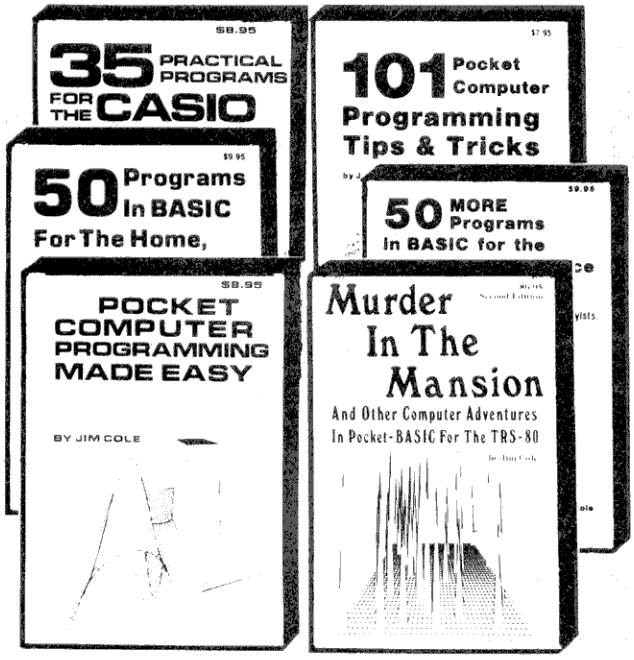

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Notes from BENEATH the KEYBOARD

by Paul Wiener

This month I would like to share some thoughts on the interconnection between video display formatting and keyboard input. Very few of the programs I have seen come anywhere near using an optimal approach to coping with this complex interrelationship.

As a programmer, use validity checks to prevent users from bombing your programs with bad input. Such error-trapping will often result in a user being prompted to reenter data previously entered incorrectly. In such a case, if you have not dealt carefully with the formatting ramifications, this could result in a messy looking screen with important data scrolling off the top prematurely.

As an example, I will present a program to solve Time/Rate/Distance relationships using the formulas: D = RT, R = D/T, T = D/R, where D, R, and T stand respectively for Distance, Rate (speed) and Time. The programming task is trivial, but demonstrates a formatting and I/O philosophy which can be used in more formidable applications.

The simplistic (and alas, all too common) approach to such a program is to first prompt the user to decide whether Time, Rate or Distance is to be solved for. Then the user is prompted to enter the two factors needed to calculate the third. Next, the solution would be displayed. Finally, the program would loop back to the beginning to let the user try other data sets.

During a session with such a program, a typical screen might look like Fig. 1. Notice the haphazard scattering of information and dialogue. There is no reason to let dialogue accumulate like dirty laundry until it scrolls off the top of the screen. Program Listing 1 is a more professional approach. This may not be the best solution, but it is certainly a step in the right direction.

When you run the program, it will display two columns—one on the left labeled Input and the one on the right labeled Output. Each column is divided into three rows: Time, Rate and Distance. Near the bottom of the screen you are prompted to enter T, R, or D. (See Fig. 2). To enter a time of 40, type T40 (no space after the T) and press Enter. The input column of the Time row is instantly updated to the latest value. Input of Distance and Rate are analogous. An arbitrary range of 0 => n > 1000000 has been selected to limit input values to those which will not cause overflow errors or display difficulties.

You can enter and reenter values to your heart's content without destroying the format. To solve for any one of the three variables in terms of the other two, simply enter its initial (such as T for time) without a number following. The solved Time/Rate/Distance trio will be posted in the output column.

After obtaining a solution, you can continue entering Times, Rates and Distances, which the program will continue to post in the input column. The output column will be updated only when you call for a solution. Therefore, the input column may contain invalid trios (T/R/D combinations that can't possibly go together), but the output column will always contain a consistent trio—obtained by the last requested solution.

The screen will not fill with unnecessary, unsightly, almost haphazard dialogue. All the data currently being handled by the program is visible in an easily comprehended tabular form. Input is entered in any order you want with a minimum of key strokes. Values can be changed at any time without going through a lengthy dialogue.

The program has also been error-trapped so non-numeric input will not be accepted and division by zero will not be attempted. When you are prompted to press Enter to continue, keys other than Enter will not be accepted. Try to bomb the program by using bad input; it will not be easy.

I purposely omitted one fairly common input technique—replacing Input statements with INKEY$ routines. The INKEY$ technique does have several benefits: The programmer can be selective about which characters are echoed on the screen when typed. Thus the format destroying consequences of keying Clear, down arrow, right arrow and Shift right arrow can be sidestepped. Input's often undesirable but compulsory linefeed (often an irrelevant question mark), are also circumvented by this technique.

Many such routines have already been presented in *80 Micro* and other computer journals. None I have tried has worked to my satisfaction. Despite authors' claims to the contrary, they were all noticeably slow to grab keystrokes. PEEKing the keyboard, instead of INKEY$ing, can improve the response time of such routines; but for this example, I have chosen to stick with good old Input.

There are many ways to improve this program's formatting and I/O. For instance, a border could be drawn around the tabular area; the input routine could be made to recognize and accept correct lower case input; the question mark at the end of the nonquestion-prompts could be eliminated (if you are willing to sacrifice

```
ENTER <T>ime, <R>ate, OR <D>istance ?T
ENTER Rate ?20
ENTER Distance ?50
Time = 2.5
ENTER <T>ime, <R>ate, OR <D>istance ?D
ENTER Time ?0
ENTER Rate ?10
Distance = 0
ENTER <T>ime, <R>ate, OR <D>istance ?R
ENTER Time ?0
ENTER Distance ?500
?/0 ERROR IN 2240
RUN
ENTER <T>ime, <R>ate, OR <D>istance ?R
```

Fig. 2.

```
Enter <T>IME, <R>ATE OR <D>ISTANCE. To Enter a Time Of 40 Type T40 Enter.
All Quantities Must Be Less Than 1000000.
```

Fig. 1.

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by Wayne Westmoreland & Terry Gilman

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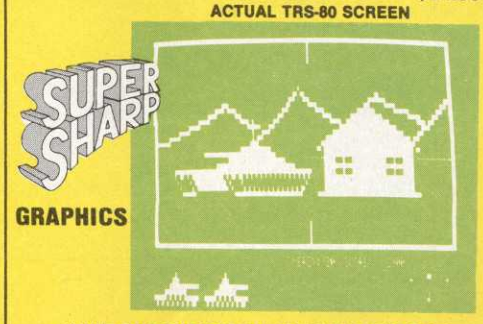

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the Input statement). In general, the coding could be made more elegant. What other improvements would you add? However many, I hope this simple example serves to inspire you toward more practical and creative I/O in your own programs.

How The Program Works

The STRING$ statements in lines 1400 and 1800 draw lines across the screen. The PRINT CHR$(31) in line 2000 clears the screen from the current cursor position at the end of frame. All on-screen material above the cursor is left alone. This ensures that previous inputs are erased before the user is prompted to enter something new.

As you may have guessed from its number, line 2010 was a last minute addition. It corrects disruptions of the display which can occur despite the program's many traps. This could happen if you press Clear or Shift right arrow. This situation could be rectified by clearing and redrawing the screen after each input cycle. But such indiscriminate redrawing is slow and results in an unpleasant flicker. Line 1210 contains a filter to eliminate unnecessary redrawings.

The line drawn across the screen near the top (Fig. 2) is built from a graphic character which does not appear elsewhere on the screen. Format disrupting errors will either clear the line from the screen entirely or cause it to scroll out of position. The PEEK at the beginning of 1210 checks video-memory where the left end of the line is supposed to be. If it is still there, control passes to the next program line. Otherwise, the screen is cleared, a call to the routine that fills in the output column takes place and the program jumps back to the routine that draws the rest of the screen and prompts for input.

Line 2200 isolates the left-most character of the input and sets I$ equal to it. Lines 2300–2500 make certain I$ is one of the acceptable designators, T, R or D. If so, it branches to the appropriate Time, Rate or Distance routine. If I$ is none of the three, the program returns, via line 2600, to line 2000 where the previous input is erased and the user is prompted to reenter the data.

If I$ equals T, then you have selected Time. Lines 3000–3800 process this selection. Line 3100 strips the left-most character off your input and sets the string variable TI$ equal to what remains. For instance, if you entered T40, line 2200 has already set I$ to T. Now, line 3100 sets TI$ to 40.

Line 3200 sets T1 equal to the value represented by TI$. If TI$ contains the string 40, line 3200 will set T1 equal to the number 40. T1 is a temporary storage variable which holds a value until it is tested and proven valid.

Line 3300 determines whether the input quantity, now stored in T1, is within the limits of 0 =< n <1000000. If not, flow returns to the data entry routine at 2000. If the input passes the limit check, flow falls through to 3400 where there is a test to see if T has been entered alone (without a number). If so, the program branches to line 10000 where Time is solved for in terms of Distance and Speed. Otherwise, flow continues to 3500.

Line 3500 may look a little obscure at first. It exists because of the following: If you type a non-numeric string that starts with a number, VAL will return the value of that number. For example, VAL("7XYZ") will return 7. This could result in an incor-

```
1000 REM INITIALIZATION
1100 CLEAR 500
1200 CLS
1300 PRINT@17,"INPUT";,,"OUTPUT";
1400 PRINT@64,STRING$(64,131);
1500 PRINT@128,"TIME",TI
1600 PRINT@256,"RATE",RA
1700 PRINT@384,"DISTANCE",DI
1800 PRINT@640,STRING$(64,179);
2000 PRINT@704,CHR$(31);"ENTER <T>IME, <R>ATE, OR <D>ISTANCE
E.G. TO ENTER A TIME OF 40 TYPE  T40<ENTER>.
ALL QUANTITIES MUST BE LESS THAN 1000000.
2010 IF PEEK(15424)<>131 THEN CLS: GOSUB 13000: GOTO 1300
2100 INPUT IN$
2200 I$=LEFT$(IN$,1)
2300 IF I$="T" THEN 3000
2400 IF I$="R" THEN 4000
2500 IF I$="D" THEN 5000
2600 GOTO 2000
3000 REM TIME
3100 TI$=RIGHT$(IN$,LEN(IN$)-1)
3200 T1=VAL(TI$)
3300 IF T1<0 OR T1>1000000 THEN 2000
3400 IF TI$="" THEN 10000
3500 IF LEN(TI$)+1<>LEN(STR$(T1)) THEN 2000
3600 IF T1=0 AND TI$<>"0" THEN 2000
3700 T2=T1: PRINT@144,"              ";: PRINT@144,T2;
3800 GOTO 2000
4000 REM RATE
4100 RA$=RIGHT$(IN$,LEN(IN$)-1)
4200 R1=VAL(RA$)
4300 IF R1<0 OR R1>1000000 THEN 2000
4400 IF RA$="" THEN 11000
4500 IF LEN(RA$)+1<>LEN(STR$(R1)) THEN 2000
4600 IF R1=0 AND RA$<>"0" THEN 2000
4700 R2=R1: PRINT@272,"              ";:PRINT@272,R2;
4800 GOTO 2000
5000 REM DISTANCE
5100 DI$=RIGHT$(IN$,LEN(IN$)-1)
5200 D1=VAL(DI$)
5300 IF D1<0 OR D1>1000000 THEN 2000
5400 IF DI$="" THEN 12000
5500 IF LEN(DI$)+1<>LEN(STR$(D1)) THEN 2000
5600 IF D1=0 AND DI$<>"0" THEN 2000
5700 D2=D1: PRINT@400,"              ";:PRINT@400,D2;
5800 GOTO 2000
10000 REM SOLVE FOR TIME
10100 IF R2<>0 THEN 10400
10200 PRINT@768,CHR$(31);"SORRY--CAN'T DIVIDE BY ZERO. PLEASE CHANGE RATE.
PRESS <ENTER> TO CONTINUE";
10300 IN$=INKEY$: IF IN$<>CHR$(13) THEN 10300 ELSE 2000
10400 TI=D2/R2: DI=D2: RA=R2
10500 GOSUB 13000: REM OUTPUT ROUTINE
10600 GOTO 2000
11000 REM SOLVE FOR RATE
11100 IF T2<>0 THEN 11400
11200 PRINT@768,CHR$(31);"SORRY--CAN'T DIVIDE BY ZERO. PLEASE CHANGE TIME.
PRESS <ENTER> TO CONTINUE.";
11300 IN$=INKEY$: IF IN$<>CHR$(13) THEN 11300 ELSE 2000
11400 RA=D2/T2: TI=T2: DI=D2
11500 GOSUB 13000: REM OUTPUT ROUTINE
11600 GOTO 2000
12000 REM SOLVE FOR DISTANCE
12100 DI=R2*T2: TI=T2: RA=R2
12200 GOSUB 13000: REM OUTPUT ROUTINE
12300 GOTO 2000
13000 PRINT@175,CHR$(30);TI
13100 PRINT@303,CHR$(30);RA;
13200 PRINT@431,CHR$(30);DI;
13300 RETURN
```

Program Listing

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Notes from BENEATH the KEYBOARD

rect value accidentally being entered into the program. Line 3500 circumvents this error. To do so it must take the following into account: A numeric variable always has a LEN-length one character greater than it looks. This is because of a cursor movement character imbedded in the number. For instance, LEN("6") = 1, but LEN(STR$(6)) = 2. This accounts for the + 1 in line 3500 which compares the length of the number derived by VAL with the length of the string it was derived from. This detects whether the string contained any non-numeric characters invisible to VAL. Failure to pass this test means you miskeyed and the program will not accept your input. Otherwise flow falls through.

Line 3600 is the last error trap of the series. It ensures that if T1 = 0, you actually typed 0. This is necessary because VAL will evaluate a non-numeric string as zero. Again, detection of faulty input bounces you back to line 2000.

If flow reaches line 3700, it means T1 has been proven to hold a valid time value. So T2, the variable used to contain such bonafide values, is set equal to T1. Next, the new value must be printed at the appropriate place on the screen. After the cursor is positioned, a series of spaces is printed. This ensures that if a new short value (such as 8) replaces a previous longer value (such as 987654), there is no "residue" from the older value cluttering up the display. CHR$(30) cannot be used for that purpose here. The information in the right column must not be erased. Finally, the cursor is repositioned to the beginning of the field, the new time-value is printed and control returns to the input routine.

Line sequences 4000-4800 and 5000-5800 parallel 3000-3800, except they deal with Rate and Distance input, respectively.

Lines 10000-10600 calculate Time from Rate and Distance values. Lines 10100-10300 contain an error-trap which precludes a program crash due to attempted division by zero. The INKEY$ statement in line 10300 accepts a single character of keyboard input. Note the phrasing IF IN$<>CHR$(13). Since the user is prompted to press to continue, it is befitting to code in such a way so only Enter actually results in the program's continuing.

Line 10400 solves for Time and stores the result in the variable TI. Note, TI holds time-values obtained by solving an equation, as opposed to T1 and T2 which hold values (uncertified and certified, respectively) entered by the user. Likewise for R and D variables. Line 10500 calls a subroutine to output the result of calculations. Finally, at line 10600, the program jumps back to the data entry routine.

The 11000-11600 sequence is analogous to the 10000-10500 sequence except Rate, rather than Time, is solved for. The 12000-12300 is the corresponding Distance determining routine. The only noteworthy difference between this routine and its Time and Distance counterparts is the zero trap has been dispensed with as there is no division involved.

Lines 13000-13300 print the calculation results in the output column. The PRINT@'s position the cursor. This time, we are working in the right-most display column, so CHR$(30) may be used to remove residual digits left by previously posted values. Line 13300 returns to the calling routine after a valid Time/Rate/-Distance trio has been posted in the output column.

I have often been amazed at the poor display quality of the otherwise fine programs I have seen during my career as a software editor. I hope this program example succeeds at imparting a superior video formatting philosophy to you programmers. ■

Reader Service for facing page ✓28→

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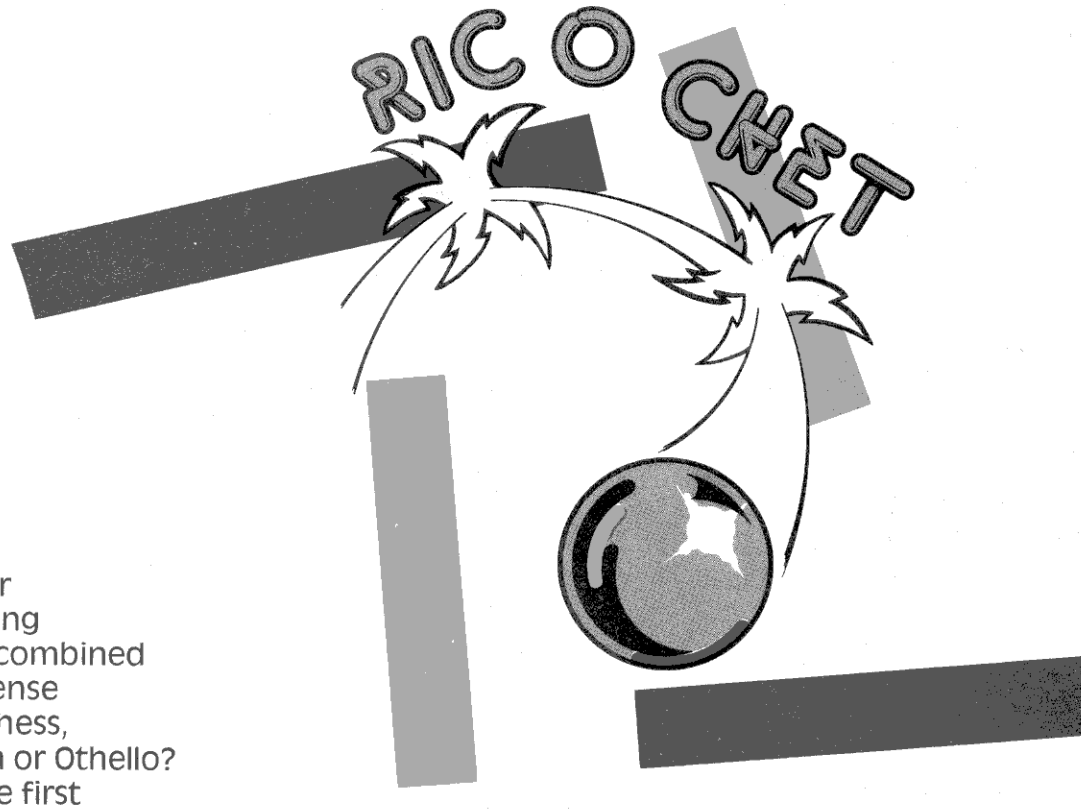

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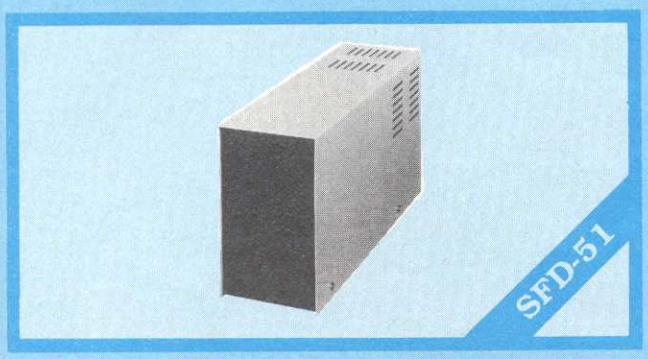

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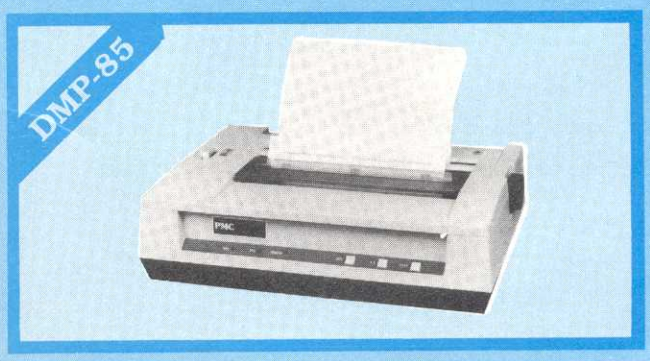

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An artistic sampling from our own menu.

The Editor's Choice

Kalvos Gesamte is an itinerant programmer and artist, as well as the pen name one of our editors shares with various friends. Kalvos is also the author of the program which appears on our cover. The program creates a design which starts off simply and becomes more and more complex as it continues through several revolutions; it ends up, finally, looking much like a complex piece of embroidery.

Photos 1-3 show the program in several of its stages. Part of the pleasure of this program comes from watching it make its changes. What amazes us most about this program is that Kalvos created it using a black and white monitor.

Jake Commander is our own Technical Consultant, an ex-rock and roll musician, a newcomer to the States and to skiing, and a programmer extraordinaire. Photos 4-11 are samples of what can be produced with the short program he has chosen for this sampler. The best part of his program, as we see it, is that it allows the user to become an artist. Even better, it got Jake thinking and led to an even more complex and beautiful program that we will be featuring in our May issue. Read what Jake has to say about this month's program:

The program is very simple and operates on the Spirograph (c) principle. I have plans for an in-depth article on that subject, so I'll reserve the heavy stuff until then.

Photo 4.	180.9	: L :	0,.3	:	.05,.05
Photo 5.	181	: L :	0,.3	:	.1,.1
Photo 6.	357.8	: L :	0,.4	:	.05,.05
Photo 7.	45.1	: L :	0,.3	:	.3,.3
Photo 8.	44.9	: B :	0,0	:	.6,.6
Photo 9.	33	: B :	0,0	:	.4,.4
Photo 10.	180.5	: B :	0,0	:	.4,.4
Photo 11.	91	: L :	0,0	:	.5,.5

Table 1. Input for results pictured in Photos 4-11

As a basic explanation, suffice it to say the program draws circles. The circles *aren't* the common or garden variety, however. They are created by setting points on the screen with a known distance between each point. This distance is input when you reply to the prompt asking for the number of degrees between points. If you answer ten degrees, the program will plot a single point, move ten degrees clockwise, then plot another, and so on. Since there are 360 degrees in a circle, this would simply create a circle of 36 dots, so the radius is varied as the pixels are plotted. That's how we get some nice spiral effects.

To add some versatility, I added a feature whereby you can set a whole small circle or draw a line or box to the new coordinate instead of merely setting pixels. Most interesting patterns come from unanticipated visual interaction between previously set pixels. You're more likely to get this if you use degrees between points that are not ex-

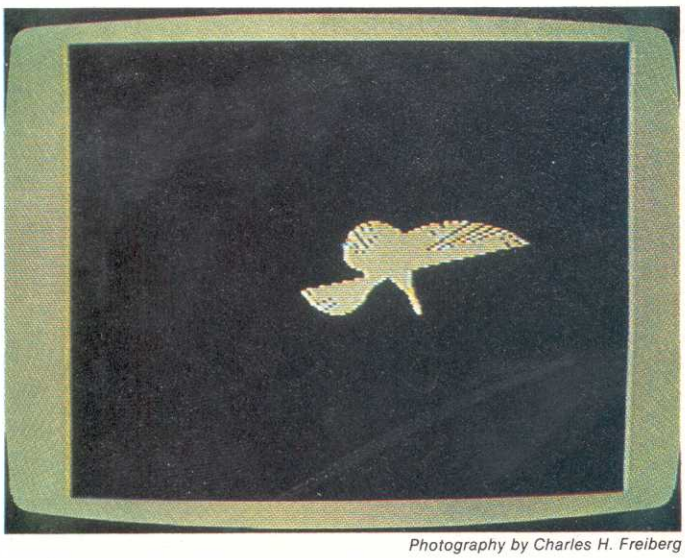

Photo 1

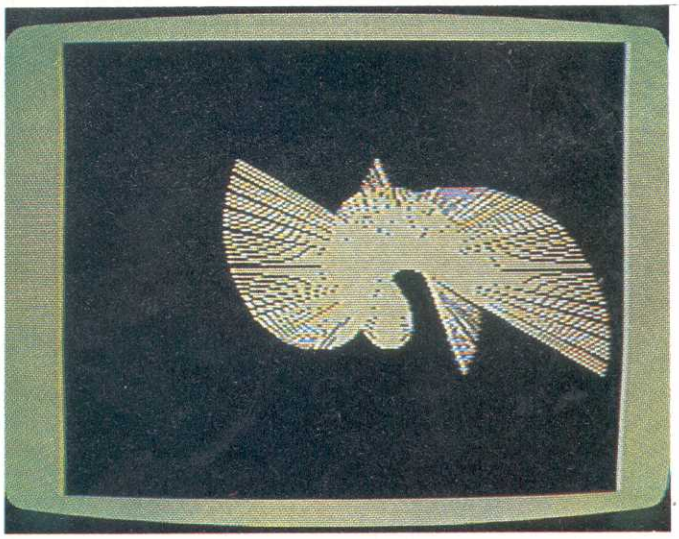

Photo 2

Photography by Charles H. Freiberg

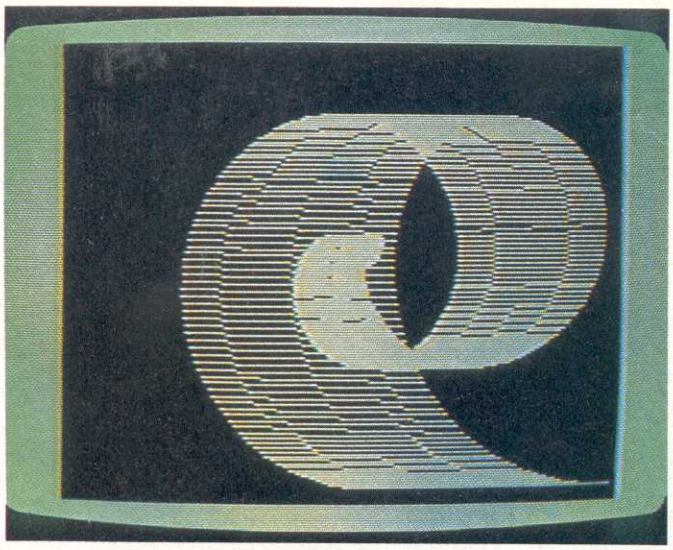

Photo 3

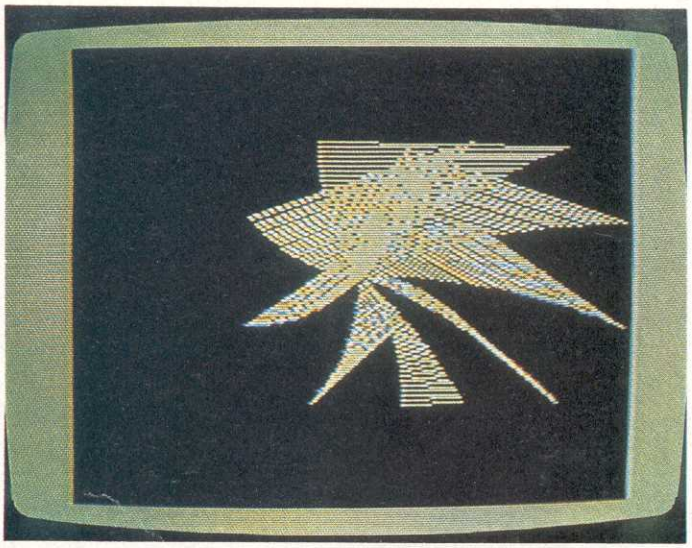

Photo 4

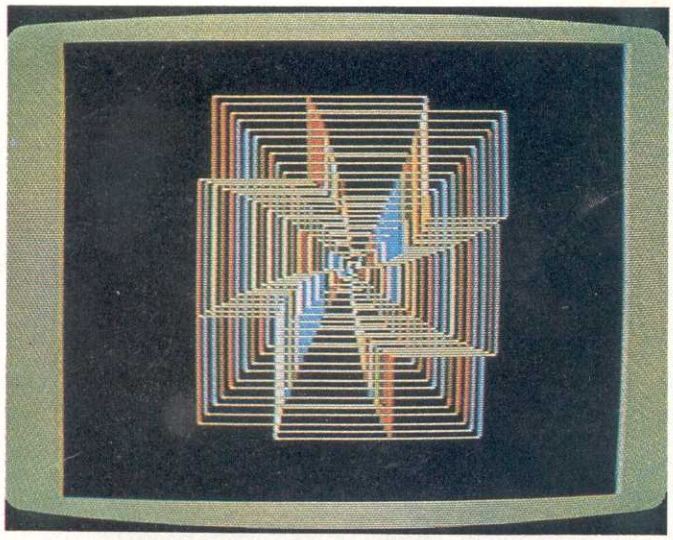

Photo 5

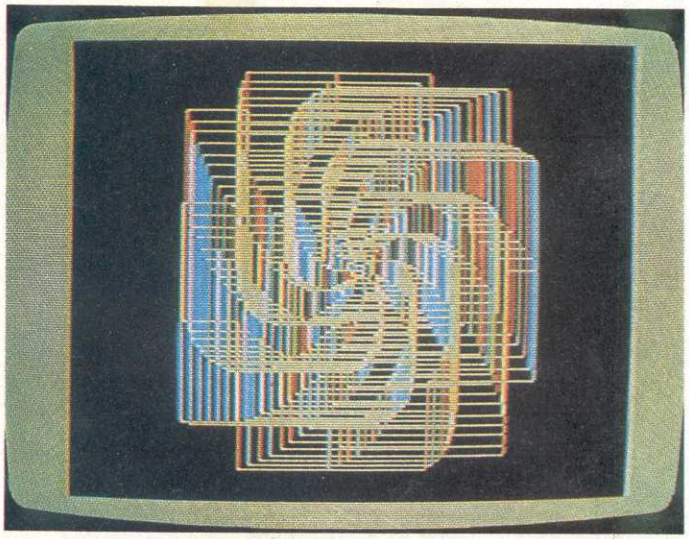

Photo 6

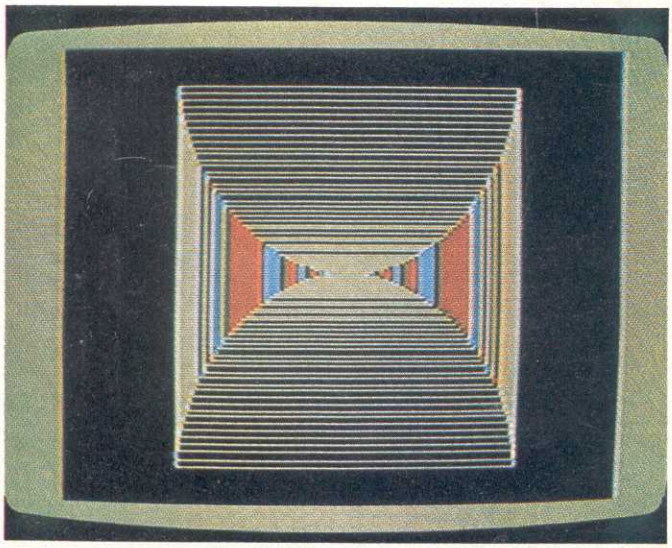

Photo 7

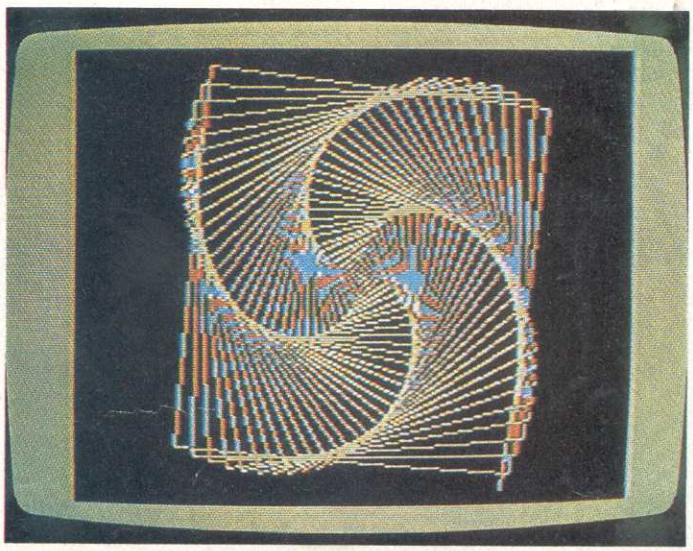

Photo 8

"Delta offset is just a posh way of asking for the change of step size for each iteration."

Photo 9

```
10 PCLEAR4
20 PMODE4,1
30 PCLS
40 SCREEN1,1
50 DIM C(1,63) : A=31
60 FORN=10TO1STEP-2
70 FORQ=252TO255
80 LINE(Q,0)-(Q,191),PSET
90 NEXT
100 FORQ=189TO191
110 LINE(0,Q)-(255,Q),PSET
120 NEXT
130 FOR X=63TO 0 STEP-N
140 LINE(X,0)-(31,31),PSET
150 NEXT
160 FOR Y=0 TO 63 STEPN
170 LINE (0,Y)-(31,31),PSET
180 NEXT
190 FOR X = 0TO63STEPN
200 LINE (X,63)-(31,31),PSET
210 NEXT
220 FOR Y=63TO0 STEP-N
230 LINE (63,Y)-(31,31),PSET
240 NEXT
250 GET(0,0)-(62,62),C,G
260 PUT(63,0)-(125,62),C,PRESET
270 PUT(126,0)-(188,62),C,PSET
280 PUT (189,0)-(251,62),C,PRESET
290 PUT(0,63)-(62,125),C,PRESET
300 PUT (63,63)-(125,125),C,PSET
310 PUT (126,63)-(188,125),C,PRESET
320 PUT (189,63)-(251,125),C,PSET
330 PUT (0,126)-(62,188),C,PSET
340 PUT(63,126)-(125,188),C,PRESET
350 PUT(126,126)-(188,188),C,PSET
360 PUT(189,126)-(251,188),C,PRESET
370 NEXT
380 FOR A=0TO255STEP5
390 LINE(A,0)-(127,95),PSET
400 NEXT
410 FOR A=0TO191STEP5
420 LINE(255,A)-(127,95),PSET
430 NEXT
440 FOR A=255 TO0STEP-5
450 LINE(A,191)-(127,95),PSET
460 NEXT
470 FOR A=191TO0STEP-5
480 LINE (0,A)-(127,95),PSET
490 NEXT
500 FOR A=1TO254STEP5
510 LINE(A,0)-(127,95),PRESET
520 NEXT
530 FOR A=1TO190STEP5
540 LINE(255,A)-(127,95),PRESET
550 NEXT
560 FOR A =254TO1STEP-5
570 LINE (A,191)-(127,95),PRESET
580 NEXT
590 FOR A=190TO1STEP-5
600 LINE(0,A)-(127,95),PRESET
610 NEXT
620 FOR A=1TO130STEP3
630 CIRCLE(127,95),A
640 NEXT
650 FOR B=0 TO 95
660 LINE(127,95-B)-(127+B,95),PRESET
670 LINE-(127,95+B),PRESET
680 LINE-(127-B,95),PRESET
690 LINE-(127,95-B),PRESET
695 CIRCLE(127,95),B/2
700 NEXT
710 GOTO60
```

Program Listing 1. Kalvos Gesamte.

act multiples of 360, but nearly so. For instance, if you use 91 degrees instead of 90, the pattern will have reached 364 degrees after four iterations. This is a circle plus four degrees. The pattern will then repeat except that it will now be offset by four degrees. This is the sort of trick to use to get interesting combinations.

To allow still more flexibility, I have included an option to move each spiral to the right after each iteration. Patterns created using this option will spread out across the X-axis. So you won't become too bored by this facility, you are also able to increase the step size between each rightward move as the drawing progresses. This gives a successively larger gap between each spiral, resulting in an illusion of acceleration. Both these parameters are input to the program in answer to the Offset, Delta Offset prompt. Delta offset is just a posh way of

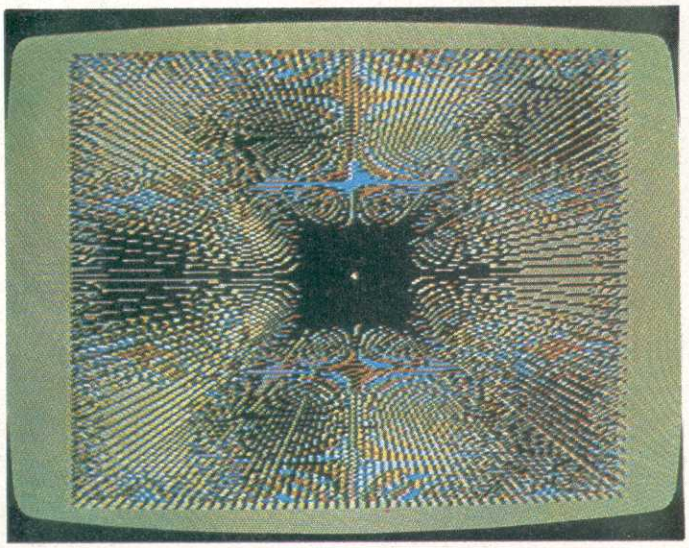

Photo 10

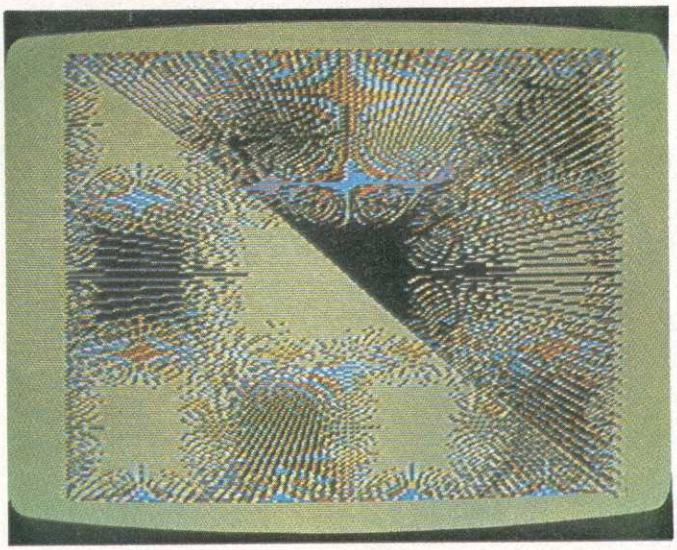

Photo 11

Reader Service for facing page ✓35→

"Indiscriminate use of this parameter makes for messy patterns."

```
10 CLS
20 INPUT"DEGREES BETWEEN POINTS";D:D=D/57.29578
30 INPUT"D)OTS L)INES C)IRCLES B)OXES";S$
35 INPUT"OFFSET, DELTA OFFSET";OF,DO
40 INPUT"RATIO OF X TO Y";A,B
60 PMODE4,1:PCLS:SCREEN1,1:XA=128:YA=95
70 R=0
80 X=R*COS(R)*A+128:Y=R*SIN(R)*B+95
85 XP=X+OF:YP=Y:OF=OF+DO
90 IFXP<0ORXP>255ORYP<0ORYP>191THEN140
100 IFS$="D"THEN120ELSEIFS$="B"THEN110ELSEIFS$="C"THEN115
105 LINE(XA,YA)-(XP,YP),PSET:GOTO130
110 LINE(XA,YA)-(XP,YP),PSET,B:GOTO130
115 CIRCLE(XP,YP),5,1:GOTO130
120 PSET(XP,YP)
130 XA=X:YA=Y:R=R+D:GOTO80
140 IFINKEY$<>CHR$(13)THEN140
```

Program Listing 2. Jake Commander.

asking for the change of step size for each iteration. The two figures should be input separated by a comma, not the best way to ask for input in a Basic program, but sufficient for our purposes here. When first trying out this routine, answer this prompt with two zeroes; later on, use small numbers only. Indiscriminate use of this parameter makes for messy patterns.

Finally, you can change the aspect ratio (or horizontal/width ratio) of the spirals when replying to the prompt asking for the ratio of X to Y. Start out by answering 1,1 to this prompt, later using smaller numbers such as .8,.4. If you reply with two equal numbers, the spirals will simply be smaller.

There's no error trapping in the program; it's only for experimental use, so go easy with your input. To achieve the results in photos 4–11, use the input in Table 1 in the order given. ■

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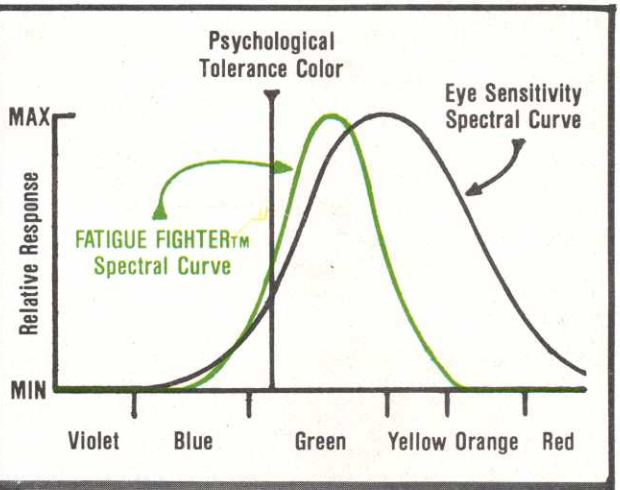

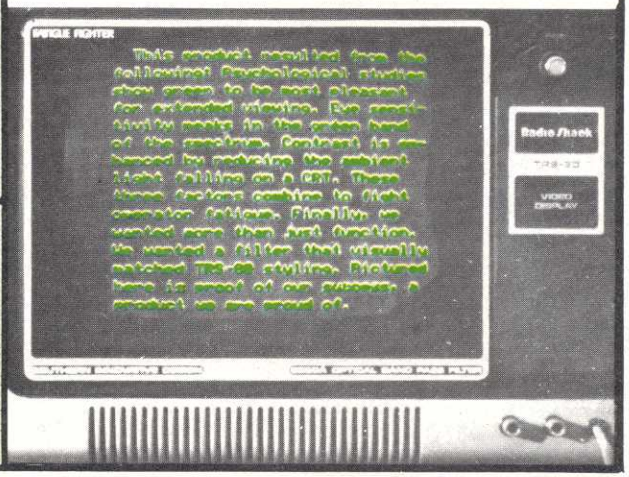

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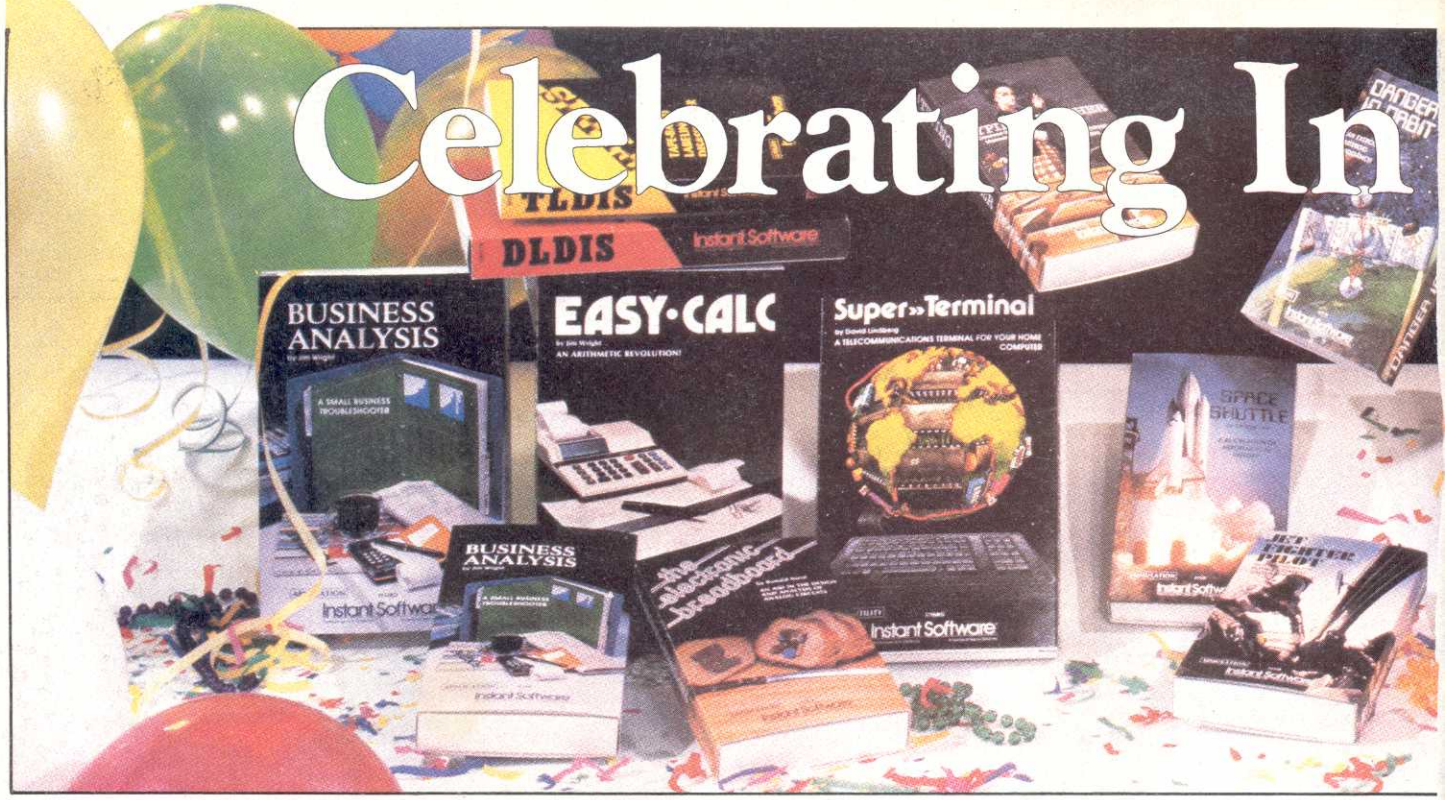

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One frustration that comes with using the TRS-80 Color Computer in conjunction with CompuServe Information Service (CIS) is the inability to obtain a printout on your printer. Tandy says it's impossible because the Color Computer only has one RS-232C port. At the TRS-80 show in Los Angeles this year, one of the repeated questions of business people, stockbrokers and home users was, "How do I use a printer with the Videotex Terminal or the Color Computer while on CIS?" The answer each and every time was, "It can't be done." As far as most business people were concerned, regardless of whatever other attractions the Color Computer or Videotex Terminal may have had, the nearly unanimous reaction was, "No printout—no sale."

All of the above negative proclamations aside, there is a simple way to use any 300 baud serial printer (that is compatible with Color Basic) to print CompuServe or many other computer bulletin board services—plus the use of the printer alone for computer output and have the test function required by the diagnostic cartridge RS-232 port test. All this without the hassle of switching cables. However, (and here's the bad news) if you have one of Radio Shack's printers you'll note that it is set for only a 600-baud transmission rate. While this article may still interest you, the lack of foresight here means a baud rate converter in the future.

Now, for you farsighted individuals who purchased printers capable of being set at, or modified for, operation at 300 baud, the simple solution is to just "slave" the printer to the telephone modem output line. Then, whatever comes out of the modem runs simultaneously to the printer input and the Color Computer or Videotex Terminal input.

An easy to construct, multipurpose switchbox is the only hardware necessary. See the schematic shown in Fig. 1. Use a high quality rotary switch for S1 since the $1.98 special, wiper style is very unreliable (I know; I tried one). The connectors are all 4-pin DIN style. Keep the wiring as short as possible and use a metal box and shielded external cable, both attached to the system ground, to avoid noise and RFI (FCC) problems. Status LEDs for Printer Ready or Carrier Detect On are unnecessary,

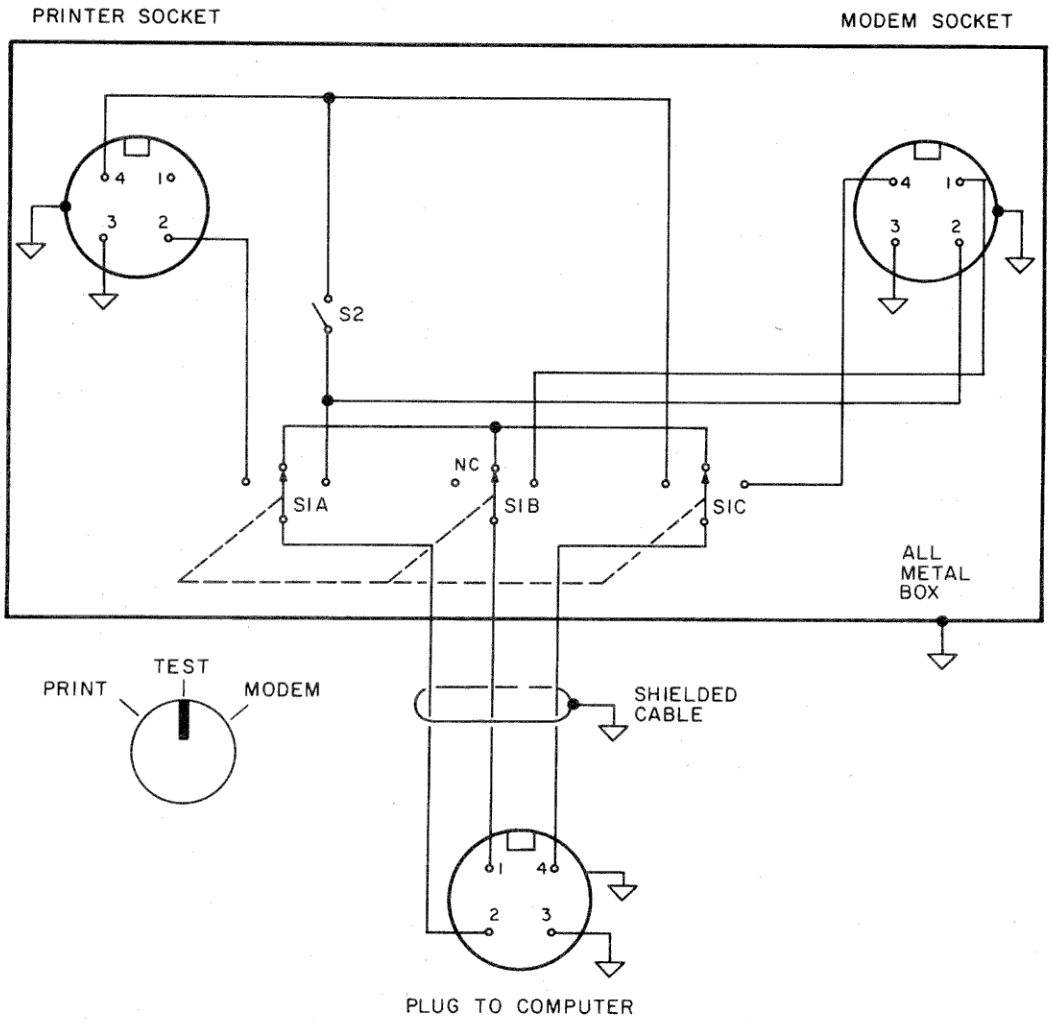

Fig. 1

but if you like lights go ahead. Closing S2 "slaves" the printer, and anything coming out of the modem will also go to the printer. The positions on the switch box are (1) printer only, (2) test/shorting plug, and (3) modem with slave printer when S2 is on. The center (2) position shorts the RS-232 input/output and carrier detect lines together as required by the RS-232 test in the diagnostic cartridge. If you have problems getting 4-pin DIN plugs and sockets you may have to special-order them, or try a parts store that has video accessories.

As mentioned before, any serial printer that is compatible with Color Computer Basic and which can be set to run at 300 baud will work. The printer must provide a line feed with every carriage return, use ASCII code, and generate a low busy signal when not ready. The serial port's input line must be pulled up high, either at all times (with a DTR signal perhaps) or go high after each character is sent, whenever you use the printer by itself. When you "slave" the printer there is no handshake line. This is because the Basic ROM output character routine uses the input line (pin 2) as a handshake line for printers that provide a high (more than +3 volts) signal when ready to accept the next character. In the terminal mode the input pin is receiving data—no handshake is possible. Of course, if you have a Videotex Terminal you don't have to worry about this.

For those of you having trouble providing any handshake for your printer (and if you run it alone you absolutely have to have one), the people at The Micro Works (who sell an excellent monitor and disassembler for the Color Computer) recommend that "the daring may install a 10K pull-up resistor between...the anode of CR6 (yes, that's inside) and +5 volts if your printer doesn't provide the proper handshake." Conversely, since the output line goes high after a character is sent, you might try that resistor and a diode going from the output line to the input line with the diode preventing positive signals from going back to the output. The 10K resistor is supposed to be high enough to not interfere with the normal input function of the RS-232 port.

The other pinouts of the serial port are: (1) Carrier Detect—not used by printer but for modem status; (2) Input—to computer from modem, also discussed above; (3) Signal Ground; (4) Output—from computer.

For my Eaton LRC7000 printer I installed one switch to select between 600 baud (normally used by the computer for printing) and 300 baud (used to synchronize with the modem output), and printer self test. Another switch allows me to select between the 64/32-column mode (no buffer), and the 40 column (buffer) mode. At 64 columns this lets me obtain a full format output from the Micro Works Color Disassembler. At 32 columns, it matches the color Computer's video output. I use the 40-column, 3-line, 128-character buffer mode for CIS or other CBBS printouts. I connected the printer's Ready To Send (RTS) line, which provides a low signal when busy, to the line going to the Color Computer's RS-232 input line.

If your printer requires switches to alternate between the necessary settings, obtain a schematic and have them installed. If they are already there, set them before you enter the CIS Videotex program. If your modes are software, program or keyboard selectable, also set them before you enter the Videotex program (this option is not possible on the Videotex terminal). Once you Exec into Videotex you lose control of your nor-

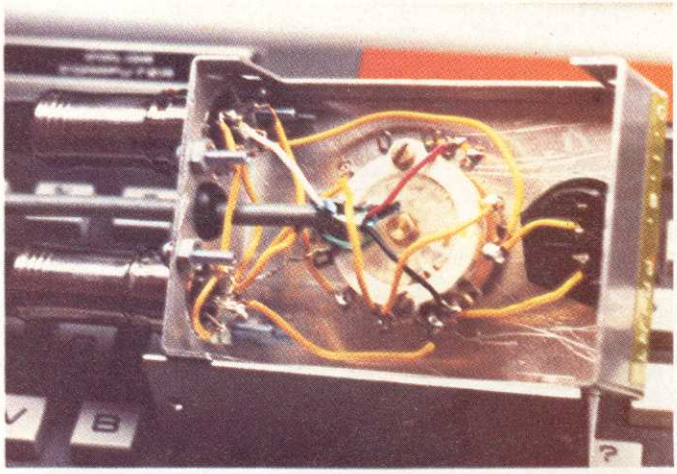

Photo 2. Inside of switch box.

Photo 1. Switch pack and modified ROM pack.

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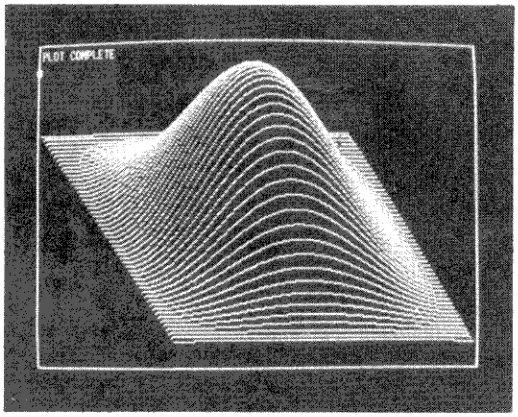

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mal computer commands; Reset just sends you back to Videotex and you'll have to turn off the machine and start over.

If your printer has sufficient buffer capacity you should have no problem copying single pages (one screen's worth of text equals 512 bytes). I have no problem with my modified Eaton LRC in the 40-column, multi-line buffer mode. If you can, upgrade or increase your printer's buffer memory. Or, if needed, you could purchase an outboard on-line serial buffer to install between the switch box and your printer. Some of these off-line buffers can even be set for different input/output baud rates and can therefore solve the only problem of the Radio Shack 600 baud (try Microcompatible for one).

If the output from the modem overflows your buffer, or is transmitted too fast for your printer to keep up, or you're scrolling the output from some long CompuServe/Micronet file, you can modify your terminal parameters with CompuServe. Using the CompuServe program going from the main menu is tedious and time-consuming. But if you enter Micronet, "TER LFD X", where X is the character time delay 0 to 255, you quickly get a line feed delay (LFD) in Micronet to allow your printer to catch up. You can enter "R DISPLA" to go back to CompuServe while still keeping the LFD for your printer. With no buffer, the 64/32-column mode X = 28 worked fine for me, even with rapid scrolling. When done you can go back to normal delay by executing the same procedure, using X = when your printing is finished and you want to go back to quick scanning. (Thanks to Dixie at CompuServe for suggesting this solution.)

You can put another ROM in most ROM cartridges by installing another socket in the area provided and use a toggle switch to select between them. Don't forget to use pull-up resistors (4.7K to 10K) on the chip enable lines to actively disable the unselected ROM. However, you may have to install another switch to reconnect the FIRQ and Q Clock lines (pins 7 and 8) that you broke to prevent the cartridge from taking over the computer. Some Color Computer programs will not function without the autostart. The diagnostic cartridge memory test, when used with Extended Basic installed, will not function at all without the autostart. Exec &HC000 and then trying the memory test will not work.

The MC6809E and MC6883 chips run very warm and, in the interest of reliability, heat sinks should be affixed. I used several lay-on-top types (used for 16-pin ICs) and a small fan from an old hair dryer. You might also try drilling some holes around the power transformer to improve air circulation around this hot area.

The suggestion to piggy-back 16K RAM chips to get 32K bytes of memory is fine, except that the line from pins 4 of the RAM chips to pin 35 of the MC6883 SAM chip should have a ferrite bead on it or run through a 33-ohm resistor. This should solve some static and transient problems that might arise. Want your hacker buddies to know how much memory you're now running? Wish there was a 32K RAM button to replace that 16K insult? Well, Radio Shack has one for the Model III that will also fit the Color Computer. Its part number is AHC-0078, its price is 50¢, and you can call 1-817-870-5600 (National Parts for Radio Shack) and order one. ■

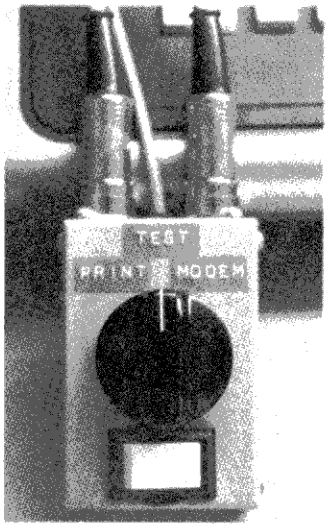

Photo 3. Switchbox. Note rocker switch used for S2.

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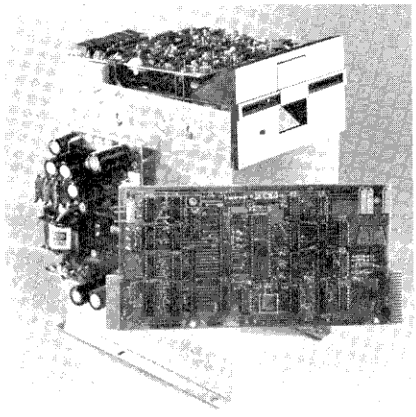

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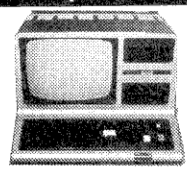

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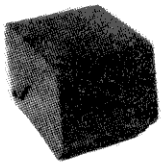

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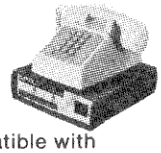

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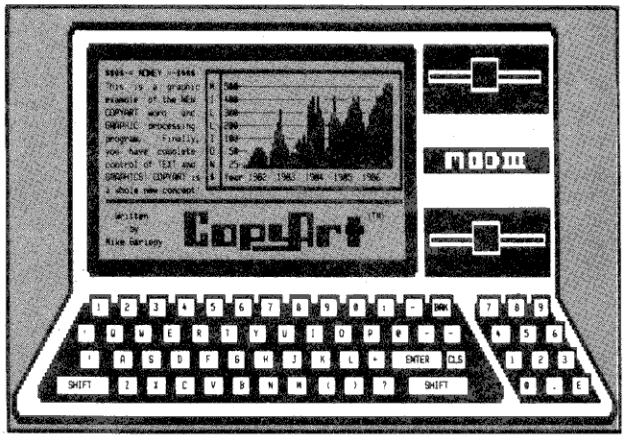

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What's this got to do with Shakespeare?

Color Reversi

Anthony M. Ledger
RR 3, Box 184
14 Musket Ridge Road
New Fairfield, CT 06810

Othello is a game played on a square even-numbered grid using disks with sides of different colors. Each player places his own color disk on the board bracketing a group of the opponent's disks and flips the trapped disks over to the opposite color. You can trap the opponent's disks in eight directions corresponding to the horizontal, vertical and diagonal axes of the board. Each disk placed on the board must trap and flip at least one of the opponent's disks. As the game progresses, the score can change radically. Entire rows, columns and diagonals are flipped by a single move.

As a novice Basic programmer I was fascinated with the challenge of programming an automated version of Othello for the Color Computer. Extended Basic rapidly draws lines and circles, paints selected areas and draws complex shapes with the Line, Circle,

Anthony Ledger is a staff engineer with the Perkin Elmer Corporation working in the area of thin film physics.

The Key Box

Extended Color Basic
Color Computer
16K RAM
Joysticks

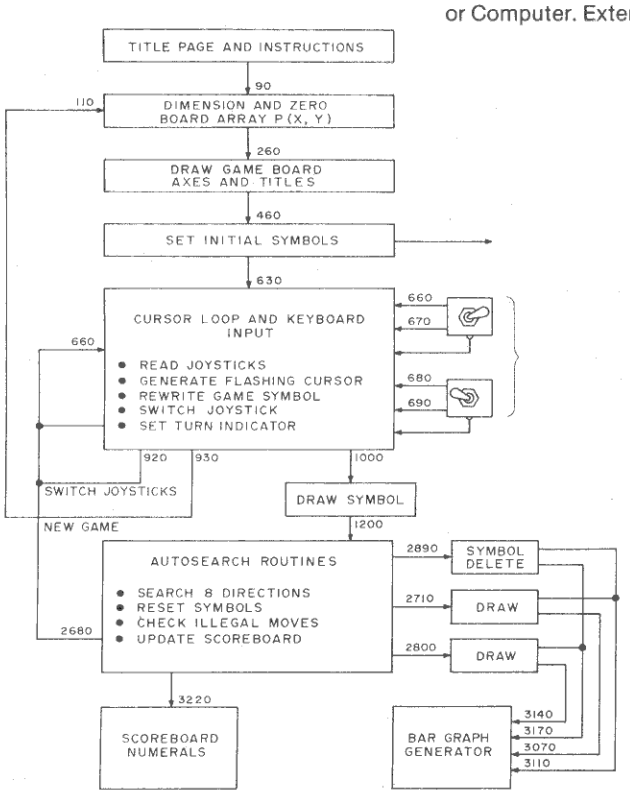

Fig. 1. Program Block Diagram for Othello for the Color Computer.

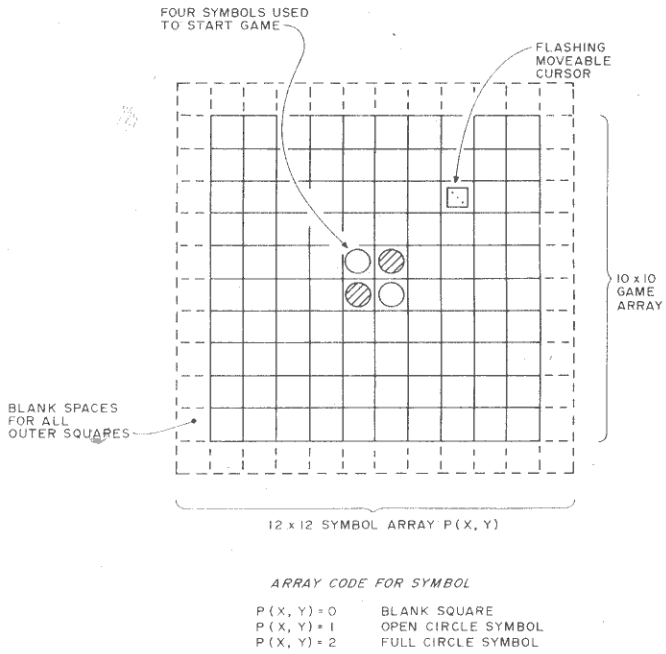

Fig. 2. Game & Symbol Array Sizes.

"The game moves relatively fast. . ."

Paint and Draw commands, I visualized composing the game on the screen with a relatively small number of simple instructions. I underestimated the complexities of display animation. A fully automated game includes joystick control of a cursor, an automatic search method for flipping the captured disks, a way to detect illegal moves and a scoring method. While finding solutions to these problems, I added a next turn indicator, a dynamic bar graph and an alphanumeric scoreboard.

The game program allows two players to interact with the graphics display in an automated mode. I wanted a minimum of keyboard input, with the main control functions performed by joysticks and the joystick buttons. The following areas show the sequential development of the program.

- Choice of Graphics Mode
- Game Symbols
- Game Board Array and Grid System
- Cursor Control Using Joysticks
- Autosearch Routine and Resetting Trapped Symbols
- Detecting Illegal Moves
- Scoring System (bar graphs, alphanumeric display)

A functional block diagram of the completed program indicates the main elements, a cursor or keyboard input loop followed by a series of automatic search routines (see Fig. 1). Several subroutines write and erase symbols and maintain the score indicator. Approximately 250 bytes of memory remain after the program is run on a 16K Color Computer equipped with Extended Basic.

The game moves relatively fast, since all changes made to the graphics display are incremental. For instance, a single move which can capture eight of the opponent's symbols is completed in four seconds. This includes the time to determine whether the move is legal, to search out and flip the trapped symbols and to reset the turn indicator and score display. Sound effects accompany the disk-flipping routine, but do not limit the speed of each move since the tone is turned on for the shortest time available with the Sound command (6/100 seconds).

Choice of Graphics Mode

The highest resolution mode (PMODE 4,1) and SCREEN 1,0 mode for the graphics display provides excellent definition of the small circular game symbols. The time-consuming Pset and Preset commands to the powerful Draw statement which generate any pattern including alphanumeric characters control the 256 by 192 addressable locations in this high resolution mode.

The highest resolution mode limits the choice of colors to two. Screen 1,0 assembles the display using green symbols and lines on a black background. Screen 1,1

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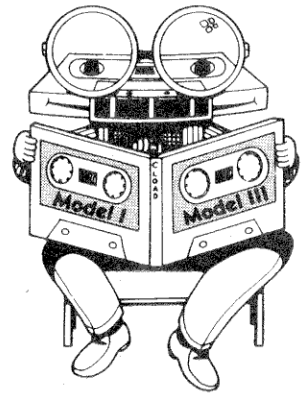

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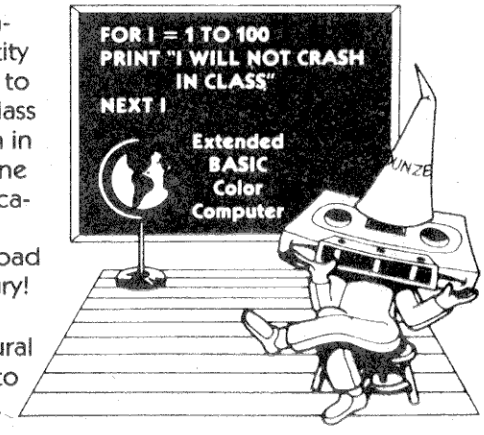

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"If a symbol is already present control returns to the cursor loop."

produces an alternative display, white horizontal lines, alternating blue and orange vertical lines and rainbow colored curved lines and characters.

Game Symbols

The number of statements needed to set or change a given game piece is minimized with simple symbols (squares, rectangles or circles). The Line statement generates the simplest symbols.

```
100 LINE (X1,Y1) – (X2,Y2),PSET(OR PRESET),B(Box) or
                    BF(Full Box)
```

The statement draws a line or a box (full or empty) by specifying the coordinates (X1,Y1) and (X1,Y2) of opposing corners. This statement, used for cursor control, also erases parts of the display by writing a full box in the background color.

The Circle and Paint statements write the open and filled circles I chose as game pieces. A program line of the form 100 CIRCLE (A,B)R,1 writes a green circle (color 1) of radius R at the point (A,B) on a black background (color 0). Repeating the above statement using color 0 deletes the circle by drawing a black circle on a black background. A filled circle is drawn by painting from the center of a circle with the foreground color.

```
100  CIRCLE (A,B),R,1
110  PAINT (A,B),1,1
```

The filled circle is deleted by painting from the center (A,B) with color 0 (black), or by using a Line statement.

The game is started on the screen by writing two circular symbols of each color with like colors on opposing diagonals in the four central squares of the board (see Fig. 2.). Additional symbols are written at a set of coordinates derived from the joystick outputs.

Game Board Array and Grid System

The game board is a 10 by 10 array of squares drawn on the screen at the beginning of the program using Line statements. The game area occupies screen positions from 40 to 250 horizontally and 17 to 187 vertically on the 256 by 192 screen and the joystick outputs map a 64 by 64 array of positions; a little numerical manipulation confines the joystick controlled cursor to the game grid. An array of numbers tracks the type of symbol in each square of the grid. This array is denoted P(X,Y) in the listing and is dimensioned one element larger than the game board in all directions, resulting in a 12 by 12 array (see Fig. 2.). This oversized array surrounds the game array by a row of blank squares at all times and simplifies the search routines described later.

At first, the joystick-controlled cursor ate the freshly drawn game grid. When the cursor coincided with a symbol or grid line, the flashing action permanently erased it; turning off the flashing action left solid cursor tracks all over the screen. Rewriting the grid and symbols between flashes of the cursor solves this problem; in practice, the game operation becomes slower as more symbols fill the board.

Cursor Control Using Joysticks

The joysticks position the cursor in the center of each square and the joystick buttons place game pieces on the screen. After each new symbol is written, symbol writing passes to the opponent's joystick. After each new piece is set on the board, the position is checked to see if it is allowed; if the move is illegal, the symbol is deleted and another move allowed.

The centers of each square are the only positions the cursor can occupy. The joystick outputs are quantized with: 100 V1 = INT(JOYSTK(0) . 4)/7) + 1. Values of the variable JOYSTK(0) range from 0 to 63; the above expression compresses all these values into integers between 1 and 10 inclusive. When performed on both joystick outputs, the joystick creates only numbers between 1 and 10 in both axes, corresponding to centers of game squares.

The screen coordinates (A,B) of the center of the cursor are expressed as the compressed joystick outputs; the joystick makes the cursor jump from the center of

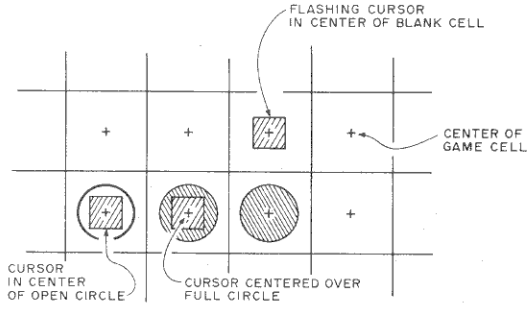

Fig. 3. Cursor Positioning in Game Cells.

"This prevents the grid from being erased and automatically positions game symbols. . ."

one square to the center of the next. This prevents the grid from being erased and automatically moves the game symbols to the correct position. (see Fig. 3). The joystick button places symbols on the board and provides a numeric output Z = PEEK (65820) which is a pair of numbers (254 or 126) for one joystick and (253 or 125) for the other. The two values reflect whether the joystick is left or right of the center position.

Lines 660 to 990 in Program Listing 1 move the cursor with joysticks to any board position without erasing any game symbols. The Line statement creates the cursor; the cursor loop continuously writes a black or green cursor, writes the appropriate symbol in the square and checks the value of Z to see if a new symbol is to be placed on the board. The joystick button branches the program out of the cursor loop. If a symbol is already present in the square, control returns to the cursor loop; otherwise, the symbol appropriate to the joystick in use is written. A joystick switching counter (W in line 640) in the cursor loop selects the correct symbol for each player.

Autosearch Routine and Resetting Trapped Symbols

The possible arrangements of symbols along a single direction from the new symbol position reduces to four distinct cases (see Fig. 4). The search routine checks the symbol present in each preceding square until it detects one of the four patterns. If the routine encounters a blank square first (case I) the search ends. If it finds an opposite symbol first the search continues until a like symbol is found (case II). The value of the counter M in the search routine (lines 1200 to 1370) is set and the trapped symbols are reset. The next symbol in case III is identical and the search ends. A full line of identical opposite symbols also ends the search (case IV). The oversized array terminates the maximum search on a known symbol (a blank square) and simplifies the reset loop limit definitions.

One dimensional searches for all eight directions are arranged serially in the program and are indicated by REM lines AUTOSEARCH LEFT or AUTOSEARCH RIGHT). Subroutines at 2710 and 2800 reset symbols and produce a series of beeps with the statement SOUND (200,1).

Detecting Illegal Moves

The search routines determine valid board positions for new symbols with the counter N8. The value of N8 is incremented by one for each case I, III or IV; if N8 equals eight at the end of the two-dimensional search, no legal moves were found. In this case, a subroutine at 2890 destroys the symbol with flashing cursors and suitable sound effects. The symbol is reset after the cursor moves to an allowed position.

Scoring System

Because it is impossible to print text on the graphics screen with simple print commands I added bar graphs, updated each time a symbol changed sides. One bar graph is empty and the other a full rectangle; the height of each is proportional to each player's score at any point in the game.

The incremental bar graph in which a small block is added or subtracted from the previous bar height as the symbols change sides is implemented in lines 3060 to 3190 as a subroutine to the symbol drawing and deleting subroutines.

An alphanumeric scoreboard, constructed with Draw statements, and a turn indicator at the top of the screen further enlighten the players.

The Draw statements in lines 370 to 450 write the words SCORE and NEXT at the top of the screen. A video scoreboard totals both scores at the end of each move (in lines 2560 to 2680 and a multibranch set of subroutines starting at 3220). A Draw statement generates each number in a 5 by 7 cell.

DRAW "BM" + P$ + ",16; (draw instructions)"

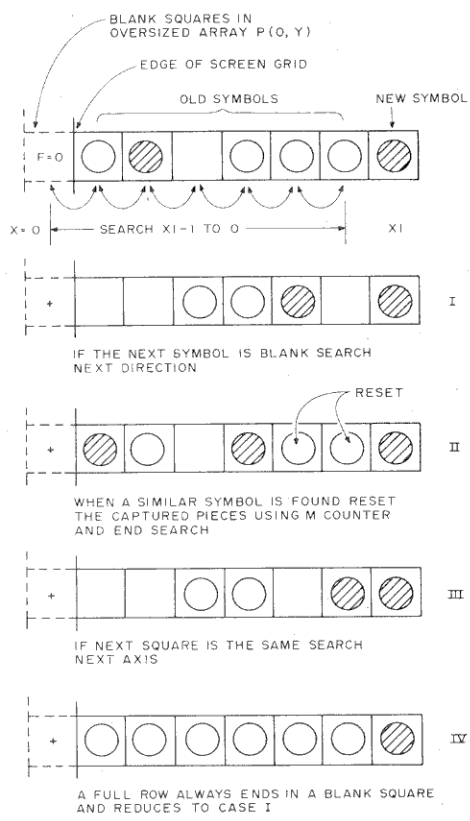

Fig. 4. One Dimensional Search used to identify trapped game pieces. The complex patterns simplify to one of four cases.

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"The joystick button branches the program out of the cursor loop."

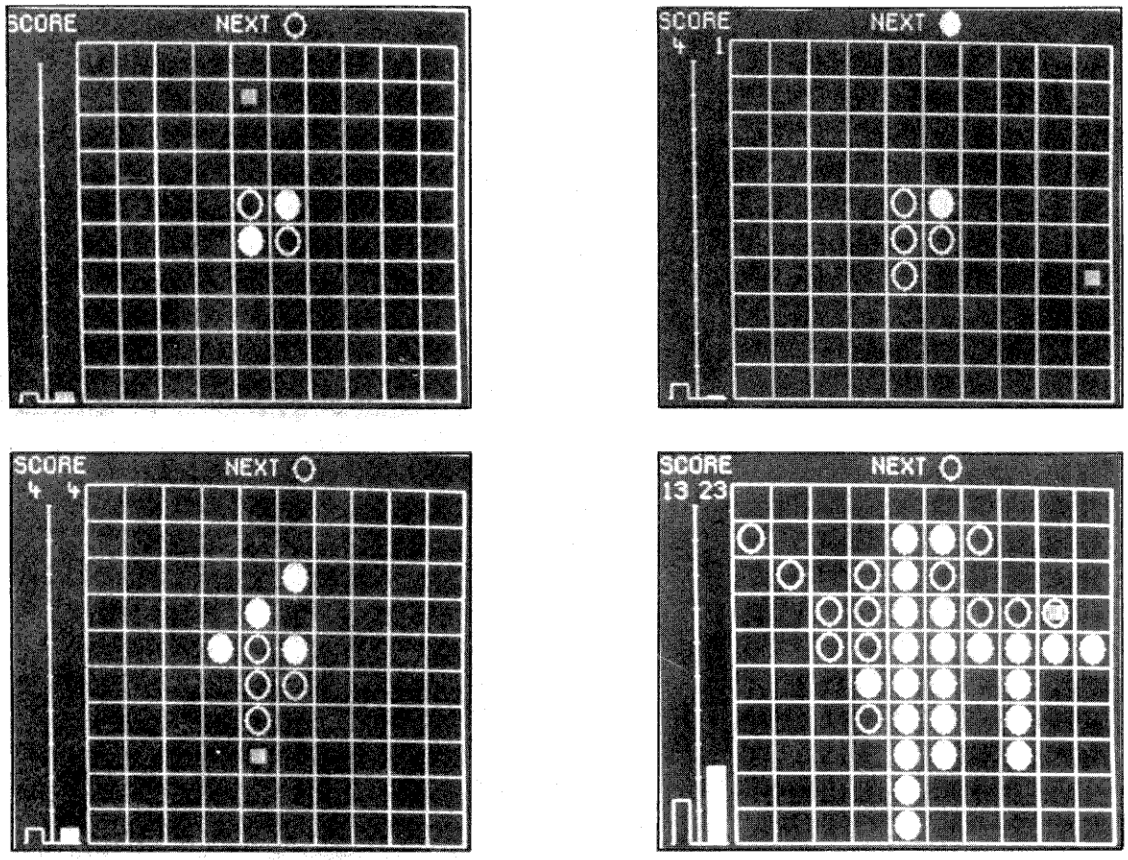

Fig. 5. Playing the Game.

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The string variable P$ moves the number to be drawn to one of four horizontal positions in the pair of two digit scores generated by the game. The Draw statement in the tens column can be skipped for single digit scores to avoid displays of 00 to 09. The scoreboard blanks before each set of numbers prints.

After playing many games to check the program I added a method of switching control from one joystick to the other. Key S transfers control to player two when player one cannot move.

Playing the Game

After the program is entered into the Color Computer, press Run to show the title page. Press the spacebar to turn the page for game instructions. Use the joysticks to move the cursor and use the joystick button to place the symbol on the game board. Symbols placed in illegal positions are deleted immediately. Switch joystick control of the cursor from player to player by pressing key S.

Press the spacebar to clear the screen and reveal the graphics page. At the end of a game press the spacebar to return to the instruction page. The flashing cursor disappears and a short delay occurs as the game array P(X,Y) is reset to zero before the instruction page is shown.

The graphics display initially shows the game grid and four starting symbols. The scoreboard indicates the correct score after the first move is made, and the bar graph to the left of the display is updated as the four starting symbols are set in place. The turn indicator at the top of the screen shows which player has the next turn with a filled or open circle. The open circle has the first move; the S key gives the first move to the closed circle.

A typical game sequence is shown in Fig. 5 from the four central pieces to approximately one-third the way through a game. Several basic strategies can win the game: Capturing corners is to your advantage and should remain your first priority. Placing symbols in the outer squares is advantageous; symbols placed in rows and columns adjacent to the outer squares is hazardous, but often unavoidable. ■

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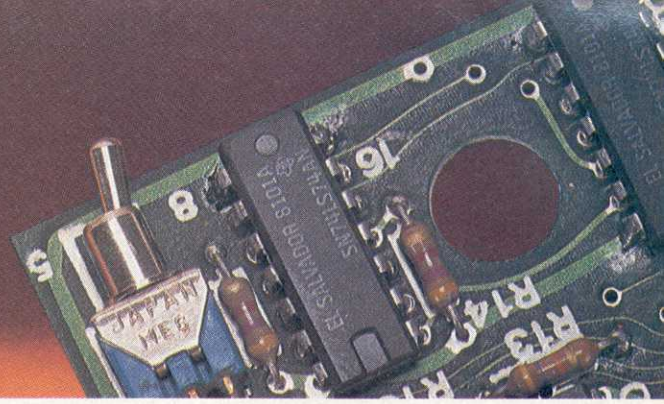

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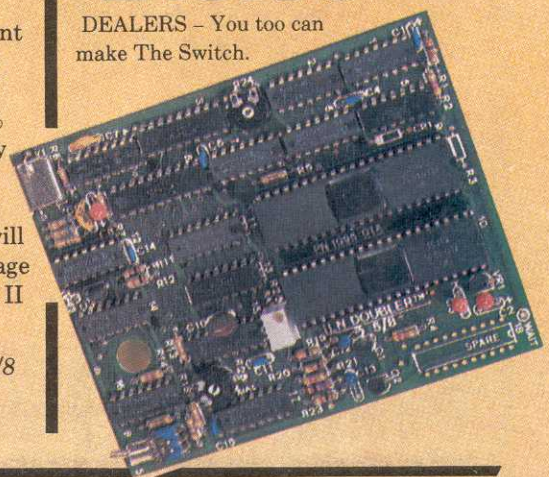

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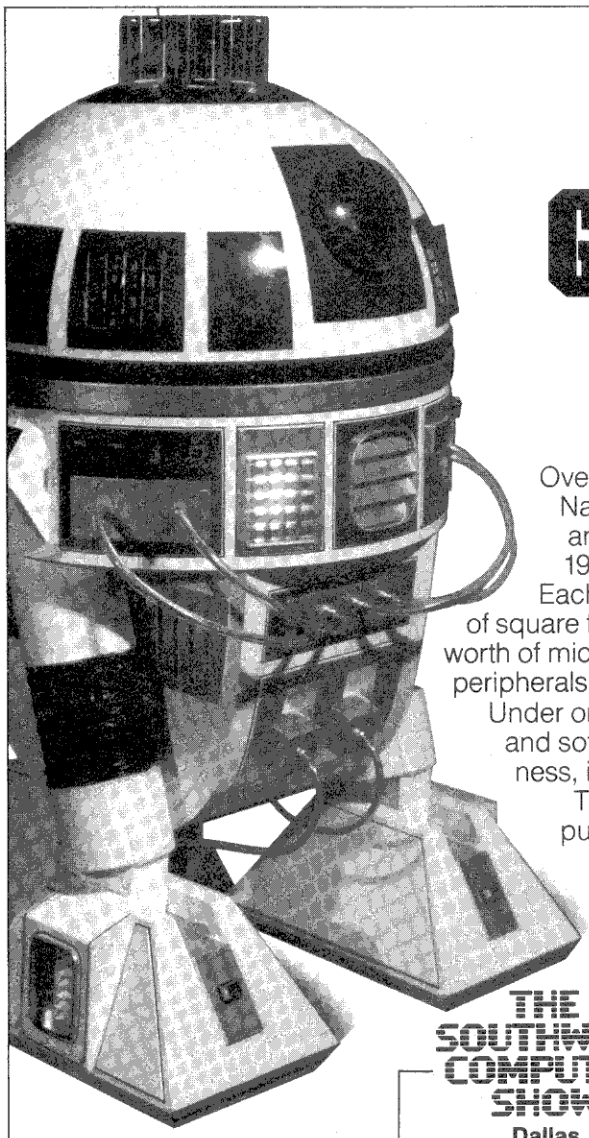
Program Listing

```
10 N=0:CLS:CLEAR 250
20 PRINT @ 0,"        ****OTHELLO****"
30 PRINT @ 64," THIS GAME OF AUTHELLO REQUIRES  APPROXIMATELY 8K OF ME
MORY      AND IS WRITTEN USING EXTENDED   COLOR BASIC FOR THE RADIO
    SHACK COLOR COMPUTER.           THE PROGRAM FEATURES AUTOMATIC  SE
ARCH AND FLIPPING ROUTINES,"
40 PRINT @ 288," A TURN INDICATOR, A BAR GRAPH   SCORE DISPLAY AS WELL
 AS        FULLY AUTOMATIC ALPHANUMERIC    SCOREKEEPING"
50 PRINT @ 448,"  PRESS SPACEBAR TO CONTINUE"
60 U$=INKEY$:B$=" "
70 IF U$=B$ THEN 90
80 GOTO 20
90 CLS
100 DIM P(11,11)
110 FOR I=0 TO 11:FOR J=0 TO 11
120 P(I,J)=0
130 NEXT J:NEXT I
140 CLS
150 PRINT @ 0,"        ****OTHELLO****"
160 PRINT @ 64,"1 SYMBOLS(FULL AND OPEN CIRCLES)  ARE POSITIONED USING
 JOYSTICKS  AND ARE SET USING THE JOYSTICK  BUTTONS"
170 PRINT @ 192,"2 IF A SYMBOL IS SET IN THE       WRONG POSITION IT W
ILL BE       AUTOMATICALLY DELETED"
180 PRINT @ 288,"3 PRESS (S) TO SWITCH JOYSTICKS"
190 PRINT @ 320,"4 PRESS SPACEBAR AT END OF GAME   TO RESET THE VIDEO
BOARD"
200 PRINT @ 416,"  * PRESS SPACEBAR TO START *"
210 U$=INKEY$:B$=" "
220 IF U$=B$ THEN 240
230 GOTO 150
240 PMODE 4,1:SCREEN 1,0
250 COLOR 3,2:PCLS
260 FOR J=40 TO 250 STEP 21
270 LINE(J,17)-(J,187),PSET
280 NEXT J
290 FOR K=17 TO 187 STEP 17
300 LINE(40,K)-(250,K),PSET
310 NEXT K
320 LINE(20,27)-(20,187),PSET
330 LINE(5,187)-(35,187),PSET
340 FOR Y=187 TO 27 STEP-16
350 LINE(19,Y)-(21,Y),PSET
360 NEXT Y
370 DRAW "BM117,4;D1;N;D6;F4;F1;D1;U7"
380 DRAW "BM125,4;N;R5;D3;N;R4;D4;R5"
390 DRAW"BM133,4;D1;F5;D1;B;L5;U1;E5;U1;B;D7"
400 DRAW"BM141,4;R4;L2;D7;B;R3"
410 DRAW"BM2,4;B;D1;D1;F1;R3;F1;D2;G1;L3;H1;B;U5;E1;R3;F1;B;D6"
420 DRAW"BM10,4;B;D1;D5;F1;R3;E1;U1;B;U3;U1;H1;L3;G1;B;D6;B;R5"
430 DRAW"BM18,4;B;D1;D5;F1;R3;E1;U5;H1;L3;G1;B;D6;B"
440 DRAW"BM26,4;N;D7;R4;F1;D1;G1;N;L4;F1;D3"
450 DRAW"BM34,4;N;R5;D3;N;R4;D4;R5"
460 P(5,5)=1:CIRCLE(134,93),7,1
470 C1=1:C2=0
480 GOSUB 3070
490 SOUND 200,1
500 P(6,6)=1:CIRCLE(155,110),7,1
510 C1=2:C2=0
520 GOSUB 3070
530 SOUND 200,1
540 P(5,6)=2:CIRCLE(134,110),7,1
550 C1=2:C2=1
560 PAINT(134,110),1,1
570 GOSUB 3140
580 SOUND 200,1
590 P(6,5)=2:CIRCLE(155,93),7,1
600 C1=2:C2=2
610 PAINT(155,93),1,1
620 GOSUB 3140
630 SOUND 200,1
640 W=1
650 REM *****KEYBOARD INPUT****
660 V1=INT((JOYSTK(0)+4)/7)+1
670 V2=INT((JOYSTK(1)+4)/7)+1
680 V3=INT((JOYSTK(2)+4)/7)+1
690 V4=INT((JOYSTK(3)+4)/7)+1
700 ON W GOTO 710,730
710 X=V1:Y=V2
720 GOTO 740
730 X=V3:Y=V4
740 A=X*21+29:B=Y*17+8
750 LINE(A-4,B-3)-(A+4,B+3),PSET,BF
760 FOR K=1 TO 30 :NEXT K
770 LINE(A-4,B-3)-(A+4,B+3),PRESET,BF
```

Program continues



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11 AM to 6 PM Daily

DIRECTIONS: EUCLID AVE & WILKE RD. TAKE NW TOLLWAY TO RTE 53 EXIT AT EUCLID AVE EAST

THE NORTHEAST COMPUTER SHOW

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Hynes Auditorium/
Prudential Center

Thursday-Sunday
November 11-14, 1982
11 AM to 6 PM Daily

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Atlanta
Atlanta Civic Center

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Program continued

```
780 IF P(X,Y)=0 THEN 820
790 CIRCLE(A,B),7,1
800 IF P(X,Y)=1 THEN 820
810 PAINT(A,B),1,1
820 A$=INKEY$
830 Z=PEEK(65280)
840 ON W GOTO 850,880
850 IF Z=254 THEN 1070
860 IF Z=126 THEN 1070
870 GOTO 900
880 IF Z=253 THEN 1150
890 IF Z=125 THEN 1150
900 S$="S"
910 B$=" "
920 IF A$=S$ THEN 1000
930 IF A$=B$ THEN 110
940 ON W GOTO 950,980
950 PAINT(160,8),0,0
960 CIRCLE(160,8),6,1
970 GOTO 990
980 PAINT(160,8),1,1
990 GOTO 660
1000 REM**SWITCH JOYSTICKS***
1010 ON W GOTO 1020,1040
1020 W=2
1030 GOTO 1050
1040 W=1
1050 GOTO 660
1060 REM**WRITE OPEN CIRCLE**
1070 IF P(X,Y)=1 OR P(X,Y)=2 THEN 660
1080 P(X,Y)=1
1090 LINE(J,K)-(J+16,K+13),PRESET,BF
1100 CIRCLE(A,B),7,3
1110 C1=C1+1:GOSUB 3070
1120 W=2
1130 GOTO 1210
1140 REM**WRITE FULL CIRCLE***
1150 IF P(X,Y)=1 OR P(X,Y)=2 THEN 660
1160 P(X,Y)=2
1170 CIRCLE(A,B),7,3
1180 PAINT(A,B),3,3
1190 W=1:C2=C2+1:GOSUB 3140
1200 REM***AUTOSEARCH LEFT X***
1210 F=P(X,Y)
1220 N8=0
1230 X1=X
1240 FOR I=X1-1 TO 0 STEP -1
1250 M=I+1
1260 IF P(I,Y)=0 THEN N8=N8+1
1270 IF P(I,Y)=0 THEN 1370
1280 IF P(I,Y)=F THEN 1300
1290 NEXT I
1300 IF M=X1 THEN N8=N8+1
1310 IF M=X1 THEN 1370
1320 FOR X=M TO X1-1
1330 P(X,Y)=F
1340 A=X*21+29
1350 ON F GOSUB 2710,2800
1360 NEXT X
1370 X=X1
1380 REM***AUTOSEARCH RIGHT X***
1390 FOR I=X1+1 TO 11
1400 M=I-1
1410 IF P(I,Y)=0 THEN N8=N8+1
1420 IF P(I,Y)=0 THEN 1520
1430 IF P(I,Y)=F THEN 1450
1440 NEXT I
1450 IF M=X1 THEN N8=N8+1
1460 IF M=X1 THEN 1520
1470 FOR X=X1+1 TO M
1480 P(X,Y)=F
1490 A=X*21+29
1500 ON F GOSUB 2710,2800
1510 NEXT X
1520 X=X1
1530 REM***AUTOSEARCH UPPER Y***
1540 Y1=Y
1550 FOR I=Y1-1 TO 0 STEP -1
1560 M=I+1
1570 IF P(X,I)=0 THEN N8=N8+1
1580 IF P(X,I)=0 THEN 1690
1590 IF P(X,I)=F THEN 1610
1600 NEXT I
1610 IF M=Y1 THEN N8=N8+1
1620 IF M=Y1 THEN 1690
1630 FOR Y=M TO Y1-1
1640 P(X,Y)=F
```

Program continues

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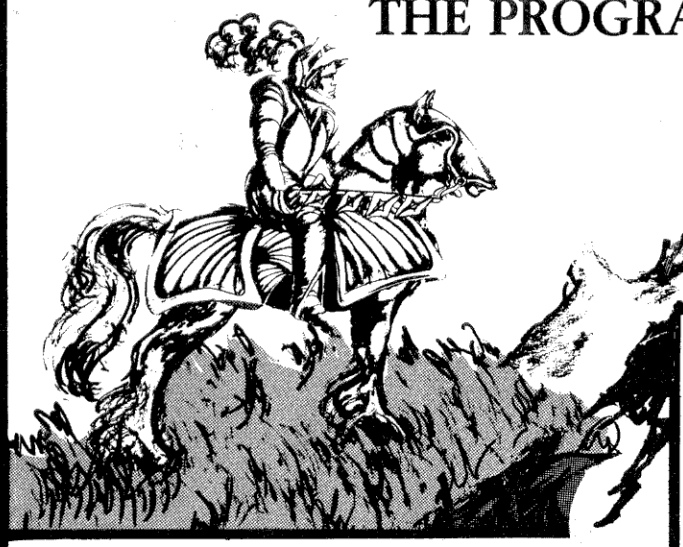

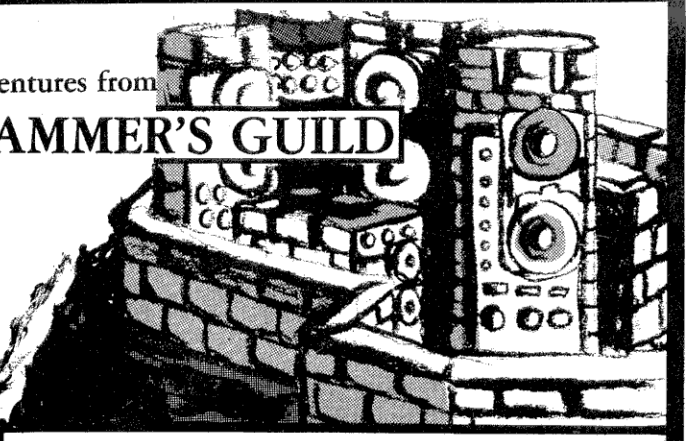

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Program continued

```
1650 A=X*21+29
1660 B=Y*17+8
1670 ON F GOSUB 2710,2800
1680 NEXT Y
1690 Y=Y1
1700 REM***AUTOSEARCH LOWER Y***
1710 Y1=Y
1720 FOR I=Y1+1 TO 11
1730 M=I-1
1740 IF P(X,I)=0 THEN N8=N8+1
1750 IF P(X,I)=0 THEN 1860
1760 IF P(X,I)=F THEN 1780
1770 NEXT I
1780 IF M=Y1 THEN N8=N8+1
1790 IF M=Y1 THEN 1860
1800 FOR Y=Y1+1 TO M
1810 P(X,Y)=F
1820 A=X*21+29
1830 B=Y*17+8
1840 ON F GOSUB 2710,2800
1850 NEXT Y
1860 Y=Y1
1870 REM**AUTOSEARCH NW DIAG***
1880 X1=X:Y1=Y
1890 FOR I=X1-1 TO 0 STEP -1
1900 M=I+1
1910 IF P(I,Y1-(X1-I))=0 THEN N8=N8+1
1920 IF P(I,Y1-(X1-I))=0 THEN 2030
1930 IF P(I,Y1-(X1-I))=F THEN 1950
1940 NEXT I
1950 IF M=X1 THEN N8=N8+1
1960 IF M=X1 THEN 2030
1970 FOR X=M TO X1-1
1980 P(X,Y-(X1-X))=F
1990 A=X*21+29
2000 B=(Y-(X1-X))*17+8
2010 ON F GOSUB 2710,2800
2020 NEXT X
2030 X=X1:Y=Y1
2040 REM**AUTOSEARCH SE DIAG***
2050 X1=X:Y1=Y
2060 FOR I=X1+1 TO 11
2070 M=I-1
2080 IF P(I,Y1+(I-X1))=0 THEN N8=N8+1
2090 IF P(I,Y1+(I-X1))=0 THEN 2200
2100 IF P(I,Y1+(I-X1))=F THEN 2120
2110 NEXT I
2120 IF M=X1 THEN N8=N8+1
2130 IF M=X1 THEN 2200
2140 FOR X=X1+1 TO M
2150 P(X,Y+(X-X1))=F
2160 A=X*21+29
2170 B=(Y+(X-X1))*17+8
2180 ON F GOSUB 2710,2800
2190 NEXT X
2200 X=X1:Y=Y1
2210 REM**AUTOSEARCH SW DIAG***
2220 X1=X:Y1=Y
2230 FOR I=X1-1 TO 0 STEP -1
2240 M=I+1
2250 IF P(I,Y1+(X1-I))=0 THEN N8=N8+1
2260 IF P(I,Y1+(X1-I))=0 THEN 2370
2270 IF P(I,Y1+(X1-I))=F THEN 2290
2280 NEXT I
2290 IF M=X1 THEN N8=N8+1
2300 IF M=X1 THEN 2370
2310 FOR X=M TO X1-1
2320 P(X,Y+(X1-X))=F
2330 A=X*21+29
2340 B=(Y+(X1-X))*17+8
2350 ON F GOSUB 2710,2800
2360 NEXT X
2370 X=X1:Y=Y1
2380 REM**AUTOSEARCH NE DIAG***
2390 X1=X:Y1=Y
2400 FOR I=X1+1 TO 11
2410 M=I-1
2420 IF P(I,Y1-(I-X1))=0 THEN N8=N8+1
2430 IF P(I,Y1-(I-X1))=0 THEN 2540
2440 IF P(I,Y1-(I-X1))=F THEN 2460
2450 NEXT I
2460 IF M=X1 THEN N8=N8+1
2470 IF M=X1 THEN 2540
2480 FOR X=X1+1 TO M
2490 P(X,Y-(X-X1))=F
2500 A=X*21+29
2510 B=(Y-(X-X1))*17+8
```

Program continues

Program continued

```
2520 ON F GOSUB 2710,2800
2530 NEXT X
2540 X=X1:Y=Y1
2550 IF N8=8 GOSUB 2890
2560 REM**SCORE DISPLAY**
2570 LINE(0,15)-(39,25),PRESET,BF
2580 N1=INT(C1/10):P$=STR$(2)
2590 IF N1=0 THEN 2610
2600 GOSUB 3220
2610 N1=C1-10*N1:P$=STR$(10)
2620 GOSUB 3220
2630 N1=INT(C2/10):P$=STR$(23)
2640 IF N1=0 THEN 2660
2650 GOSUB 3220
2660 N1=C2-10*N1:P$=STR$(31)
2670 GOSUB 3220
2680 GOTO 660
2690 REM**GRAPHICS SUBROUTINES**
2700 REM***OPEN CIRCLE***
2710 LINE(A-8,B-6)-(A+8,B+7),PRESET,BF
2720 CIRCLE(A,B),7,1
2730 SOUND 200,1
2740 C1=C1+1
2750 GOSUB 3070
2760 C2=C2-1
2770 GOSUB 3110
2780 RETURN
2790 REM***FULL CIRCLE***
2800 CIRCLE(A,B),7,1
2810 PAINT(A,B),1,1
2820 SOUND 200,1
2830 C2=C2+1
2840 GOSUB 3140
2850 C1=C1-1
2860 GOSUB 3170
2870 RETURN
2880 REM***SYMBOL DESTRUCT***
2890 FOR I =1 TO 12
2900 A=X*21+29
2910 B=Y*17+8
2920 LINE(A-8,B-6)-(A+8,B+7),PRESET,BF
2930 SOUND 240+I,1
2940 LINE(A-6+I/2,B-6+I/2)-(A+6-I/2,B+6-I/2),PSET,BF
2950 NEXT I
2960 LINE(A-8,B-6)-(A+8,B+7),PRESET,BF
2970 P(X,Y)=0
2980 ON F GOTO 2990,3010
2990 C1=C1-1:GOSUB 3170
3000 GOTO 3020
3010 C2=C2-1:GOSUB 3110
3020 ON W GOTO 3030,3040
3030 W=2:GOTO 3050
3040 W=1:GOTO 3050
3050 RETURN
3060 REM*****BAR GRAPHS*****
3070 K1=187-1.6*C1:K2=187-1.6*(C1-1)
3080 LINE(6,K1)-(15,K2),PSET,B
3090 LINE(7,K2)-(14,K2),PRESET
3100 RETURN
3110 M1=187-1.6*C2:M2=187-1.6*(C2+1)
3120 LINE(25,M2)-(34,M1),PRESET,BF
3130 RETURN
3140 M1=187-1.6*C2:M2=187-1.6*(C2-1)
3150 LINE(25,M1)-(34,M2),PSET,BF
3160 RETURN
3170 K1=187-1.6*C1:K2=187-1.6*(C1+1)
3180 LINE(6,K1)-(15,K2),PRESET,B
3190 LINE(6,K1)-(15,K1),PSET
3200 RETURN
3210 REM**VIDEO SCOREBOARD***
3220 N2=N1+1
3230 ON N2 GOSUB 3250,3260,3270,3280,3290,3300,3310,3320,3330,3340
3240 RETURN
3250 DRAW"BM"+P$+",16;B;D1;E1;R3;F1;D5;G1;L3;H1;U5":RETURN
3260 DRAW"BM"+P$+",16;B;R2;B;D1;E1;D7;L1;R2":RETURN
3270 DRAW"BM"+P$+",16;B;D1;E1;R3;F1;D1;G5;R5":RETURN
3280 DRAW"BM"+P$+",16;B;D1;E1;R3;F1;D1;G1;L2;R2;F1;D2;G1;L3;H1":RETURN

3290 DRAW"BM"+P$+",16;D4;R5;L2;U2;D5":RETURN
3300 DRAW"BM"+P$+",16;N;R5;D3;R4;F1;D2;G1;L3;H1":RETURN
3310 DRAW"BM"+P$+",16;B;D1;D3;E1;R3;F1;D2;G1;L3;H1;U5;E1;R3;F1":RETURN

3320 DRAW"BM"+P$+",16;R5;G1;D1;G1;D1;G1;D1;G1":RETURN
3330 DRAW"BM"+P$+",16;B;R1;R3;F1;D1;G1;L3;G1;D2;F1;R3;E1;U2;H1;L3;H1;U
1;E1":RETURN
3340 DRAW"BM"+P$+",16;B;D6;F1;R3;E1;U5;H1;L3;G1;D1;F1;R4":RETURN
3350 RETURN
3360 END
```


The Captain 80 Book of

BASIC ADVENTURES

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All these program listings plus an Adventure Generator not available from any other source!

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Back your way from 4K to 16K.

Color Computer Upgrade

Brian Murphy
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Want to add 16K to your Color Computer? Does the chance to do Radio Shack out of 100 bucks appeal to *your* perverse nature too?

I found out early with my Color Computer that the 4K limit was unacceptable. I needed 16K, if for no other reason, to get the high resolution graphics the system offers. Having upgraded a Model I Level II from 4K to 16K, I suspected that with the same effort I could do it to the Color Computer. I was wrong. It was easier!

Tools You Need

To upgrade the Color Computer you need three tools: a Phillips screwdriver, a small regular screwdriver (or chip puller), and needle nose pliers (or sturdy tweezers). You also need a new chip set: eight 16K by one-bit dynamic RAM memory chips—4116, 416, MM5290N or UPD416. These memory chips are all the same, just made by different manufacturers.

The best price I've seen is $16.00 for eight from Hanley Engineering. (By the way, some ads offer these kits with TRS-80 jumpers for an additional charge. Don't bother buying the jumpers. They are for the Model I and are not necessary for the Color Computer.)

Of course, you can have Radio Shack upgrade your Computer, but it will cost you $120. What's the advantage of having them do it? I don't want to mislead you. Once you open your computer, your warranty will be voided. (If you have owned a Color Computer for more than 90 days, however, it has expired in any case.)

The decision is up to you. If you have confidence in your ability, proceed.

After disconnecting any cables (cassette, video, joystick) from the computer and unplugging it, turn the computer upside down on a folded towel to protect the case from scratches. Using the Phillips, remove all the screws holding the case together.

Point A in Fig. 1 is not a screw hole, and, if you probe a screw driver deeply into it, you can damage the internal cable. Point B is a screw hole covered by the warranty warning sticker. That's how Radio Shack knows if you've been inside. Holes C and D on my

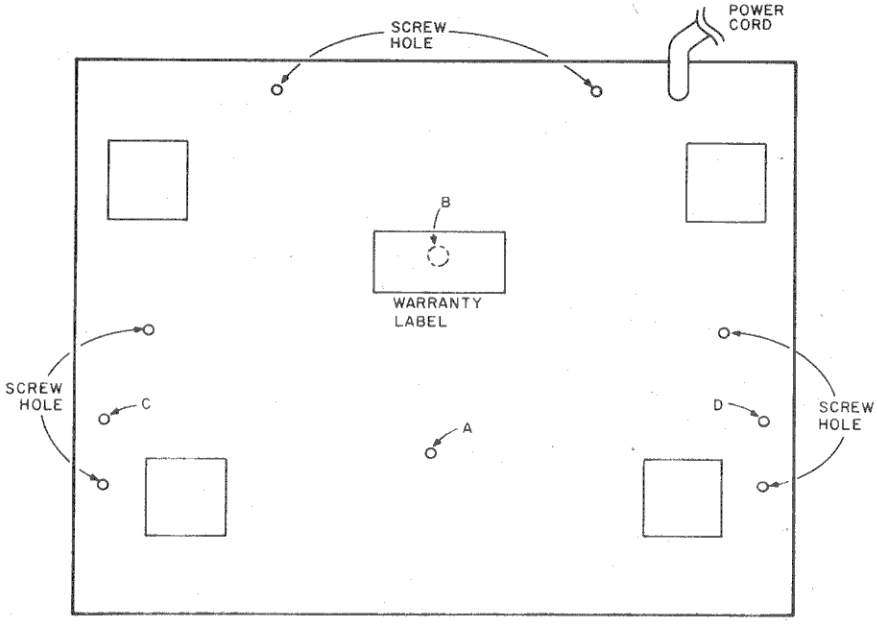

Fig. 1. Bottom View of Color Computer

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DISPLAY WORD IN CONTEXT:      ?
DISPLAY DICTIONARY:           @
ADD WORD TO DICTIONARY:       +
EXIT:                         !

WORD:        (Your error)
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```

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"If the dog begins moaning in the corner. . . don't panic!"

unit have no screws.

After the screws are out, turn the computer upright again, and lift off the top of the case. Lay the top aside, and you are faced with something that looks roughly like Fig. 2. The metal cover on the right side of the computer (keyboard toward you) is to cut down RFI (radio frequency interference) in compliance with FCC regulations. My shield had some pieces of shipping tape around the edges. If yours does also, remove the strips and put them aside.

Removing the Chips

Next, using that small screw driver, go around the top edge of the metal box, prying it up until you can lift it off. Inside the metal walls you'll find, something like Fig. 3.

First, using tweezers or needle nose pliers, remove the plastic jumpers located at points A and B in Fig. 3, and replace them in the 16K position (Fig. 4). The computer now thinks it has a 16K memory! Next, locate the eight memory chips (Fig. 3).

Before you remove the chips, notice that each has a notch on the end away from you. This orientation is important. The printed circuit board beneath the chips' sockets is marked similarly. Observe this orientation when you install your new chips.

The memory chip sockets are quite tight, so exercise caution in order not to damage anything. If you don't have a chip puller, use the small screw driver as I did. Work at one end of the chip, then the other, gently prying it up out of the socket. Take your time and go easy.

As you remove each chip, place it on the metal box lid, pins down, to protect it from possible static electricity. After all the memory chips are removed, carefully insert the new 16K memory chips. Handle them by the ends to avoid touching the pins and insert them making sure the marked end faces away from the keyboard, toward the rear of the computer. Carefully seat the chips in the sockets. When all eight are finished, you have a 16K computer.

Can't wait to see if it works, can you?

Replace the metal lid and tape strips. Make sure the keyboard is seated properly before replacing the top of the computer. You may want to test the system, as I did, before you screw the case down. If you have a game cartridge, running it will inspire confidence in your new system.

Without a cartridge, type in ?MEM. You should be rewarded with the response 14631. That's the total memory now available in Basic. (It's not 16385, because the system itself uses some space.) If your test runs smoothly, congratulations! Just screw the computer back together and go on to the next article.

If, however, when you turn on the power, the dog begins moaning in the corner and your children are cowering wth their hands over their ears, don't panic! Either one or more of the new 4116 chips is defective, in which case you send them back and request new ones, or one or more of the chips is not properly in its socket. To check out the latter possibility remove the metal lid and make sure the 4116s are properly oriented and firmly seated. (If you fouled up the placement, you probably destroyed the chip. Too bad—be more careful next time.)

The other possibility is a bent pin under one of the 4116s. Before you remove the chips visually check them. If the inspection does not turn up the culprit, remove each chip carefully and check for bent pins. If all the chips have straight pins, then the problem is with the chips themselves.

Place the original 4K memory chips back in the sockets, observing the proper orientation; move those two jumpers back to the

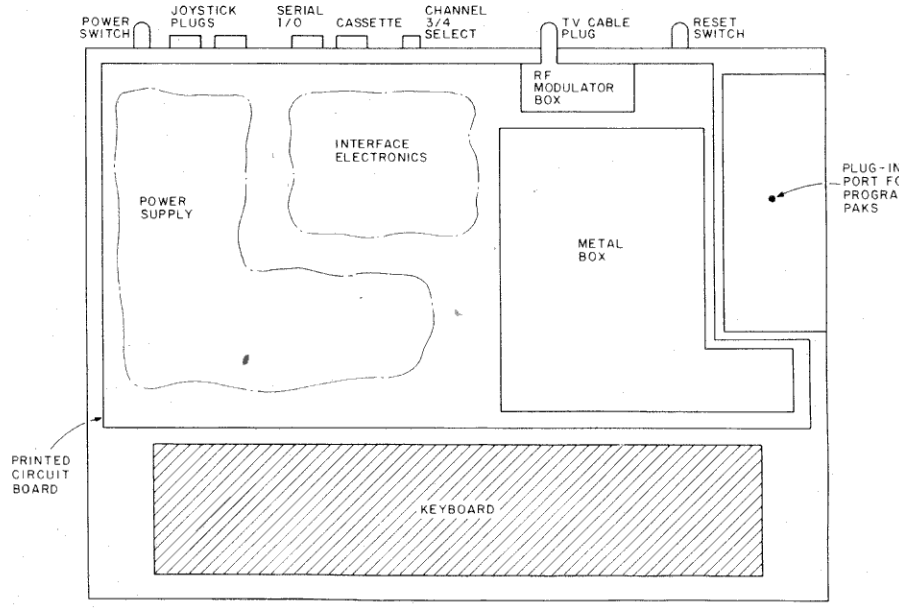

Fig. 2. Inside the Color Computer

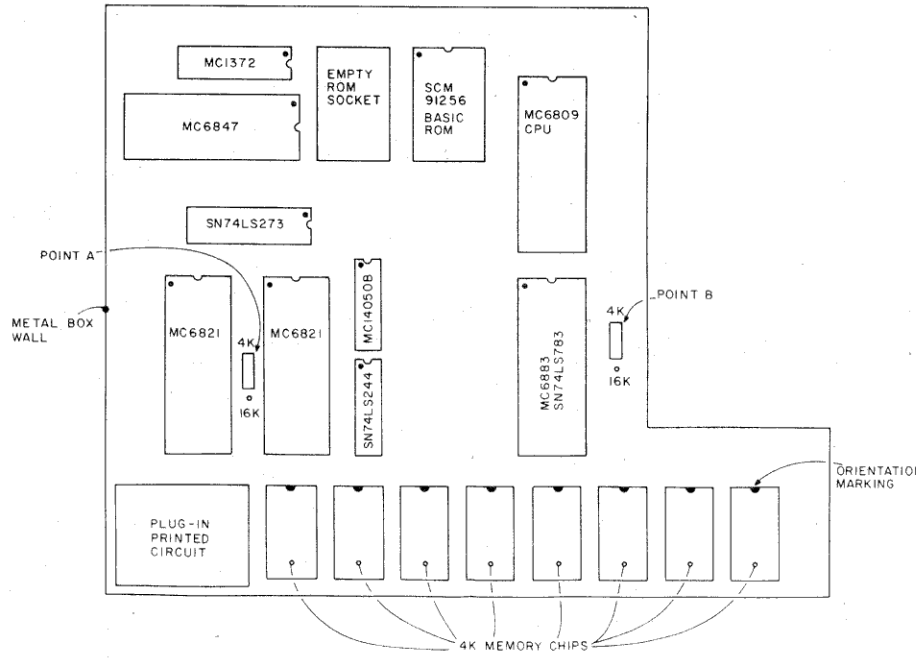

Fig. 3. Color Computer Exposed

"Common sense dictates that you don't shuffle across a rug. . . or rub a cat. . ."

4K position and close up the computer. Package the 4116s and return them with a request for replacement.

Handling Memory Chips

Memory chips are manufactured using metal oxide semiconductor (MOS) technology. While most new chips are protected against damage by static discharge, it is still wise to exercise caution when handling such devices. Common sense dictates that you don't shuffle across a rug in the dead of winter before handling MOS devices, or rub a cat on your lap while doing the project.

I like to place the chips on a conducting surface (the metal box lid) while working, and to touch the lid before taking the chip from it. It doesn't hurt to handle the chips from the end to avoid contact with the pins.

One last suggestion: You may find the two rows of pins on the chip are too widely spaced to fit into the sockets. I suggest using needle nose pliers to grasp the whole row (eight pins) at once, and gently twist them toward the center of the chip to form a 90 degree angle. Do this to both rows of pins. ■

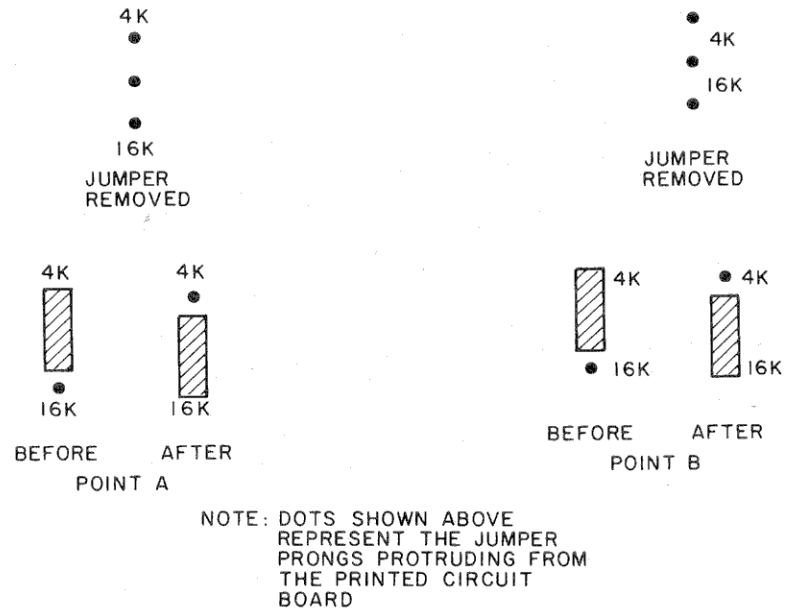

Fig. 4. 4K/16K Jumper Orientation Before and After Repositioning

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Subchaser!

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The TRS-80 Color Computer uses one of the most powerful microprocessors available, and its Extended Color Basic is excellent for graphics displays. I will explain, using Subchase (an animated sub hunt game) some of the techniques in animating a graphics display.

The Key Box

Extended Color Basic
Color Computer

Color Animation

Table 1 lists the order of setting up the graphics display screen for animation. First, select the correct mode and reserve pages of graphics memory. Most displays require four pages of memory, so start with a PCLEAR 4 command. Five graphics modes are available to the Color Computer. PMODEs 0–4 are the graphics-only modes; Table 2 lists their respective resolutions. PMODE determines the number of available colors so consider the colors you desire, as well as resolution.

PMODE 3 gives the most resolution, and allows a choice of two groups of four colors; I usually program games in this mode. You select the groups of colors with the Screen command. SCREEN 1,X sets the graphics screen, and argument X determines the color set. For example, PMODE 3,1: SCREEN 1,0 allows the colors green, yellow, blue and red; while SCREEN 1,1 has the colors buff, cyan, magenta, and orange available. The initial program listing might look like Table 3. I have set the screen to graphics mode 3, with medium resolution and colors green, blue, yellow and red available.

The color statement determines foreground and background colors. If no Color statement is used, the computer uses the highest and lowest numbers available for foreground and background colors. See Table 4 for the color numbers of the available colors.

Once you choose the colors, a PCLS command clears the screen to the background color. Begin by putting the background display on the screen. In the submarine game the background was simple: a deep blue ocean and a yellow sky. A convenient technique for drawing displays is to use a very high line number for an INKEY$ loop:

```
1000 A$ = INKEY$: IF A$ = "" THEN 1000
1010 LIST
```

After drawing the display, the computer waits at line 1000 until you press any key; it then lists the program for you to add more lines. In the submarine program, after I painted the sky, I drew the ship and subs. After you place the items to be animated on the screen, you can store them in an array to be moved later.

There are two options for putting objects on the screen. You can place them at the point where you will first see them in the program. This is simplest, but sometimes the program dictates that the object not be immediately visible. To preserve its hidden location, draw a title screen showing the objects at some usual point in the game,

1. Clear correct number of pages
2. Set correct graphics mode
3. Set screen color set
4. Choose foreground and background colors from color set chosen
5. Draw background and inanimate objects
6. Draw animated objects on screen
7. Store animated objects in arrays
8. If needed, get background array
9. Initialize display

Table 1

PMODE #	Grid Size	Color Set
0	128 by 96	two color
1	128 by 96	four color
2	128 by 192	two color
3	128 by 192	four color
4	256 by 192	two color

Table 2

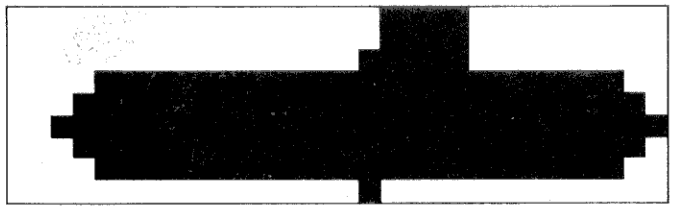

Fig. 1.

and store the arrays during the display. I used this technique in the Subchase program. The title screen also adds a professional look to the program; I use it even when there is no particular need to hide the first screen locations of the objects.

There is another way to hide object placement, using the SCREEN command. By calling the text screen and then drawing objects, the computer displays an appropriate message while drawing and storing the objects. A PCLS clears the hidden objects, the opening segments are drawn, and the game can begin. If you plan to use higher speed animation techniques, you may also store the appropriate background arrays at this point in the program.

```
10 PCLEAR 4: PMODE 3,1
20 SCREEN 1,0
30 COLOR 2,3
```

Table 3

The Color Computer's Get command automatically stores an array containing the color information of the screen location specified. The array is double dimensioned, and contains the colors of each horizontal and vertical coordinate specified. Fig. 1 illustrates the submarine used in the program, it was constructed on the screen with the Circle command. The height, width option made the circle into an ellipse. I used the Draw command to put in the tower. You can place this array anywhere on the screen to be stored by the Get command. For example, if we locate the circle at location 100,100, the center of the circle is at those coordinates. To determine the size of the array use the Line command. Pick the approximate coordinates of the upper left corner and lower right corner. Use the Line command with the B option to put a box around the display. Change the size of the box until it exactly corresponds to the array to be stored (see Fig. 1.) Use these line coordinates to store the array.

Once you have determined the size of the object to be stored, dimension the array to the proper size. The Line statement in the example above would read: LINE(88,95) – (112,104),PSET,B. To calculate the array size subtract the lower horizontal and vertical elements from the higher. In this case that would be 112 minus 88 equals 24 and 104 minus 95 equals 9. Next dimension the array and give it a variable name. In the submarine program I used S1. DIM S1(24,8) works, but for maximum memory economy, I used DIM S1 (23,7): The Color Computer uses a zero element in its arrays.

Color Numbers

0 Black	5 Buff
1 Green	6 Cyan
2 Yellow	7 Magenta
3 Blue	8 Orange
4 Red	

Table 4

Dimension each animated program variable. Each element uses five bytes, so the number of arrays stored is limited by the memory available. Unless you have the 32K option, array storage is limited to about 1400 points.

You can easily edit the Line command into the Get command. GET(88,95) – (112,104),S1 stores array S1 into its location. You can also add Graphics option G to the end of the statement. If you use this option, suffix the Put command with the appropriate graphics statement.

After you have stored all objects to be animated, you can animate your title display, or clear the screen to execute the main program. I elected to animate the title display. After the title, I restore the text screen to display a request for instructions and obtain a difficulty level choice. The Color Computer cannot store graphics and text on the same screen; any print or input command restores the text screen, so use CLS to clear the text screen before displaying text. Initialize any variables for animation at this time. I use H and V corresponding to horizontal and vertical with the graphics screen. I used H and V for the ship H1 and V1 for the sub moving right and H2 and V2 for the sub moving left. You can update these variables by the keyboard, joysticks, or the computer depending upon what you want to do with the objects. In Subchase, you move the ship using the right joystick, and automatic random loops in the computer move the two subs.

In moving the ship, V remains at 46 unless the depth charge is dropped. V returns to 46 when the drop charge routine finishes. H is initially set to 0, incremented when you move the joystick right, and decremented when you move the joystick left. A limiter keeps the computer from making H less than 0 or more than 213. An increase of H to larger than 213 results in a rather spectacular graphics crash on the right side of the screen; a value less than 0 results in a function call error. I placed the same limiters upon the subs.

The Put command puts an object on the screen. Initialize H to 0 and V to 100. PUT(H,V) – (H + 24,V + 9),S1 places the array at location 0,100. When we make H equal 25 there will be two subs on the screen. If we continue, the screen fills with submarines in a hurry, but there's an easy way to remove the original sub.

Look at Fig. 1 again. At the rear of the sub, the array containing the background color stores two rows of information. If we limit H to increases of two or less and do not require it to go backward, the background

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"tail" removes the old image of the sub as it moves. The ship requires foreward and rearward movement; therefore, there are rows of background color at both ends of the ship. This technique requires no extra steps, and provides maximum use of the available screen. The array redraws the background automatically.

This technique is relatively slow. The Subchase program does not need high speed animation, so the technique works well. Space games and other high speed games would look silly using this method, so we need a high speed animation technique. One way is to use the graphics options available. Logical operators place the device on the new screen location. The AND suffix sets the point in the array, if the array point and the point in the destination location were set. A logical OR sets a given array point when either the array point or the new location point is set. NOT reverses the point state at the location; PSET and PRESET set the location to which the array is PUT, to the exact contents of the stored array (PSET), or to the exact opposite of the array's contents (PRESET). The PSET option in the sub program sets the destination rectangle to the colors originally set in the origination (Get) rectangle.

Another high speed technique is to store a background array. You can take this array from anywhere containing the appropriate background colors. A background array put at the old location completely removes the object previously put there. It is a simple matter to place the object at the new position. This position may even overlap the background rectangle. By alternating object and background, high speed motion is easily attainable. In many cases, you may have to slow down this action by external loops. This is desirable in programming a variable speed loop. Sometimes the person using the computer needs time to act upon the new display information.

One of the simplest techniques to slow motion is with a joystick. A joystick reading of 63, could send the computer to a subroutine such as 1000 A = JOYSTK(0): IF A = 63 THEN 1000 ELSE RETURN. This subroutine stops all action on the screen as long as the joystick is held to its extreme end. Moving the stick slightly achieves the return, whereupon the computer could go to a loop such as 90 FOR I = 1 TO A: NEXT I. This loop takes the joystick reading and stops execution until it quits counting the joystick value. When finished, the computer updates the values and puts the display at the new location. It then reenters the JOYSTK loop to update the value of A. A smaller joystick reading means a shorter loop time. By multiplying or dividing (watch for a divide by zero error), you can achieve almost any speed delay.

Another technique is to update the H or V coordinates or both in relation to the joystick. This does not slow program execution as the other method does.

```
100 A=JOYSTK(0)+1 REM ADDING
    ONE ELIMINATES DIVIDE BY 0
    ERROR
110 H=H+INT(A/8) REM WILL UP-
    DATE H BY UP TO 8 UNITS FROM
    PREVIOUS
```

This technique works well when more than one person is involved and two joysticks are in use.

Subchase

Subchase is an adaptation of the familiar program. A ship tries to drop depth charges on unwary submarines below the surface of the water. I have updated it to modern times: the submarines have special underwater lasers that fire upon the ship. The object of the game is to sink submarines while sustaining as little damage as possible. The submarine's aim is not perfect, but they will inflict considerable damage on your ship before the game is over.

You lose the game when both submarines reach the opposite sides of the screen. You cannot drop a charge from the extreme left of the screen. This gives the sub a safe port and avoids a function call error, when the sunk sub is being cleaned up.

There are four difficulty levels; the hardest is almost impossible, so there is plenty of challenge (one is the most difficult,

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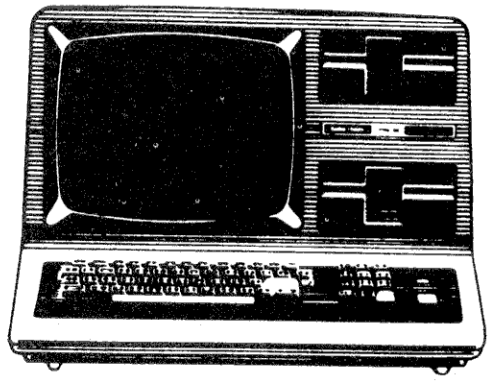

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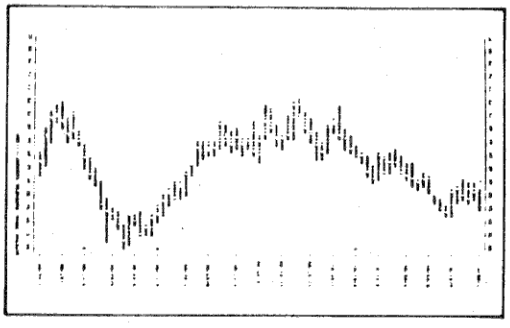

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Program Listing

```
5 REM INITIALIZE
10 CLEAR5:PCLEAR4:PMODE3,1:CLS3:SCREEN1,0:COLOR2,3:PCLS
20 DIM S(41,12),S1(28,7),S2(28,7):D=0
25 REM DRAW SHIP
30 DRAW"C2;BM0,56R255;":PAINT(0,55),2,2
40 CIRCLE(22,54),19,4,.25,0,.5
50 DRAW"C4BM4,54;R32":PAINT(15,55),4,4
60 DRAW"BM4,54;E4R12U2R2D2R4U3R3D3R3F4":PAINT(8,53),1,4
70 GET(0,46)-(42,59),S,G
75 REM DRAW SUB 1
80 CIRCLE(80,150),12,1,.25:PAINT(82,150),1,1
90 DRAW"C1BM82,148;U3R2D3"
100 GET(64,145)-(92,153),S1,G
105 REM DRAW SUB 2
110 CIRCLE(175,130),12,1,.25:PAINT(175,130),1,1
120 DRAW"BM171,128;U3R2D3"
130 GET(161,125)-(189,133),S2,G
135 REM SOUND EFFECTS
140 H$="O1;FEFEFGGGEG
150 L$="T255O4;AF
155 REM DRAW TITLE
160 DRAW"S15C2;BM40,160;BD1DF1R3F1D2G1L3H1BU5E1R3F1;S8;BD6BM+6,-2;D5F2
R1E2U5D7
170 DRAW"BM+6,-12;D12U2F2R2E2U3H2L2G2;BD5BM+12,0;BU1F1R4E1BL7U4E2R4F1;
BM+6,-6;D12BR6U5H2L2G2BD1
180 DRAW"BM+12,0;D3F1R2E2D2U7D2H2L1G2D1;BM+10,+2;BD1F1R1E1U1H3U1E1R1F1
;BM+6,+2;R7H3L2G3D2F2R3E2
185 REM LASER DISPLAY ROUTINE
190 FORI=1TO10:LINE(168,126)-(25+I,70),PSET
200 LINE(168,126)-(25+I,70),PRESET:PLAYL$:NEXT
205 REM MOVE SHIP DISPLAY
210 FORH=0TO165STEP2:PUT(H,46)-(H+42,59),S,PSET:NEXT
220 H1=161:V1=125:GOSUB470
230 CLS(3):PRINT@13,"SUBCHASE";:PRINT@224,"DO YOU WANT INSTRUCTIONS?";

240 A$=INKEY$:IFA$=""THEN240
250 IFA$="N"THEN320
260 CLS:PRINT"THE OBJECT OF THIS GAME IS TO":PRINT"DESTROY AS MANY SUB
MARINES AS"
270 PRINT"YOU CAN BEFORE THEY DESTROY YOU.":PRINT"TO MOVE, USE THE RIG
HT JOYSTICK
280 PRINT"TO DROP DEPTHCHARGE, PRESS THE":PRINT"FIRE BUTTON."
290 PRINT:PRINT"YOU MUST HIT THE SUB BEFORE IT":PRINT"REACHES THE OPPO
SITE SIDE.
300 PRINT:PRINT"THE SUBS WILL BE USING LASERS
310 PRINT"TO FIRE UPON YOU.
320 PRINT@448,"CHOOSE DIFFICULTY LEVEL (1 TO 4)";:A$=INKEY$:IFA$<"1"OR
A$>"4"THEN320
325 REM X= DIFFICULTY LEVEL: D FLAGS DISPLAY ROUTINE FINISHED
330 X=VAL(A$):D=1
335 REM SET UP DISPLAY SCREEN AND ORIGINAL POSITIONS OF BOATS
340 PMODE3,1:SCREEN1,0:COLOR2,3:PCLS:DRAW"C2;BM0,56R255;":PAINT(0,55),
2,2:H=0:V=46:H1=RND(10)+10:H2=RND(10)+215:V2=RND(50)+100:V1=RND(50)+10
0
345 REM PUT SHIP AT NEW POSITION
350 PUT(H,V)-(H+42,V+13),S,PSET
355 REM READ AND UPDATE SHIP POSITION
360 A=JOYSTK(0)
370 IFA<25THENH=H-1:IFH<0THENH=0
380 IFA<3THENH=H-1:IFH<0THENH=0
390 IFA>50THENH=H+1:IFH>210THENH=210
400 IFA>60THENH=H+1:IFH>210THENH=210
410 IFH1=227ANDH2=0THEN720'YOU LOSE
420 IF RND(5)>X THEN GOSUB660
430 IF RND(5)>X THENGOSUB600
435 REM SHIP CANNOT DROP CHARGE AT SCREEN LEFT
440 IFH<28THEN460
445 REM CHECKS FIRE BUTTON CLOSURE
450 P=PEEK(65280):IFP=254 OR P=126THENGOSUB470
455 REM RESTORE V TO SHIP LOCATION
460 V=46:GOTO350
465 REM DROP DEPTH CHARGE
470 FORV=58TO170:IFPPOINT(H,V+4)<>3THENSC=SC+1:GOTO520
475 REM ALLOWS SUB MOVE DURING CHARGE DROP
480 IFRND(5)>X AND D>0THEN GOSUB600
490 IFRND(5)>X AND D>0THEN GOSUB660
495 REM CHARGE DROPPING
500 LINE(H,V)-(H,V+3),PSET:LINE(H+1,V)-(H+1,V+3),PSET
510 LINE(H,V-1)-(H,V),PRESET:LINE(H+1,V-1)-(H+1,V),PRESET:NEXT
515 REM CHARGE EXPLODES
520 PLAYH$
525 REM CHARGE HIT BOTTOM
530 IF V>165 THEN 590
535 REM DESTROY SUB
540 FORI=1TO50:PSET(RND(5)+H,RND(8)+V,4):NEXT
545 REM CLEAN UP REMAINS
550 FORI=-25TO28:FORJ=-1TO12:PRESET(H+I,V+J):NEXTJ,I
555 REM CHECKS TO SEE IF SUB 2 WAS DESTROYED, IF SO SETS NEW SUB 2 POS
ITION
560 IFPPOINT(H2+5,V2+5)=3THEN H2=RND(10)+215:V2=RND(50)+100
565 REM SETS NEW SUB 1 POSITION
570 IFPPOINT(H2+5,V2+5)=1THENH1=RND(10)+10:V1=RND(50)+100
580 RETURN
585 REM REMOVES CHARGE FROM SCREEN AFTER HITTING BOTTOM
590 FORI=0TO3:FORJ=0TO3:PRESET(H+I,V+J):NEXTJ,I:RETURN
595 REM MOVES SUB 1 TO NEW POSITION
600 H1=H1+1:IFH1>227THENH1=227
610 PUT(H1,V1)-(H1+28,V1+8),S1,PSET
615 REM SUB 1 LASER ROUTINE PPOINT CHECKS FOR LASER HIT
620 S=RND(20):IF RND(5)=3 THEN GOSUB640:IF PPOINT(H+S,57)=4 THEN HT=HT
+1
630 RETURN
635 REM FIRES LASER-WON'T FIRE IF SHIP TOO FAR LEFT
640 IFH<10THENRETURN
650 LINE(H1+13,V1-2)-(H+(S-2),57),PSET:PLAYL$:LINE(H1+13,V1-2)-(H+(S-2
),57),PRESET:RETURN
655 REM POSITION SUB 2
660 H2=H2-1:IFH2<0THENH2=0
670 PUT(H2,V2)-(H2+28,V2+8),S2,PSET
675 REM SUB 2 LASER ROUTINE
680 S=RND(20):IF RND(5)=3 THEN GOSUB 700:IFPPOINT(H+S,57)=4 THEN HT=HT
+1
690 RETURN
```

Program continues

Program continued

```
695 REM FIRE SUB 2 LASER
700 IFH<10THENRETURN
710 LINE(H2+13,V2-2)-(H+(S-2),57),PSET:PLAYL$:LINE(H2+13,V2-2)-(H+(S-2
),57),PRESET:RETURN
715 REM END ROUTINE
720 CLS3:PRINT@64,"YOU HAVE DESTROYED ";SC;"SUBS!
730 IFSC<10THENPRINT"WHOSE NAVY ARE YOU WITH?":GOTO750
740 PRINT"I CONGRATULATE YOU ON YOUR COOL":PRINT"UNDER FIRE!"
750 PRINT"THE SUBS HIT YOU ";HT;" TIMES.
760 PRINT"PRESS FIRE BUTTON TO PLAY AGAIN!
770 FORI=1TO500:P=PEEK(65280):IFP=126 OR P=254THENSC=0:HT=0:GOTO340
775 REM RESTORE COMPUTER TO POWER UP STATE
780 NEXT:CLEAR200:PMODE0,1:PCLEAR4
```

four is the easiest). Your ship cannot move while the depth charge is being dropped, however the subs will move. Be sure to drop the charge in front of the sub you are aiming at.

The Program Listing is well remarked, and requires little explanation. Due to the size of the arrays stored, delete all remarks before running the program. The remarks are in line numbers ending in five. After listing the program there will be nearly 5K of memory available. However, after running the program and storing the graphics arrays, you will find only about 500 bytes of memory left. The graphics arrays for the two subs and the ship use over 4K of memory.

To play again push the fire button. At the end of each game I restore all conditions (Pclear, string memory, and so on) to power-up conditions. This ensures all programs initialize to the same level. In the Color Computer, graphics storage and text storage can conflict, causing loading or running problems.

I reserved only 5 bytes for string storage; if you do not modify the program you cannot load an eight character program name. ■

John Steiner, an electronics instructor, has had his Color Computer since February 1980. Other pastimes include amateur radio, writing and photography.

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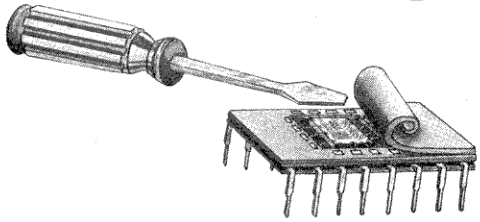

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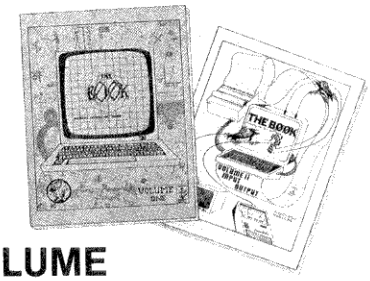

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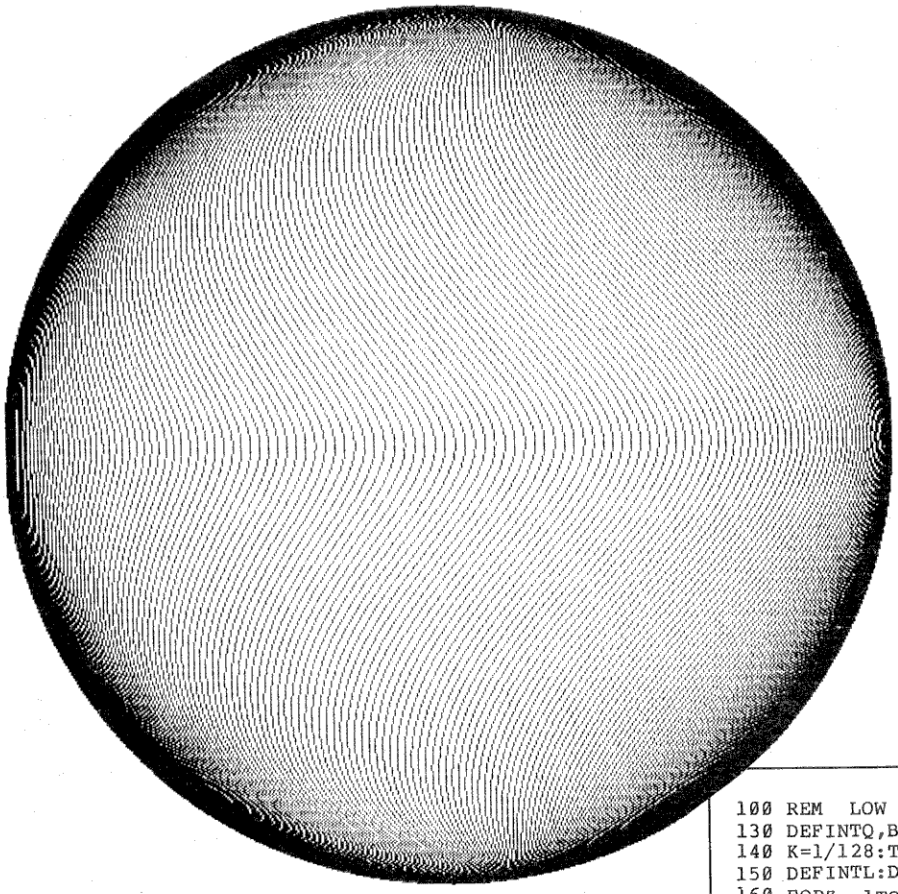

Fig. 1. Sphere.

Bob Boothe
4651 Browndeer Lane
Rolling Hills Estates, CA 90274

Ever since I started plotting surfaces (about as long as I have had a computer) I have wanted to plot a sphere. Because I finally created a decent one, now you can plot a sphere on your very own video. Unfortunately, video does not have the resolution of the designs in this article, all produced on an Epson MX-80 printer with the Graftrax 80 graphics ROM update.

The program in Listing 1 plots a sphere on the video. Because the monitor distorts shapes, it may look a bit more like an ellipsoid.

How the Program Works

The program uses three-dimensional Carte-

Bob Boothe, a freshman at the University of California at San Diego, is 19 years old and majors in Computer Engineering.

```
100 REM  LOW RESOLUTION SPHERE   *** VIDEO ***
130 DEFINTQ,B
140 K=1/128:T=1/8192:X=1:Y=1:Z=1:Q=1:S=1:A=1:MY=1
150 DEFINTL:DIML(127):CLS
160 FORZ=-1TO1STEP1/23
180 B=B+1
190 MY=SQR(1-Z*Z)-T
200 Y=-MY
210 X=SQR(1-Y*Y-Z*Z)+T
220 A=SQR((1+Y*Y/X/X)*(1+Z*Z/X/X))
230 S=1/A/10
240 IFS<KTHENS=K
250 Y=Y+S
260 IFY>MYTHENL(64+MY*63)=1:GOTO290
270 L(64+Y*63)=1
280 GOTO210
290 FORQ=0TO127:IFL(Q)=1THENSET(Q,B)
300 L(Q)=0:NEXT
310 NEXTZ
320 GOTO320
```

Program Listing 1. Low Resolution Sphere.

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Wayne Hepburn

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"For a visual demonstration, take a piece of paper, ruler or any parallelogram."

sian coordinates. The Z-axis runs vertically down the screen. The Y-axis runs horizontally, and the X-axis, projecting out of the screen, connects with the tip of your nose.

Line 160 controls the number of horizontal lines the design will use. Z starts at one end of the design and moves up or down, depending on the step. The total number of lines in the design equals the total change in Z divided by the step. In this case Z goes from minus 1 to 1, a distance of 2. The step is 1/23, so 2 times 23 equals 46 lines.

The equation of a sphere is $X^2 + Y^2 + Z^2 = 1$. Line 190 finds the maximum value of Y. To change this line, let X equal 0 and solve the equation for Y. This produces a trace in the Y-Z plane. T stands for tiny; a very small number is subtracted to keep the computer from getting a divide-by-zero error.

Line 210 is our equation solved for X in terms of Y and Z, with a tiny bit added to appease the TRS-80.

```
100 REM  HIGH RESOLUTION SPHERE
110 CLEAR2000
120 OPEN "O",1,"SPHERE/DAT:1"
130 DEFINTQ,B
140 K=1/480:T=1/8192:X=1:Y=1:Z=1:Q=1:S=1:A=1:MY=1:B=0
150 DEFINTL:DIML(7,480)
160 FORZ=-1TO1STEP1/288
170 PRINT"Z=";Z,
180 B=B+1
190 MY=SQR(1+Z*Z)-T
200 Y=-MY
210 X=SQR(1-Y*Y+Z*Z)+T
220 A=SQR((1+Y*Y/X/X)*(1+Z*Z/X/X))
230 S=1/A/44
240 IFS<KTHENS=K
250 Y=Y+S
260 IFY>MYTHENL(B,240+MY*240)=1:GOTO290
270 L(B,240+Y*240)=1
280 GOTO210
290 IFB=7THENGOSUB340
300 NEXTZ
310 IFB>0THENGOSUB340
320 CLOSE1
330 END
340 FORQ=1TO480
350 PRINT#1,CHR$(35+L(1,Q)*64+L(2,Q)*32+L(3,Q)*16+L(4,Q)*8+L(5,Q
)*4+L(6,Q)*2+L(7,Q));
360 FORB=1TO7:L(B,Q)=0:NEXT
370 NEXT:B=0
380 RETURN
```

Program Listing 2. High Resolution Sphere.

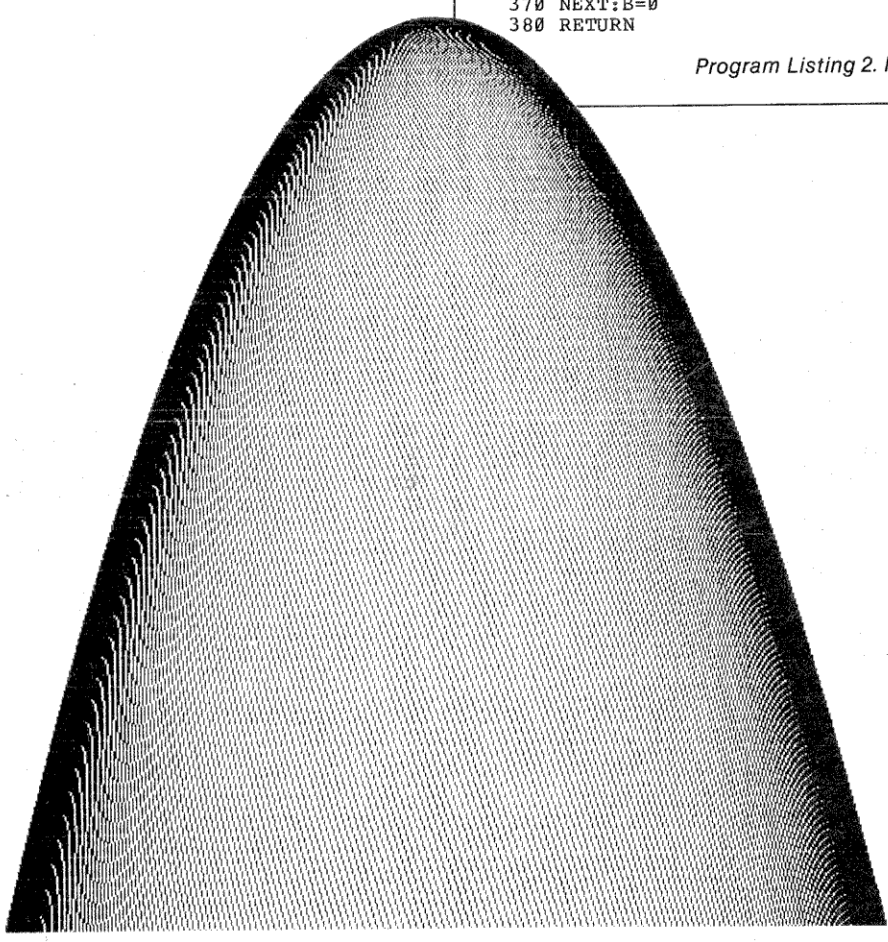

Fig. 2. Paraboloid.

Line 220 computes the relative area of a tiny square of viewing surface. Look at the big sphere on your video or in Fig. 1. At the very center of this design, a plane tangent to the sphere is parallel with the page. Pretend that we draw a square on this plane. Take another plane, tangent to the sphere at some point other than the center. The plane is no longer parallel with the page. Again, pretend to draw a square on the imaginary plane. This time it is not actually a square, but a rectangle or a parallelogram whose projection onto the page is a square.

For a visual demonstration, take a piece of paper, ruler or any thin parallelogram. No matter what its dimensions are, if you look at it from a certain angle it approximates a square. Closing one eye helps.

If you rotate this plane so that it is parallel to the page, you can see the true rectangular shape drawn on it and calculate its area using the standard formula: base times height.

I use calculus to find the base and the height. Without deriving this formula, I will give you an equation into which you can plug two partial derivatives:

$$\text{Area} = \sqrt{\left[1 + \left(\frac{\partial X}{\partial Y}\right)^2\right] \cdot \left[1 + \left(\frac{\partial X}{\partial Z}\right)^2\right]}$$

Reader Service for facing page ✓20→

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"Of other common three dimensional shapes, my favorite is the paraboloid."

This equation is used directly in line 220. In the case of the sphere, the partial derivative of X with respect to Y (holding Z constant) is Y/X. The partial derivative of X with respect to Z (holding Y constant) is Z/X. These derivatives are both plugged into the equation and it's all set.

```
10 REM LOADER FOR SPHERE DATA
15 CLEAR2000
20 OPEN "I",1,"SPHERE/DAT:1"
30 LPRINTCHR$(27);CHR$(65);CHR$(7)
40 E=255:FORQ=1TO83
50 LPRINTCHR$(27);CHR$(75);CHR$(224);CHR$(1);
60 FORW=1TO480
70 IFE=255THENLINEINPUT#1,S$:E=0
80 E=E+1:A=ASC(MID$(S$,E,1))-35
90 IFPEEK(14312)<>63THEN90
100 POKE14312,A
110 NEXT:LPRINT:NEXT
120 CLOSE 1
```

Program Listing 3. Loader for Sphere Data.

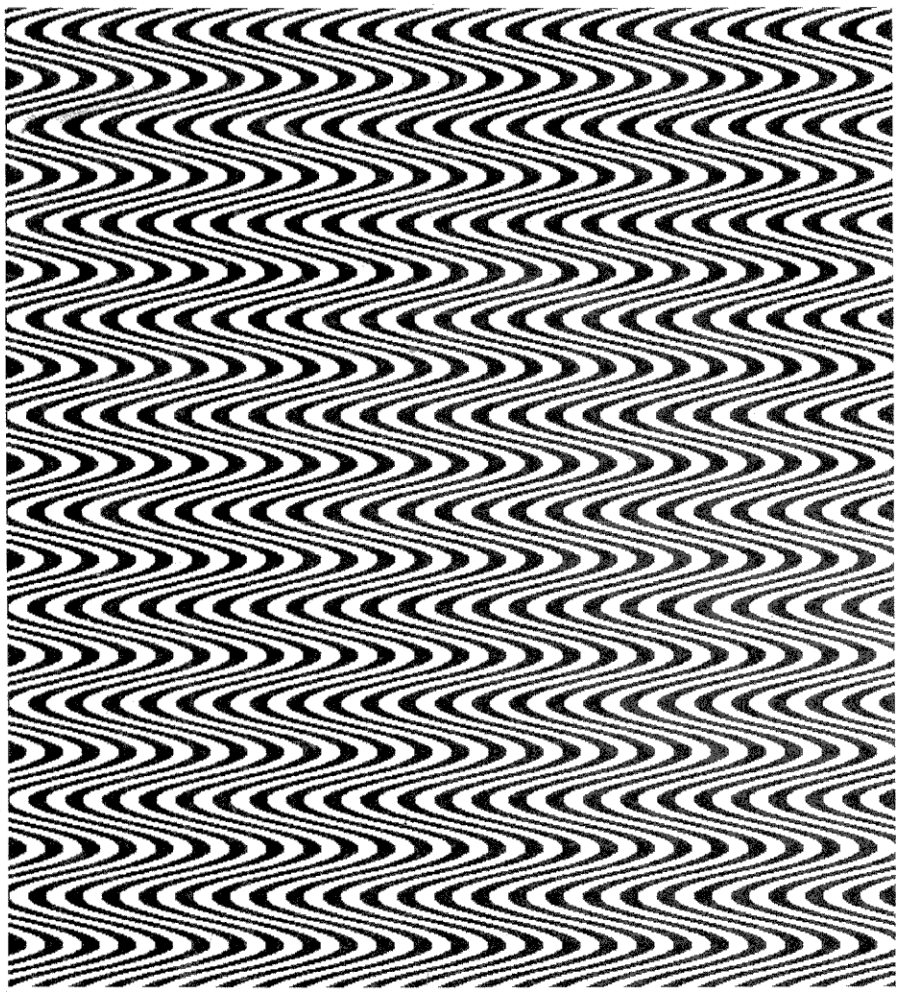


Fig. 3. The Eye Killer.

Line 230 computes a value to step across the Y-axis to plot the next point. The step is inversely proportional to the area.

Line 240 compares the step to a minimum value K, which is equal to half a graphics block. If the step is too small, it defaults to the value of K. The relative surface area at the perimeter of the design is theoretically infinite; without K the program would start like a snail climbing Mount Everest.

The rest of the program adds the point to an array, tests for the end of a line and then prints a line when it is finished. When the entire design is drawn on the screen, the program enters an endless loop instead of printing an ugly Ready over the design.

Other Shapes

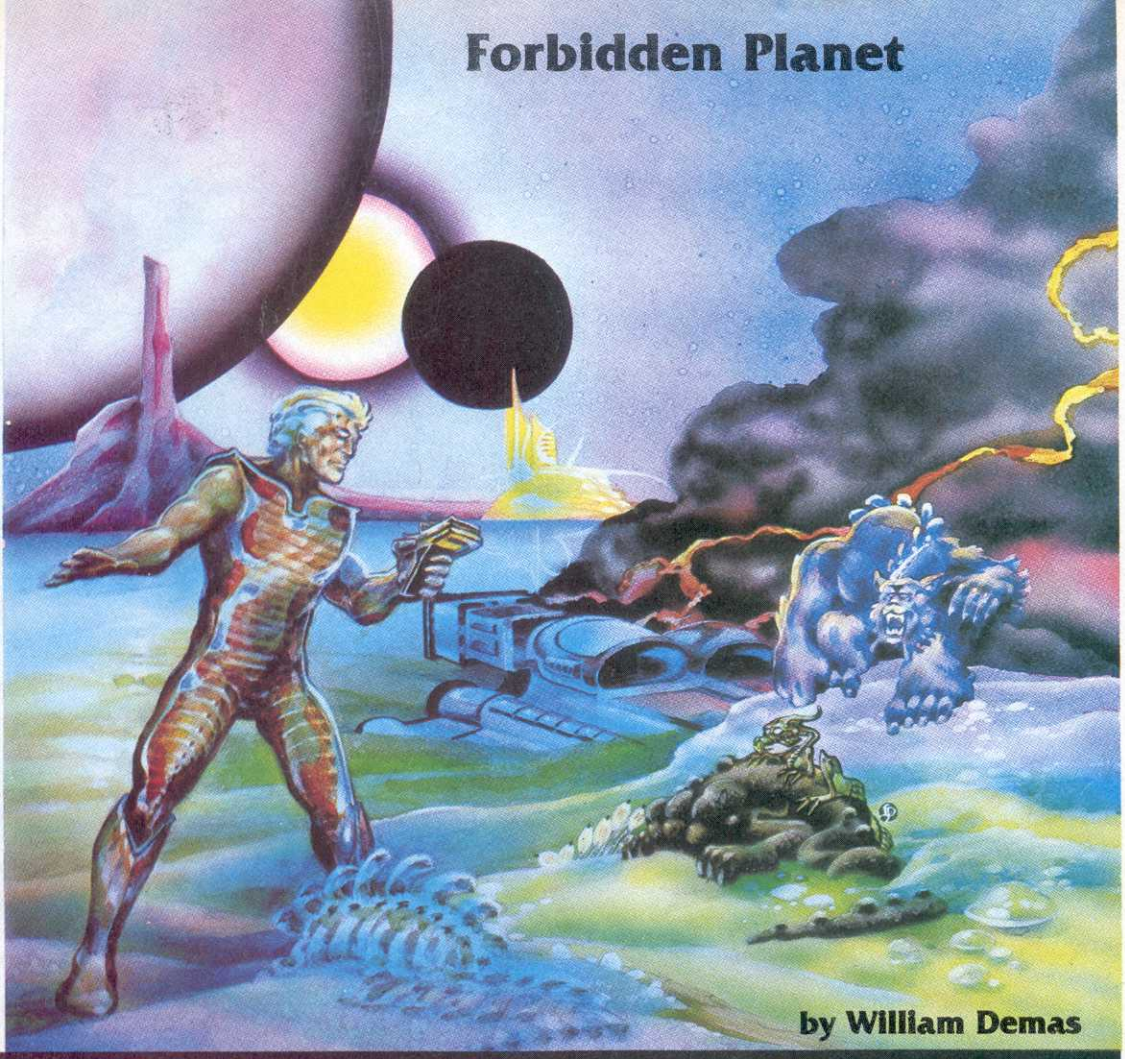
Of other common three dimensional shapes, my favorite is the paraboloid (Fig. 2.) The equation of the paraboloid is: $Z = X^2 + Y^2$. A hyperboloid of one sheet is given by: $X^2 + Y^2 - Z^2 = 1$. A hyperboloid of two sheets is: $X^2 - Y^2 - Z^2 = 1$. A quadratic cone is: $X^2 + Y^2 = Z^2$. If you know any other interesting equations (such as a torus) I would be glad to see them.

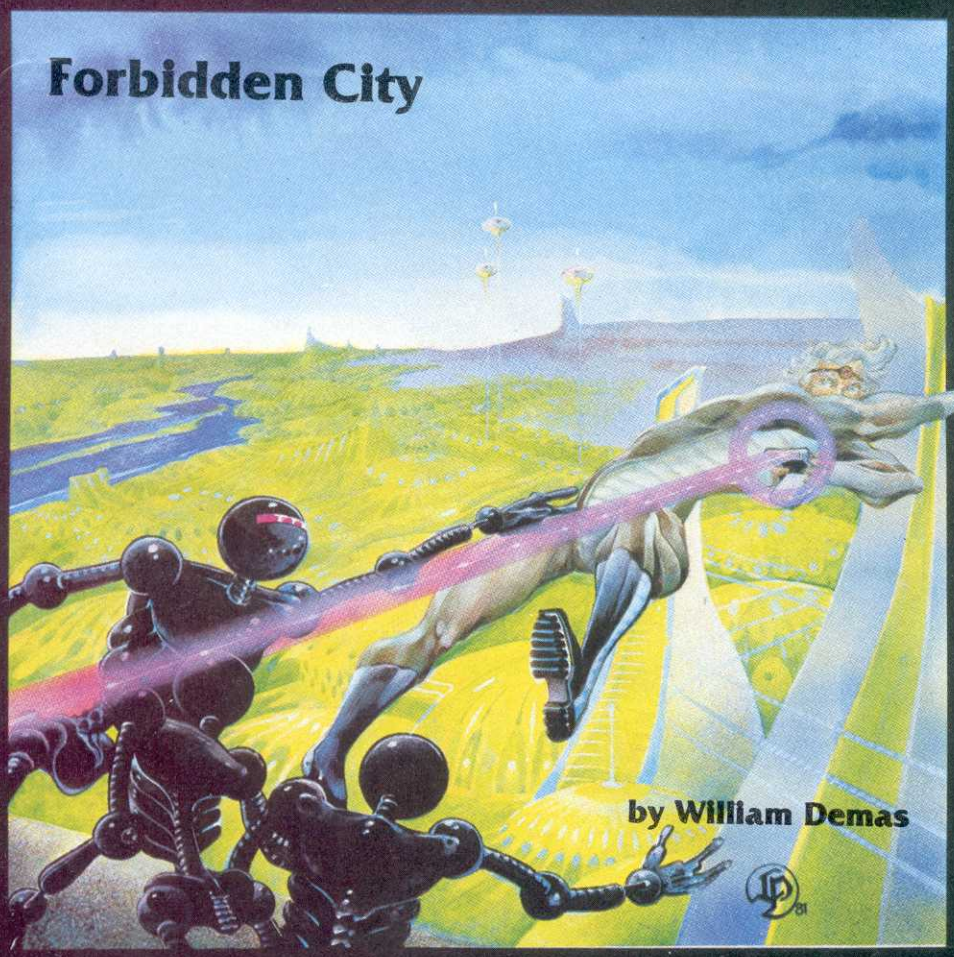
Listing 2 stores seven lines of data in an array, compresses the array, and writes it to a disk file before going on.

There are several advantages to saving the data on disk. First, you can print whenever you want. Second, once the disk file is created, I can quickly read it in and make as many copies of the design as I want. It takes about half an hour to read the file in, fairly reasonable considering that the disk file is 156 sectors long. Third, a disk file gave me the opportunity to write one more program to read in all data and print it on an Epson MX-80 printer with the graphics ROM (See Program Listing 3).

Program Listing 4 generates the design shown in Fig. 3. I call it the Eye Killer; if you stare at it for a while you can guess why. This fairly common design is made of a bunch of fat sine waves. Listing 4, an attempt at structured programming, would look pretty good if line 290 weren't so long.

The Epson graphics package uses eight-wire printing which requires a bit of extra work over seven wire designs. The TRS-80 cannot output certain numbers to the printer. If you send a CHR$(0) to the printer the ROM will intercept it and pretend nothing happened. To get around this I directly POKE my data into the printer's memory mapped address 14312. Lines 1000–1020 check the printer status and out-





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"Noticing the beauty in this simple binary pattern I wrote Listing 5 to count forward. . ."

```
100 REM   EYE KILLER
110 LPRINTCHR$(27);CHR$(65);CHR$(8)
120 DIM C(100),D(20)
130 FOR Q=0TO90STEP20
140   FORW=1TO10
150     C(Q+W)=1
160   NEXT
170 NEXT
180 FOR L=1TO80
190   FOR D=0TO7
200     X=X+.1
210     S(D)=SIN(X)*35+35
220   NEXT D
230   LPRINT
240   A=27:GOSUB1000
250   A=75:GOSUB1000
260   A=224:GOSUB1000
270   A=1:GOSUB1000
280   FORQ=1TO20
290     D(Q)=C(Q+S(7))+C(Q+S(6))*2+C(Q+S(5))*4+C(Q+S(4))*8+C(Q+S
(3))*16+C(Q+S(2))*32+C(Q+S(1))*64+C(Q+S(0))*128
300   NEXT Q
310   FORQ=1TO24
320     FORW=1TO20
330        A=D(W)
340        GOSUB1000
350     NEXT W
360   NEXT Q
370 NEXT L
380 END
1000 IFPEEK(14312)<>63THEN1000
1010 POKE14312,A
1020 RETURN
```

Program Listing 4. Eye Killer.

```
100 REM          MIRROR
110 DIM N(255),R(255)
120 FORQ=0TO255
125   PRINTQ;
130   N(Q)=Q
140   FORW=0TO7
150     IF Q AND 2[W THEN R(Q)=R(Q)+2[(7-W)
160   NEXT W
170 NEXT Q
180 LPRINTCHR$(27);CHR$(65);CHR$(8);
190 FORB=1TO8
200   GOSUB2000
210     FORQ=255TO0STEP-1:A=N(Q):GOSUB1000:NEXT
220     FORQ=0TO255:A=N(Q):GOSUB1000:NEXT
230   GOSUB2000
240     FORQ=0TO255:A=N(Q):GOSUB1000:NEXT
250     FORQ=255TO0STEP-1:A=N(Q):GOSUB1000:NEXT
260   GOSUB2000
270     FORQ=0TO255:A=R(Q):GOSUB1000:NEXT
280     FORQ=255TO0STEP-1:A=R(Q):GOSUB1000:NEXT
290   GOSUB2000
300     FORQ=255TO0STEP-1:A=R(Q):GOSUB1000:NEXT
310     FORQ=0TO255:A=R(Q):GOSUB1000:NEXT
320 NEXT B
330 LPRINT:END
1000 IFPEEK(14312)<>63THEN1000
1010 POKE14312,A
1020 RETURN
2000 LPRINT
2005 A=27:GOSUB1000
2010 A=76:GOSUB1000
2020 A=0:GOSUB1000
2030 A=2:GOSUB1000
2040 RETURN
```

Program Listing 5. The Mirror.

put a byte. A USR call might have been faster, but I wanted to avoid assembly language.

To convert these programs to another printer such as the Base 2 or the Paper Tiger, keep in mind that the print wires are upside down on the MX-80. In other words, wire one is at the bottom and wire eight is at the top.

I will briefly describe converting the Eye Killer to work on a Base 2 printer. The Base 2 uses seven wires, so line 190 should read FOR D = 0TO6. Since the Base 2 has wire 1 at the top, line 290 should have the subscripts 7,6,5,4,3,2,1,0 reversed to 0,1,2,3,4,5,6 with the last term omitted. The control codes in lines 240–270 are changed to 27, 99 (only two are needed). But the control codes in line 110 need to be 27, 49, 27, 98, 14. With a little string packing this program could really go fast on the Base 2 (seven minutes). On the MX-80 it took 23 minutes, slow because of my POKEing method. The column alignment is where the MX-80 has its great advantage in graphics.

Program Listing 5 produces Fig. 4, which I call the Mirror. I produced this design by accident when testing the printer to see what codes make it past the ROM. I typed in a one-line For...Next loop to output numbers from 0 to 255; it made a pattern just like the first half of the second line. Noticing the beauty in this simple binary pattern, I wrote Listing 5 to count forward, backward and upside down. It prints these different patterns in groups of eight for eight repetitions. The entire design only takes twelve minutes from start to finish. ■

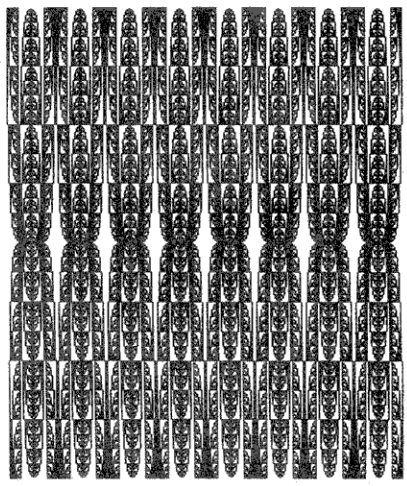

Fig. 4. The Mirror.

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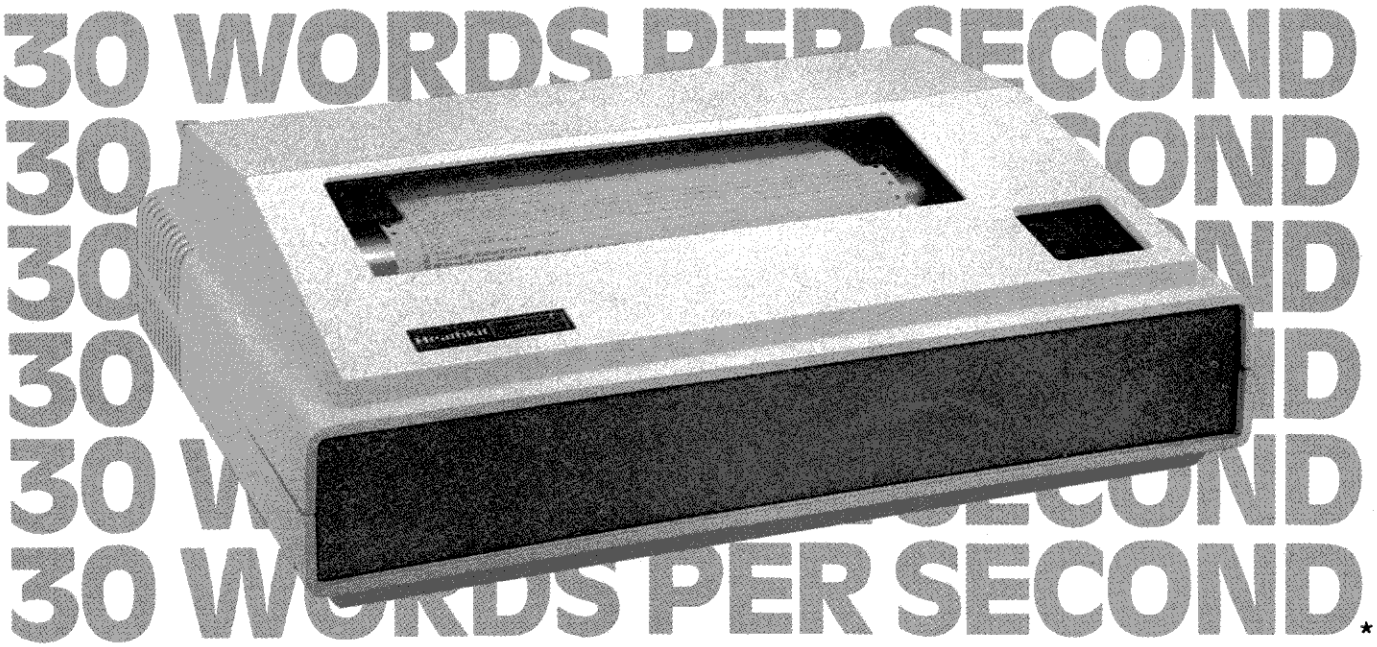

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Your first reaction to the program listing may be one of concern that the printer missed your issue in a few places. Actually, lines 10 through 165 are the data lines that will become the basis of your graphics program. They are blank, waiting for the creating program to be run, when they will be filled with the ASCII codes corresponding to what was on the screen.

Program action begins at line 1000. From that point to the listing's end is the complete routine for working on the screen. The segment from line 300 to line 410 is the routine that will create your graphics program. Beyond the last blank data line at 165, the remaining lines form the routine that will turn the gathered data into graphics.

Program Listing

```
??10 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
15 DATA , , , , , , , , , , , , , , , ,
20 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
25 DATA , , , , , , , , , , , , , , , ,
30 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
35 DATA , , , , , , , , , , , , , , , ,
40 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
45 DATA , , , , , , , , , , , , , , , ,
50 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
55 DATA , , , , , , , , , , , , , , , ,
60 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
65 DATA , , , , , , , , , , , , , , , ,
70 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
75 DATA , , , , , , , , , , , , , , , ,
80 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
85 DATA , , , , , , , , , , , , , , , ,
90 DATA , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
  , , , , , , , , , , , , , , , , , ,
95 DATA , , , , , , , , , , , , , , , ,
100 DATA , , , , , , , , , , , , , , , ,
```

Program continues

Rules for Entering the Program

All lines through line 165 must be typed exactly as shown.

- Type line number 10.
- Type the word data.
- Type three spaces.
- Type one comma.
- Type three spaces.
- Type another comma.
- Continue in this manner until exactly 56 groups of three spaces and 56 commas have been typed.
- Note that after the last comma there are no spaces. The line ends with a comma.
- Press enter and then type line number 15.
- Do exactly the same for line 15, except that only eight groups of three spaces and eight commas will be typed.
- Now repeat the procedure right through line 165—a 56-unit line followed by an eight-unit line.

As you can see, each two program lines represent 64 characters or one complete screen line, and there are 16 screen lines.

Directions for Use

With the program loaded, user entry is at line 1000, so run 1000. A twinkling asterisk will appear at position zero (3C00H) on your screen. That's the cursor, which can be moved forward or backward by pressing the right or left arrow keys. To

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move the cursor more than one position at a time, type the required number of spaces and press the arrow for the direction desired.

As you enter a quantity for a move, you will see the numbers appearing at the lower right of the screen. Any value from one to 1023 may be entered. If you should overdo it and ask the cursor to go beyond the screen limits, it will simply move to the end of the screen. That holds for both forward and backward moves, with the cursor going to (Print@) positions 1023 or zero respectively. To move exactly one line up or down, enter 64 and the appropriate arrow or 128 for a two line move, and so on.

To print a keyboard character at the cursor position, enter P. The cursor will stop twinkling. Then enter the character and it will appear, with the cursor moving over one space.

To print a graphics character block, enter G. Again, the cursor will be motionless. Now enter the graphic block desired:

- For graphics characters 129–154, press keys A–Z in alphabetical order.
- For characters 155–188, press A–Z with the shift key down.
- For characters 181–189, press numbers 1–9.
- For character 190 press 0, and for character 191 press the colon.

Should you want to print a series of the same character, enter the amount you want (just as you would to move the cursor), enter P or G and then the character. You may print up to 255 repeated characters at one time. If you should inadvertently ask for more than 255, your request will be ignored.

Spaces are always present by default, since the screen is filled with them at the start. The space bar, however, will cause a space to be printed at the cursor position, and so deletion is accomplished by P and space. The spaces may be printed one at a time or in a series of up to 255.

When you have patterned the screen with a magnificent graphics structure and are ready to record it, press the up-arrow. Now you will see each ASCII value appearing in the lower right of the screen showing you that the characters are being programmed into the blank data statements at the beginning of the program. It will take a few minutes to work. The screen will then be cleared and your graphics will roll back exactly as they were designed.

"Spaces are always present by default since the screen is filled with them at the start."

You may now delete all program lines from 300 to the end and be left with a program for printing your screen format. The program may be used as is or applied as needed for another program. If you have a disk system, the graphics program can be renumbered to fit into a host program, saved with the A option (ASCII), and merged into the host. You can, of course, adapt the program to feed graphics to the screen one line at a time or in any other way that suits the need. Because of the easy-to-see structure of the data statements, it is relatively simple to vary the print to screen method.

DOS Versus Level II

Look at the program-creating segment (lines 300–410). At line 310, S is initialized at one less than the first screen address, and PR is set at 27176 (6A28H). The 6A28H address is for disk systems, and the user must enter at the file's question. Level II Basic users must substitute 17133 (42EDH) in place of 27176.

The program PEEKs the screen one location at a time at line 340. The value of P is the ASCII value of the character found but expressed as a binary (or hex) number. The value P is then printed at screen location 1015. At line 350, the number displayed at 1015 is PEEKed, digit

Program continued

```
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
105 DATA
110 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
115 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,
120 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
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    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
125 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,
130 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
135 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,
140 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
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    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
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145 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,
150 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
155 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,
160 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
    ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
165 DATA    ,   ,   ,   ,   ,   ,   ,   ,   ,
170 CLS
180 FOR X=1 TO 16
190 FOR Y=1 TO 64:READ A:PRINT CHR$(A);:NEXT Y
200 NEXT X
210 GOTO 210
300 REM *** END OF CREATED GRAPHICS PROGRAM ... BEGINNING OF CRE
ATING PROGRAM ***
310 S=15359:PR=17133
320 FOR L=1 TO 16
330 FOR X=1 TO 64:S=S+1
340 P=PEEK(S):PRINT@1015,"   ";:PRINT@1015,P;
350 P1=PEEK(16376):P2=PEEK(16377):P3=PEEK(16378)
360 PR=PR+1:POKE PR,P1:PR=PR+1:POKE PR,P2:PR=PR+1:POKE PR,P3:PR=
PR+1
370 IF X=56 THEN PR=PR+6:ELSE IF X=64 THEN PR=PR+6
380 NEXT X
390 NEXT L
400 CLS
410 GOTO 10
1000 REM *** BEGINNING OF SCREEN WORKING PROGRAM ***
1010 CLEAR 3000
1020 CLS :C=0
1030 C1$=STRING$(255," "):C2$=STRING$(255," "):C3$=STRING$(255,"
 "):C4$=STRING$(255," ")
1040 PRINT@0,C1$;C2$;C3$;C4$;:C=C+A1:IF C>1014 THEN C=1014:ELSE
IF C<0 THEN C=0
1050 P=PEEK(15360+C):A1=0
1060 PRINT@C,"*";
1070 A$=INKEY$ :IF A$="" THEN FOR X=1 TO 5:NEXT X:POKE 15360+C,P
:FOR X=1 TO 5:NEXT X:GOTO 1060
1080 A0=ASC(A$):IF A0<>48 AND VAL(A$)=0 THEN 1200
1090 A=VAL(A$):IF A1=0 THEN A1=A:GOTO 1110
1100 A1=(A1*10)+A
1110 PRINT@1015,A1;:GOTO 1070
1200 REM *** INSTRUCTION TO BE FOLLOWED ***
1210 IF A1=0 THEN A1=1
1220 IF A0=9 THEN 1300 :ELSE IF A0=8 THEN 1260 :ELSE IF A0=91 TH
EN 310
1230 IF A1>255 THEN PRINT@1015,"   ";:A=0:A1=0:GOTO 1040
1240 IF A0=80 THEN 1400 :ELSE IF A0=71 THEN 1500
1250 A1=0:PRINT@1020,"   ";:GOTO 1040
1260 IF C-A1<0THEN A1=C
1270 A1=-A1
1300 PRINT@1020,"   ";:GOTO 1040
1400 REM *** PRINT KEYBOARD CHARACTER ***
1410 A$=INKEY$ :IF A$="" THEN 1410 :ELSE A0=ASC(A$)
1420 IF A0<32 OR A0>90 THEN 1410
1430 C$=STRING$(A1,A$)
1440 GOSUB 1600 :GOTO 1040
1500 REM *** PRINT GRAPHICS CHARACTER ***
1510 A$=INKEY$:IF A$="" THEN 1510 :ELSE A0=ASC(A$)
1520 IF A0>64 AND A0<91 THEN A0=A0+64
1530 IF A0>96 AND A0<123 THEN A0=A0+58
1540 IF A0>48 AND A0<58 THEN A0=A0+132
1550 IF A0=48 THEN A0=A0+142
1560 IF A0=58 THEN A0=A0+133
1570 IF A0<129 THEN 1510
1580 C$=STRING$(A1,CHR$(A0))
1590 GOSUB 1600 :GOTO 1040
1600 REM *** MANIPULATE STRINGS FOR SCREEN FORMAT ***
1610 IF C>254 THEN 1640
1620 C0=C:IF C0+A1<=255 THEN C0$=C1$:GOSUB 1710 :C1$=C0$:RETURN

1630 C0$=C1$:GOSUB 1720 :C1$=C0$:C0$=C2$:GOSUB 1730 :C2$=C0$:RET
URN
1640 IF C>509 THEN 1670
1650 C0=C-255:IF C0+A1<=255 THEN C0$=C2$:GOSUB 1710 :C2$=C0$:RET
URN
1660 C0$=C2$:GOSUB 1720 :C2$=C0$:C0$=C3$:GOSUB 1730 :C3$=C0$:RET
URN
1670 IF C>764 THEN 1695
1680 C0=C-510:IF C0+A1<=255 THEN C0$=C3$:GOSUB 1710 :C3$=C0$:RET
URN
1690 C0$=C3$:GOSUB 1720 :C3$=C0$:C0$=C4$:GOSUB 1730 :C4$=C0$:RET
URN
1695 C0=C-765:IF C0+A1>255 THEN A1=255-C0
1700 C0=C-765:C0$=C4$:GOSUB 1710:C4$=C0$:RETURN
1710 C0$=LEFT$(C0$,C0)+LEFT$(C$,A1)+RIGHT$(C0$,255-C0-A1):RETURN

1720 C0$=LEFT$(C0$,C0)+LEFT$(C$,255-C0):RETURN
1730 C0$=RIGHT$(C$,A1+C0-255)+RIGHT$(C0$,255-A1-C0+255):RETURN
```

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by digit. Finally, line 360 POKEs each digit into the program locations set up by the blank data statements. In that way, the binary-expressed ASCII is converted to ASCII-expressed ASCII, which is required by Basic in data statements.

In the created program, note line 190 reads DATA and prints it as a sequence of CHR$s. The printing is slow. You can revise line 190 as follows:

```
DIM A$(16):FOR Y=1 TO 64:READ
A:A$(X)=A$(X)+CHR$(A):NEXT Y
```

That will fill 16 strings, each representing a line on the screen. It takes time to initialize strings but once they have been, they are always available during a program run. To print the graphics, simply print the complete set of strings:

```
(FOR X=1 TO 16:PRINT A$(X);:NEXT X)
```

print any string in any order. Printing previously evaluated strings is a faster procedure, as you will notice by experimenting with both the method in the program listing and this alternate one.

The routine for creating the screen graphics is merely a string manipulation process. Four strings hold all the screen information (C1$,C2$,C3$,C4$). These strings are cut and pasted as demanded by the user's cursor and printing orders. The programming is fairly ordinary and can be followed if you have some background in manipulation of string segments. Line 1600 to the end performs the routines to keep track of the screen. The user instruction is checked to determine the make-up of the four C strings, and the appropriate strings are evaluated as needed. At 1500 through 1590, the graphics ASCII value is created by adding the required amount to the keyboard ASCII.

One final point: The last half of the last screen line is used as a work area, so you have to add any data values (ugh!) manually. ■

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The day I ordered my 16K Level II TRS-80 Color Computer I also ordered eight 16K dynamic RAMs. The additional memory installation was amazingly simple.

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 they will not fall out.

With the computer right-side-up, remove the top cover. Unplug the keyboard and put it aside to avoid damaging the cable connecting it to the PC board. After clipping two plastic cable ties, remove the metal shield covering the section of the board that contains the Central Processing Unit (CPU), Synchronous Address Multiplexer (SAM), Peripheral Interface Adapters (PIA's) and memory.

Place all parts on a sheet of aluminum foil to avoid static electricity damage. Make an electrical contact with the computer Radio Frequency (RF) shield and the soldering iron to ensure that no static electricity causes a burnout (see Photo 2). Remove the RAMs, plug in the Godbout memory, and reconnect the keyboard and power connections to test the chips (leave the shield off for this test only). With the top cover off, power up, and type ?MEM to receive the 8487 OK message.

The Key Box

Install additional 16K RAM on a 16K Level II TRS-80 Color Computer

Checking It Out

At this point, I loaded and ran a large graphics program that uses all available memory. It worked fine; my new chips were probably all right.

After removing the Godbout memory chips, carefully bend them (except pin 4) inward a little so they hug the Radio Shack memory chips. Bend pin 4 out at a 45 degree angle for later attachment. With all the memories now outside of the machine place the new memory chips piggyback over each of the Radio Shack memory chips (notched ends together) and solder them in place (except for pin 4). After all chips are soldered and carefully checked for solder bridges and cold solder joints, wire the eight pin 4s together in daisy-chain fashion, and solder them to ensure connection. Leave a wire loop between each one for easy installaton. Leave a 10-inch piece of wire on the last chip for later attachment to the SAM chip.

Reinsert the modified memory chips into

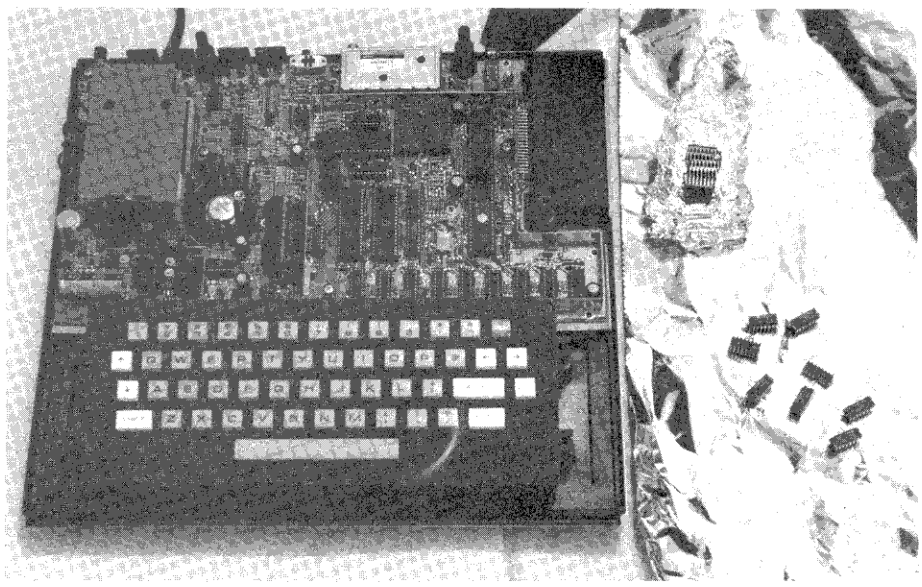

Photo 1. Open TRS-80 Color Computer shows IC layout, original memory chips are removed, ready for piggyback operation. Aluminum foil prevents static electricity damage.

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"The graphics program could now access three times as much memory."

their sockets, making sure the notches are aligned properly (see Photo 2). Cut the 10-inch wire to the proper length and solder it to pin 35 of the SAM chip (the number on the chip is 6883).

The Final Connection

Reconnect the keyboard, power and antenna and turn it on. In answer to the memory question the computer will print 24871, an increase of 16K (16,384) over the original 8487. Reassemble the computer, making sure to replace the metal RF shield.

I ran the graphics program as before, but now it could access three times as much memory.

I was relieved that my machine contained a genuine Motorola 6809E; it was rumored that early versions of the TRS-80C had stripped-down Tandy chips. Some early models of the TRS-80C machines came without IC U16, and the 32K modification may not work unless this chip is installed. My machine, serial number 0000991, had the chip; make sure yours can support 32K before ordering extra memory.

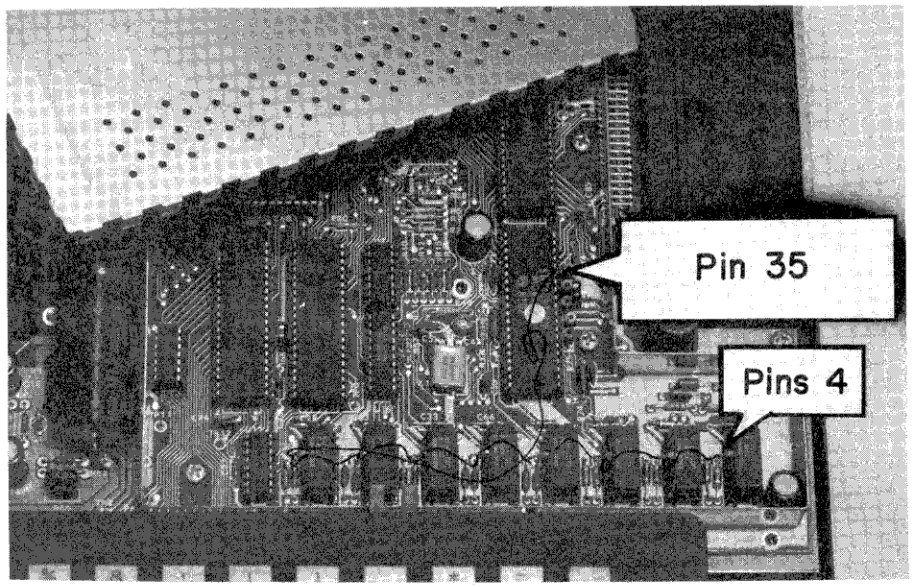

Photo 2. 32K memory array installed and wire soldered to pin 35.

Remember, you are working with metal-oxide type semiconductors (MOS). Static electricity can do irreparable damage, so be careful! ■

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THE COMPUTRONICS INC.

MONTHLY NEWSMAGAZINE FOR TRS-80™ OWNERS

MONTHLY NEWSMAGAZINE

Practical Support For Model I, II, III & Color

- PRACTICAL APPLICATIONS
- NEW EXPANDED BUSINESS SECTION
- GAMBLING • GAMES
- EDUCATION
- PERSONAL FINANCE
- BEGINNER'S CORNER
- NEW PRODUCTS
- SOFTWARE EXCHANGE
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- QUESTIONS AND ANSWERS
- PROGRAM PRINTOUTS

. . . . AND MORE

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- STATISTICAL COMBINATIONS
- PASCAL'S TRIANGLE
- ASSEMBLY LANGUAGE FOR BEGINNERS
- DISK FILES
- MOD-III REVIEW
- KEYBOARD THUNDER AND LIGHTING EXPLAINED
- DOS COMMANDS IN LEVEL II
- PROBABILITY CURVE GENERATOR
- CALCULATOR SIMULATIONS
- THE MEGABYTE GAP
- STOCKS AND BONDS
- BUDGET ANALYSIS (FOR BUSINESS AND HOME)
- NEWDOS 80 REVIEW
- DUTCHING THE HORSE SYSTEM THAT CAN'T LOSE
- A SIMULATED GOLF GAME
- CONTINUOUS FORM SOURCES
- TAX SAVER REVIEW

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Form **1040** Department of the Treasury—Internal Revenue Service **U.S. Individual Income Tax Return** **1981**

For Privacy Act Notice, see page 3 of instructions | For the year January 1–December 31, 1979, or other tax year beginning , 1979, ending , 19

Use IRS label. Otherwise, please print or type.	Your first name and initial (if joint return, also give spouse's name and initial)	Last name	Your social security number
	Present home address (Number and street, including apartment number, or rural route)		Spouse's social security no.
	City, town or post office, State and ZIP code	Your occupation ▶ / Spouse's occupation ▶	

Presidential Election Campaign Fund					
▶	Do you want $1 to go to this fund?	Yes	No	**Note:** *Checking "Yes" will not increase your tax or reduce your refund.*
	If joint return, does your spouse want $1 to go to this fund? . . .	Yes	No	

MICROMATIC PROGRAMMING COMPANY

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Now With Printout!

FOR MODEL I or MODEL III

TAX/SAVER™ — The tax help program for the layman, the professional accountant or tax preparer.

New and expanded, TAX/SAVER™ offers a different approach to preparing a tax return. Like the original, the new version has the tax regulations programmed in so it is more than just a calculator. Designed for non-accountants, TAX/SAVER™ asks you questions, just as an accountant does. Based on your answers, it leads you through the tax maze to your lowest legal tax. Then it tells you how to fill in your return, line by line, or it will output to a printer.

TAX/SAVER™ also has speed features for those doing more than one return. Optional program instruction and tax text make TAX/SAVER™ the practical system for professional preparers as well. TAX/SAVER™ has full disk storage of data files (with optional password protection).

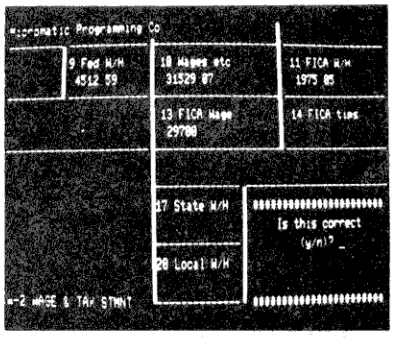
The manual includes information on special tax areas, lists of possible deductions and a tax glossary.

TAX/SAVER™ compares itemized deductions to national averages; automatically computes certain limitations - for example, on medical deductions and contributions; checks for excess FICA; helps determine dependents. Yet, TAX/SAVER™ offers the privacy and convenience of home use.

The user-oriented design with special screen formatting makes data entry, verification and correction easy. Yet you are always in control. You can skip any help features or parts of the program that you don't need.

TAX/SAVER™ II completes long and short forms including:

- Itemized Deductions - Schedule A
- Interest & Dividends - Schedule B
- Tax Calculation - Tables, Rates
- Tax Saving Methods - Income Averaging, Maximum Tax, Alternative Tax
- Business Income - Schedules C & SE
- Capital Gains - Schedule D
- Allows you the privacy of your own home
- Lets you help friends and relatives with their taxes
- Has built-in aids. Answers specific questions like "Is my father my dependent?" and "Are my deductions reasonable?"
- Tax deductible
- Manual includes 1981 tax forms, information on special tax areas, lists of possible deductions, and glossary of tax terms
- Completes long and short forms including itemized deductions, excess FICA, earned income credit, community property, tax calculation (comparing all possible filing statuses in one run)
- Tax regulations are programmed in by our team of accountants. Just type in your figures and you've done your own tax return.
- Helps you find the lowest tax
- Discount on yearly updates
- Prints out on standard IRS forms overlays or plain tractor feed paper



REVIEWS:
"...well designed and easy to use" - D. Lubar, Creative Computing 1/81
"...TAX/SAVER™ may very well live up to its name" - M. Tannenbaum, CPA, 80 Microcomputing 2/81

FROM OUR CUSTOMERS:
"...best tax program for the layman I've seen."
"I would (and have) highly recommended it."
"Bravo"

TAX/SAVER™ is like having a personal accountant helping you do your own return!

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Please check your model:
☐ TRS-80* Model I, 32K with 2 disk drives
☐ TRS-80* Model III, 32K with 2 disk drives

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☐ TAX/SAVER™ II @ $119.95 - Manual included.
☐ TAX/FORECASTER™ @ $49.95 (with either TAX/SAVER™ $29.95)
☐ Tax Form Overlays @ $19.95

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Inventory Control.....Payroll.....Bookkeeping System.....Stock Calculations.....
Checkbook Maintenance.....Accounts Receivable.....Accounts Payable.....

BUSINESS 100 PROGRAM LIST

	NAME	DESCRIPTION
1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNU1	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCONVBD	Investor's rate of return on convertable bond
100	PORTVAL9	Stock market portfolio storage-valuation program

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- ★ THE ULTIMATE PERSONAL CHECK REGISTER
- ★ A PROFESSIONAL ACCOUNTING SYSTEM
- ★ A PERSONAL FINANCIAL MANAGER
- ★ A SMALL BUSINESS ACCOUNTING SYSTEM
- ★ A COMPLETE GENERAL LEDGER

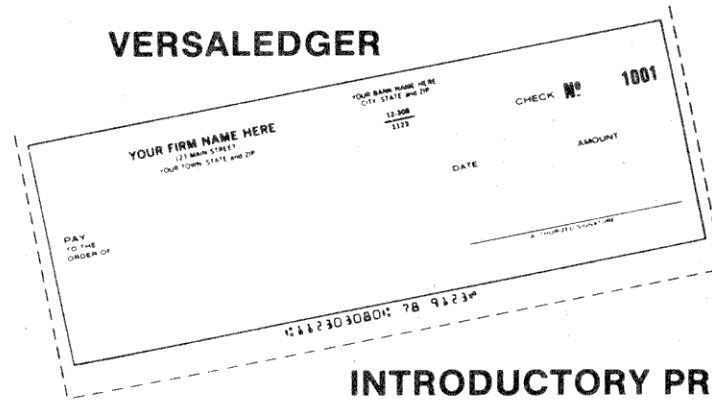
FOR YOUR TRS-80 MODEL I, II, III or COLOR COMPUTER • APPLE II • I.B.M. • XEROX • ATARI
ALL MICROSOFT BASIC COMPUTERS

HOW IT WORKS . . . .

VERSALEDGER is a complete accounting system that grows as you or your business grows. To start, your VERSALEDGER acts as a simple method of keeping track of your checkbook. Just enter your check number, date and to whom the check is made out to. As you or your business grows, you may add more details to your transactions . . . . account number, detailed account explanations, etc.

- VERSALEDGER can give you an instant cash balance at anytime. **(IF YOU WANT IT TO)**
- VERSALEDGER can be used as a small personal checkbook register. **(IF YOU WANT IT TO)**
- VERSALEDGER can be used to run your million dollar corporation. **(IF YOU WANT IT TO)**
- VERSALEDGER prints checks. **(IF YOU WANT IT TO)**
- VERSALEDGER stores all check information forever. **(IF YOU WANT IT TO)**
- VERSALEDGER can handle more than one checkbook. **(IF YOU WANT IT TO)**
- VERSALEDGER can be used to replace a general ledger. **(IF YOU WANT IT TO)**

VERSALEDGER



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  (300 checks per month on single density 5¼" disk drives such as the TRS-80 Model-I)
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  (6000 checks per month on the TRS-80 Model II)
  (3000 checks per month on single density 8" CP/M)
- VERSALEDGER will soon have an add-on payroll package. **(IF YOU NEED IT)**

— CAN BE USED WITH 1 or MORE DISK DRIVES —

VERSALEDGER HAS BEEN CREATED WITH THE FIRST TIME COMPUTER USER IN MIND

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- Add exact postage to all other countries

BUSINESS/80 *presents*

NEW **PROFESSIONAL BUSINESS SYSTEMS** NEW

PBS
for
TRS-80 MODEL II
or
TRS-80 MODEL III
with 2 Disk Drives
and 48K (64K for Model II)

★ **Each Module Can Be Operated Individually Or As A Completely Coordinated System.**
★ **Turn-Key Error Catching Operation For Beginners.**
★ **Each Module Is Accompanied By More Than 100 Pages Of Step-By-Step Documentation.**
★ **Manuals Available Separately. ($50 each)** ★ **Complete Sample Report Listings ($10)**

$195 (Model I Or Model III TRSDOS Version)
$250 Apple Version (From Peachtree - Requires CP/M)
$295 (Model II TRSDOS Version)
$495 (Model II Peachtree CP/M Version)

BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80 * BUSINESS/80

GENERAL LEDGER

Processes

★ Flexible design allows system to be easily adapted to both small businesses and also to firms performing client writeup services.
★ Add, change or delete records within the Chart of Accounts (Master) File.
★ List the Chart of Accounts File.
★ Key in transactions into the Transactions (Journal Entries) File.
★ List the Transactions File.
★ If other Peachtree Software packages are present, pass summary transactions from these packages to the General Ledger at the end of the accounting period.
★ At the end of an accounting period, print out the major reports:
(1) Trial Balance (Detail Report)
(2) Transaction Registers
(3) Balance Sheet
(4) Prior Year Comparative Balance Sheet
(5) Income Statement
(6) Prior Year Comparative Income Statement
(7) Department Income Statements

File Information

There are two main computer files maintained within the General Ledger System.

(1) The of Accounts File
Account Number
Description
Account Type
Balance Sheet Column Code
Current Amount
Year-To-Date Amount
Budget Amount
Prior Year Monthly Amounts

(2) The Transactions File
Account Number
Description
Source Code
Reference
Date
Amount

ACCOUNTS RECEIVABLE

Processes

★ Add, change or delete records within the Customer File.
★ List the entire Customer File, or any Customer within the File.
★ Enter invoices, payments, credits and adjustments.
★ Prepare invoices and statements.
★ Produce the following reports:
(1) Aged Accounts Receivable
(2) Invoice Register
(3) Payment, Credit and Adjustment Register
(4) Customer Account Status Report
★ At the end of a month, post the following items to the General Ledger:
(1) Invoiced Sales
(2) Freight Charges
(3) Sales Tax
(4) Service Charge Income
(5) Cash Payments
(6) Discounts Allowed
(7) Returns/Credits
(8) Income Adjustments
(9) Accounts Receivable

File Information

There are three main computer files maintained within the Accounts Receivable System, the Customer File, the Invoice File, and the Transaction File.

CUSTOMER FILE
Customer Account Number
Customer Name
Address
Phone
Type of Account
Credit Terms
Credit Limit
Tax Rate
Discount Rate
Date of Last Credit
Date of Last Debit
Amount of Last Credit
Amount of Last Debit
Current Balance
High Balance
Year-To-Date Sales
Year-To-Date Payments
Automatic Billing Amount

INVOICE FILE
Invoice Number
Invoice Date
Invoice Amount
Credit Terms

TRANSACTION FILE
Transaction Type
Transaction Date
Transaction Amount

ACCOUNTS PAYABLE

Processes

★ Add, change or delete records within the Vendor File.
★ List the Vendor File.
★ Enter vouchers.
★ Automatically determine which vouchers to pay.
★ Print checks and a Check Register.
★ Produce the following reports:
  (1) Open Voucher Report.
  (2) Accounts Payable Ageing Report.
  (3) Cash Requirements.
★ At the end of a month, prepare the General Ledger Transfer File, passing the following information for each debit or credit transaction:
  (1) Account Number
  (2) Description
  (3) Source Code
  (4) Date
  (5) Amount

File Information

There are two main computer files maintained within the Accounts Payable System, the Vendor File and the Voucher File.

VENDOR FILE
- Vendor Code
- Vendor Name
- Address
- Phone
- Year-To-Date Purchases
- Year-To-Date Payments
- Current Balance
- Last Payment
- Date of Last Payment
- Monthly Entry Flag
- Due Date of Month
- Debit Account Number
- Amount (Debit)
- Month Last Paid

This file may also contain information to enable generation of automatic vouchers for those items such as rent or bank payments that are paid every month.

VOUCHER FILE
- Voucher Code
- Voucher Date
- Amount Due
- Date Due
- Discount Percent
- Discount Amount
- Discount Date
- Invoice Number
- Invoice Date
- Status

Plus up to six account number-amount fields for General Ledger account numbers to which the amount due is to be distributed.

PAYROLL

Processes

★ Add, change or delete records within the Employee File.
★ List the Employee File.
★ Modify the Tax Information Files.
★ At the end of a pay period -
  (1) Calculate Pay
  (2) Print Checks
  (3) Print Payroll Register
★ At the end of a month -
  (1) Print the monthly summary
  (2) Print the Unemployment Tax Report
  (3) Prepare the General Ledger Transfer File, passing the following information:
    - Net Pay (Cash)
    - Employee FICA Withheld
    - Federal Tax Withheld
    - Insurance Deductions
    - Miscellaneous Dedutions
    - State Tax Withheld
    - Local Tax Withheld

  The gross pay for up to twenty payroll departments may also be passed to the General Ledger.
★ At the end of a quarter, print the 941A report information.
★ At the end of a year, print the W-2 forms.

File Information

There are two main computer files maintained within the Payroll System, the Employee Master File and the Tax File.

EMPLOYEE MASTER FILE
- Name
- Address
- Local Code
- State Code
- Marital Status
- Exemptions, Federal
- Exemptions, State
- Social Security Number
- Pay Period
- Pay Type
- Pay Rate
- Insurance Deduction
- Miscellaneous Deduction
- Date Employed
- Date Terminated
- Last Check Information

Payroll (con't)

And current, month-to-date, quarter-to-date and year-to-date totals for:
- Regular Earnings
- Overtime Hours/Earnings
- Other Hours Rate/Earnings
- Commission Earnings
- Miscellaneous Income
- FICA Deductions
- Federal Deductions
- State Deductions
- Local Deductions
- Insurance Deductions
- Miscellaneous Deductions

TAX FILE
(for single and married persons)
- Federal Tax Information Tables
- State Tax Information Tables
- Local Withholding Tax Information Tables

An Overview of the Inventory System

Inventory is probably the most speculative of all of a company's assets. A true measure of the effectiveness of management is the ability with which it supervises the inventory control function.

The Peachtree Software™ Inventory Management System is designed to (1) give you better merchandise control, (2) allow you to lower your dollar investment in inventory, and (3) improve customer service and response.

The System maintains detailed information on each inventory item including the part number, description, unit of measure, vendor and reorder data, item activity, and complete information on current item costs, pricing, and sales. Transactions effecting inventory (sales, receipts, adjustments) may be applied at any time to insure the inventory data is always up to date and accurate.

As with all Peachtree products, the system is interactive, simple to operate, and provides reports that are up to date and comprehensive.

Particular features of the Peachtree Software™ Inventory Management System include:

- Interactive, menu-driven programs
- Self-instructing user documentation
- Long item number - up to 15 characters
- Departmentalizing of items
- Multiple pricing levels
- Processes items on reserve (committed but still in stock)
- Online item query at any time
- Comprehensive management reporting
- Automatic month end file backup
- Recovery routines for hardware failures
- Sample data for demonstration and training

How the System is Designed

The Inventory Management System operates with an **Inventory Master File** which allows for the creation of each inventory item and for the recording of transactions (sales, receipts, returns, reserves, and adjustments) to each inventory item.

The Inventory Master File contains the item number, description and various other data on item costs, prices, reorder levels, vendor refereence, and activity. The items within the Master File are entered, changed, deleted, and queried through the **Inventory Master File Maintenance** program. All data on all items may be listed by using the **Detail Inventory Report** program.

Transactions may be applied at any time to the Master File through the **Enter Inventory Transactions** program. An **Update Report** automatically prints during this entry process to provide an audit trail of all inventory acitivity.

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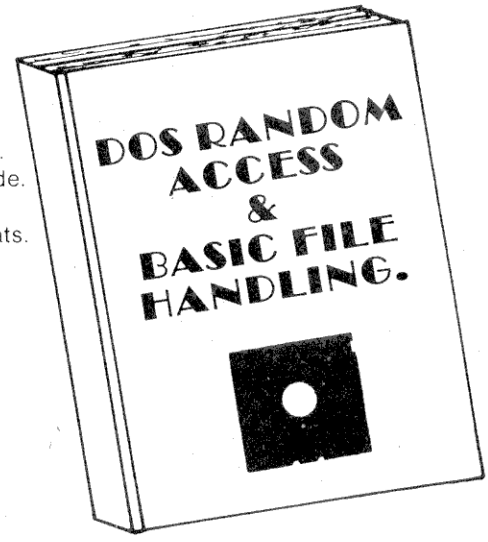

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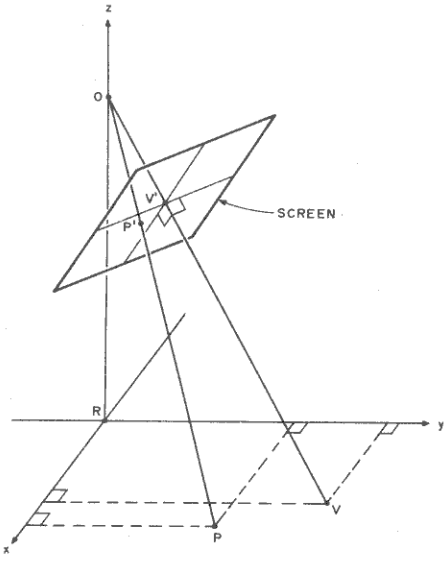

Fig. 1. 3-D View.

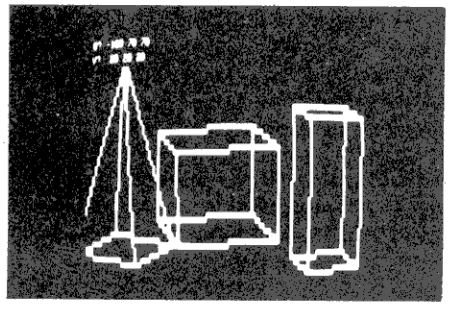

Photo 1

Even the most serious people doodle cubes, pyramids and other geometrical figures on scraps of paper. With this short Basic program you can create universes of geometrical solids floating on your TRS-80's screen. The program will run in Level II 4K machines and up. With more memory you can display a greater number of objects, limited only by Basic's lack of speed compared to machine language. The program does not display objects instantaneously but it will create them in a reasonably short time. The three objects in the photographs took 10 seconds to compute and 40 seconds to draw. If you have machine language programs to draw lines connecting two points use them instead of my slower Basic routine. This program does not produce real-time 3-D graphics, but it may provide a start for a machine language program.

Low graphics resolution is another limitation. Square instead of rectangular pixels on the TRS-80 would improve the display.

The Problem's Geometry

The problem involves right triangles. Fig. 1 shows the basic idea behind the problem:

x_O, y_O, z_O	Observer's coordinate
x_V, y_V, z_V	Viewing point
K_S	Distance of observer from screen
C_X, C_Y	center screen coordinates

Table 1. Knowns.

The three axes in Fig. 1 are X, Y and Z. R is the origin of this system, while O, P and V are the observer's coordinates, a point in space and the point in the center of view, respectively. The point V along with O determine the viewing vector, or the direction of sight. We will project point P with respect to our observing position. This point could be a vertex of a geometric figure.

The program works with end points, drawing lines after calculating the projection effect. When drawing railroad tracks, for example, you need notice just four points: two nearby and two on the horizon. Once you project these four points correctly, you can draw the lines connecting them.

Points P and V are in the same plane in

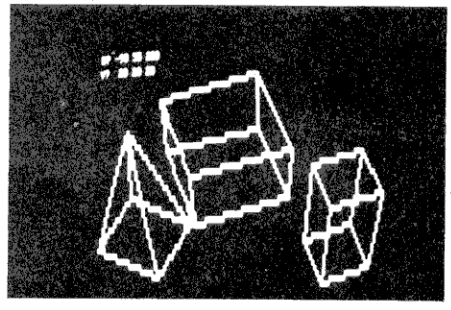

Photo 2

The Key Box

Basic Level II
Model I or III
4K RAM

"This routine allows you to view objects at any angle in any quadrant."

Fig. 1, but they need not be. $\overline{OV}$ is always perpendicular to the middle of the screen at point V'. $\overline{OP}$ intersects the screen at P', whose screen's X,Y components we want to find. If the observing position is moved closer to point V, the distance between P' and V' increases. This produces the projection effect.

Fig. 2 shows the projection of Fig. 1 on the X,Y plane. You see the same lines as in Fig. 1. Use this representation to calculate the various angles and distances. (Table 2 shows the equations I use. Remember this problem involves right triangles.) Our task is to find the values of Θ_P, Θ_A and the distance $\overline{AR}$. You can calculate Θ_A and Θ_P quickly because you know the X,Y coordinates of P and V (see Table 1). Find the distance RP by using the Pythagorean theorem, and also the angle between Θ_A and Θ_P. Using these quantities it is possible to find distance AR.

Fig. 3 shows a view perpendicular to the plane ORV. The task is to find the values of Θ_H, Θ_y, S_y and $\overline{DS}$ where S is in back of P'. First, calculate Θ_H: You can calculate the distance $\overline{RV}$, and you know $\overline{OR}$ (the Y-component of point O). Find Θ_y using $\overline{AR}$ and OR. K_s is the distance of the observer from the screen. You can now find S_y, the screen's Y-component of point P'. Calculate S_y by using K_s and the angle between Θ_H and Θ_y. To calculate $\overline{DS}$, first calculate $\overline{OS}$ using the Pythagorean theorem with sides K_s and S_y. Since you know Θ_y, use trigonometry to find $\overline{DS}$. $\overline{DS}$ and $\overline{OS}$ are hard to see because Figs. 3 and 4 project points on top of one another.

Finally, you can find the X component of P'. In Fig. 4 you are again looking perpendicular to the X,Y plane with the screen surface, $\overline{OV}$ and $\overline{OP}$ projected against the plane. Since you have calculated $\overline{DS}$, and you already know the angle between Θ_A and Θ_P, you can find S_x. You now have the screen's X and Y components of P'. Use this same procedure for any other point.

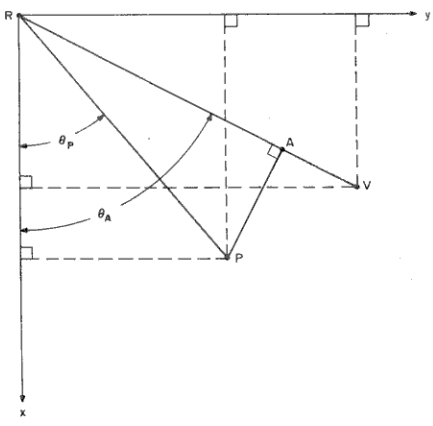

Fig. 2. XY Plane.

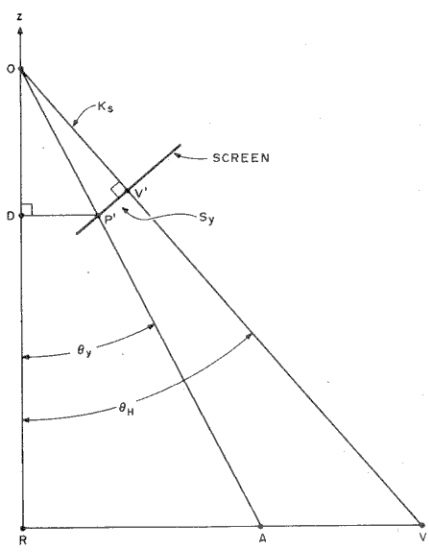

Fig. 3. ORV Plane.

Program Description

I declare certain variables integers to make the program run faster. The dimensioned variable holds the X,Y components of the projected figures. It can store fifty points, but you can raise this to your memory limit.

The first statement (OUT254,1) speeds up computers with Dennis Kitsz's speed-up modification (*80 Microcomputing*, February 1980). You can remove this but it should cause no problem if you do not have the mod.

The next routine requires the observer's position and a point in the center of vision. This routine prints the old (X,Y,Z) components for O and V so you can enter new viewpoints. To enter new coordinates type over the old ones, separating components with commas. Enter leaves the old data alone.

The routine in lines 160–220, the heart of the program, performs calculations. The program projects the vertices of the geometrical figures using data in lines 1000–1220.

After all the points have been projected properly, they are connected using the second block of data (lines 2000–2120). This routine gives the X,Y coordinates of the beginning and ending of the line, and calls the line drawing routine.

The next routine, called when computing the arc tangent, returns the angle in the correct quadrant. This routine allows you to view objects at any angle in any quadrant.

The line-drawing routine uses the equa-

Program Listing

```
5  '*-------------------------------------------------------------*
10 '*                THREE DIMENSIONAL GRAPHICS                   *
15 '*                                                             *
20 '*  WRITTEN BY - E. FOGELIN, 42K SOUTHWOOD APTS., AMHERST,     *
30 '*                MA. 01002.  COPYRIGHTED MARCH 1981.          *
40 '*-------------------------------------------------------------*

90 '
        INITIALIZATION OF VARIABLES.

100 OUT254,1:CLEAR300:CLS:DEFINTC,I,J,S,B,X-Z:DIMC(100):ONERRORG
OTO510
110 CX=63:CY=23:KS=500:PI=3.1415927:P2=PI/2:GOTO125
115 '
        INPUT OBSERVER'S POSITION AND POINT TO BE OBSERVED
        TO ESTABLISH THE VIEWING VECTOR.

120 RESTORE:A$="":FORI=15424TO15550:A$=A$+CHR$(PEEK(I)):NEXT
125 PRINT@4,XOCHR$(8)YOCHR$(8)ZO;:PRINT@0,;:INPUT"O";XO,YO,ZO:PR
INTLEFT$(A$,63);
130 PRINT@68,XVCHR$(8)YVCHR$(8)ZV;:PRINT@64,;:INPUT"V";XV,YV,ZV
140 PRINTRIGHT$(A$,63);:ID=1:AX=XV-XO:AY=YV-YO:GOSUB300:TA=AV
150 AY=SQR(AX[2+AY[2):AX=ZO-ZV:GOSUB300:TH=AV
155 '
        ROUTINE THAT COMPUTES THE X-Y SCREEN COORDINATES
        WITH THE PROPER PROJECTION.

160 READXP,YP,ZP:IFZP=-999CLS:GOTO230
170 XP=XP-XO:YP=YP-YO:Z=ZO-ZP
180 AY=YP:AX=XP:GOSUB300:T1=TA-AV:AR=COS(T1)*SQR(XP[2+YP[2)
185 AX=Z:IFZ>0THENAY=ABS(AR):GOSUB300:TX=AV*SGN(AR)ELSEAY=AR:GOS
UB300:TX=AV
190 T2=TH-TX:IFABS(T2)>=P2THENSX=936:GOTO220
200 SY=KS*TAN(T2):DS=SIN(TX)*SQR(SY[2+KS[2)
210 IFDS<>0THENSX=DS*TAN(T1)ELSESX=KS/COS(TH)*SQR(XP[2+YP[2)/Z*S
GN(T1):IFABS(T1)>P2THENSX=-SX
220 C(ID)=SX+CX:C(ID+1)=SY*.41+CY:ID=ID+2:GOTO160
```

Program continues

"If you desire curves, approximate them with a number of smaller segments."

Program continued

```
225 '
        ROUTINE THAT DETERMINES WHICH POINTS SHOULD BE
        CONNECTED WITH LINES.

230 READIP:IFIP=0THEN120
240 I1=C(IP*2-1):I2=C(IP*2):READIN
250 FORI=1TOIN:READJ:I3=C(J*2-1):I4=C(J*2):IFI1<>999ANDI3<>999G
OSUB400
260 NEXT:GOTO230
290 '
        ROUTINE TO PLACE ANGLES IN CORRECT QUADRANTS.

300 IFAX=0THEN340
310 AV=ATN(AY/AX):IFAX>0ANDAY>=0RETURN
320 IFAX>0ANDAY<0THENAV=AV+2*PI:RETURN
330 AV=AV+PI:RETURN
340 IFAY>=0THENAV=P2ELSEAV=3*P2
350 RETURN
390 '
        ROUTINE THAT CONNECTS TWO POINTS WITH A LINE.

400 IF(I1<0ANDI3<0)OR(I1>127ANDI3>127)RETURN
410 IF(I2<0ANDI4<0)OR(I2>47ANDI4>47)RETURN
420 I5=I3-I1:I6=I4-I2:IFI5=0THEN470ELSEA=I6/I5:IFI6=0THEN480
425 B1=I2-A*I1:B2=A*127+B1:IFA=0THEN440ELSEB3=-B1/A:B4=(47-B1)/A

430 IF(B1<0ORB1>47)AND(B2<0ORB2>47)AND(B3<0ORB3>127)AND(B4<0ORB4
>127)RETURN
450 IFFIX(A)=0FORX=I1TOI3STEPSGN(I5):Y=(X-I1)*A+I2+.5:SET(X,Y):N
EXT:RETURN
460 FORY=I2TOI4STEPSGN(I6):X=(Y-I2)/A+I1+.5:SET(X,Y):NEXT:RETURN

470 FORY=I2TOI4STEPSGN(I6):SET(I1,Y):NEXT:RETURN
480 FORX=I1TOI3STEPSGN(I5):SET(X,I2):NEXT:RETURN
500 '
        ERROR TRAP TO ALLOW SETTING POINTS OFF THE SCREEN.

510 RESUMENEXT
1000 '
        X, Y AND Z COORDINATES OF POLYGON VERTICES.

1010 DATA 10,40,0
1020 DATA 30,40,0
1030 DATA 20,49,0
1040 DATA 20,31,0
1050 DATA 20,40,40
1060 DATA 20,10,0
1070 DATA 20,30,0
1080 DATA 40,10,0
1090 DATA 40,30,0
1100 DATA 20,10,20
1110 DATA 20,30,20
1120 DATA 40,10,20
1130 DATA 40,30,20
1140 DATA 0,0,0
1150 DATA 0,10,0
1160 DATA 10,0,0
1170 DATA 10,10,0
1180 DATA 0,0,30
1190 DATA 0,10,30
1200 DATA 10,0,30
1210 DATA 10,10,30
1220 DATA -999,-999,-999
2000 '
        POINT TO POINT LINE DATA.

2010 DATA 1,2,3,4
2020 DATA 2,2,3,4
2030 DATA 5,4,1,3,2,4
2040 DATA 6,3,7,8,10
2050 DATA 9,3,7,8,13
2060 DATA 12,3,8,10,13
2070 DATA 11,3,7,13,10
2080 DATA 14,3,15,16,18
2090 DATA 17,3,15,16,21
2100 DATA 20,3,16,18,21
2110 DATA 19,3,15,21,18
2120 DATA 0
```

tion y = mx + b to compute intercepts and slopes. The routine does not draw lines that do not intersect the screen area. However, the routine draws all lines that appear even partially on the screen.

Because FC errors halt any program trying to set points off the screen, I used an On Error GOTO...Resume Next statement. The computer ignores the error arising from points set off-screen.

The data statements in lines 1000–1220 contain the vertices of the three geometrical figures in the photographs. Each point is on its own line.

When drawing geometrical figures, one point can be connected to more than one other point. Lines 2000–2120 describe which point should be connected to which other points. The first data statement says that point one (the vertex in line 1010) should be connected to 2 points: three and four (lines 1030 and 1040). The first number is the main point, the second is the number

$$\Theta_A = \tan^{-1}\left[(y_V - y_O)/(x_V - x_O)\right]$$

$$\Theta_P = \tan^{-1}\left[(y_P - y_O)/(x_P - x_O)\right]$$

$$\Theta_H = \tan^{-1}\left[\sqrt{(x_V - x_O)^2 + (y_V - y_O)^2}/(z_O - z_V)\right]$$

$$\overline{AR} = \cos(\Theta_A - \Theta_P)\sqrt{(x_P - x_O)^2 + (y_P - y_O)^2}$$

$$\Theta_y = \tan^{-1}\left[\overline{AR}/(z_O - z_P)\right]$$

$$S_y = K_S \tan(\Theta_H - \Theta_y) + C_y$$

$$\overline{DS} = \sin(\Theta_y)\sqrt{(S_y)^2 + (K_S)^2}$$

$$S_X = \overline{DS} \tan(\Theta_A - \Theta_P) + C_X$$

Table 2. Equations.

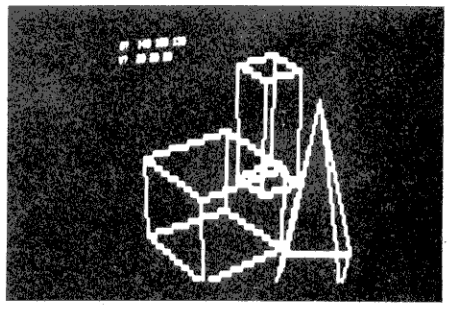

Photo 3

of points to be connected with lines, and the following numbers are the points to be connected. As with the first block of data statements, there should be one data statement for each group of line descriptions.

The first block of data ends with -999, -999,-999 to signal the end of the vertices. The second block of data must end with a zero for the same reason.

When you type in this program you can leave out the remark statements. Do not put the On Error GOTO statement in until you discover every typing error.

Limitations

Since the program draws an entire line even if the line has only a small section in the screen area, a lot of time is wasted drawing invisible lines. Alleviate this by breaking up long lines into smaller sections. If you desire curves, approximate them with a number of smaller segments.

Keep graph paper within arm's reach when you are placing objects in a developing universe. Determining vertices and their connection is a snap.

By increasing K_s, you produce a telephoto lens of any power. Experiment with this variable to yield interesting views. Decreasing K_s produces severe projection as in fish-eye lens views.

Remember you can observe objects from any position. All objects can be coplanar or floating in different areas of space.

Where do we go from here? 3-D graphic representation is a fascinating area of computer science. More sophisticated programs block objects behind others as the position of the observer changes. Real-time graphics make games exciting; engineers use them to study the design of buildings, airplanes and cars. ■

Eric Fogelin is an undergraduate at the University of Massachusetts where he majors in Astronomy and Computer Science.

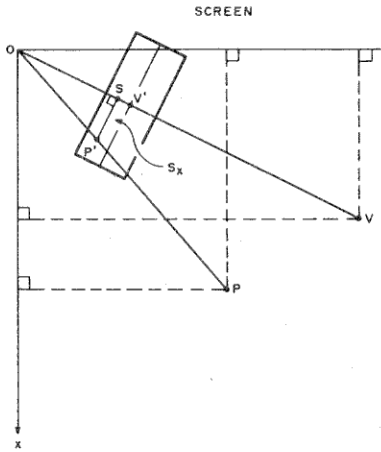

Fig. 4. XY Plane.

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Advanced graphics translated for the Color Computer.

Is a Rose in Color Still a Rose?

Roy Green
Box 2248
Athens, GA 30602

I recently bought a Color Computer and have been busy translating graphics programs. Bob Boothe's article "Advanced Graphics Techniques—Part II" (*80 Microcomputing*, May 1981) quickly caught my eye. Program Listing 1 is the Color Computer conversion of the figures in his article combined in a menu program. Note that using RUN instead of GOTO1 avoids a redimensioned array error with designs one and two.

I also could not resist Part III of Bob Boothe's graphics articles (*80 Microcomputing*, June 1981). Program Listing 2 produces a hat with visor, rotated on demand.

Program Listing 3 is a conversion of Howard Batie's "Supermaze" (*80 Microcomputing*, June 1981). This program, run on a 16K Extended Basic machine, comes within a few bytes of the stack area. To add new statements, remove remarks or combine lines.

Some machines may have problems with the POKE 65495,0 statement. If yours does, remove the statement.

I'd like to hear from people who have designed mazes or drawn new objects for the 3-D program. ■

Program Listing 1

```
1 'CONVERSION FOR TRS-80 COLOR COMPUTER OF A SERIES OF GRAPHICS
2 'PROGRAMS FROM THE ARTICLE 'ADVANCED GRAPHICS TECHNIQUES--PART
 II',
3 'WRITTEN BY BOB BOOTHE AND PUBLISHED IN THE MAY 1981 ISSUE OF
4 '80-MICROCOMPUTING, PP. 119-142.
5 'ARTICLE AND ORIGINAL PROGRAMS (C) 1981, 1001001 INC.
6 '
7 'COLOR COMPUTER VERSION (C) 1981, ROY GREEN.
8 '(16K extended basic required)
9 '
10 'initialize and present menu
20 PI=3.14159
30 CLS
40 PRINT"TRS-80 ARTIST":PRINTSTRING$(32,"-");
50 PRINT" CHOOSE ONE OF THE FOLLOWING:"
60 PRINTTAB(4)"1--DIAG. OF N-SIDED POLYGON"
70 PRINTTAB(4)"2--THE EYE!"
80 PRINTTAB(4)"3--MOIRE INTERFERENCE"
90 PRINTTAB(4)"4--THE TUNNEL"
100 PRINTTAB(4)"5--THE IRIS"
110 PRINTTAB(4)"6--THE ABYSS"
120 PRINTTAB(4)"7--FOUR LEAF ROSE"
130 PRINTTAB(4)"8--THE PILLOW"
140 PRINTTAB(4)"9--EIGHT LEAF ROSE"
150 PRINTTAB(3)"10--ARCHEMEDES'S SPIRAL I"
160 PRINTTAB(3)"11--ARCHIE'S SPIRAL II"
170 INPUT"WHICH ONE";A
180 IFA<1 OR A>11 THEN170
190 CLS:ON A GOTO1000,2000,3000,4000,5000,6000,7000,8000,9000,10
000,11000
200 '
210 'set up graphics screen
220 PMODE4,1:PCLS1:SCREEN1,0
```

Program Listing 1 Continues

The Key Box

Extended Color Basic
Color Computer
16K RAM

Program Listing 1 Continued

```
230 RETURN
300 '
310 'draw line
320 LINE(X1,Y1)-(X2,Y2),PRESET
330 RETURN
1000 '
1010 'design one
1020 INPUT"NUMBER OF POINTS";N
1030 DIMA(N),B(N)
1040 FORT=0TO2*PI-.001STEP2*PI/N
1050 Z=Z+1
1060 A(Z)=COS(T)*95+127:B(Z)=SIN(T)*95+96
1070 NEXTT
1080 GOSUB200
1090 FORS=1TO N-1:FORD=S+1TO N
1100 X1=FIX(A(S)):Y1=FIX(B(S))
1110 X2=FIX(A(D)):Y2=FIX(B(D))
1120 GOSUB300
1130 NEXTD,S
1140 FORI=1TO4000:NEXTI:RUN
2000 '
2010 'design two
2020 INPUT"NUMBER OF POINTS";N
2030 GOSUB200
2040 DIMA(N),B(N)
2050 FORQ=0TO191STEP6
2060 X1=0:Y1=Q:X2=Q:Y2=191
2070 GOSUB300
2080 X1=Q+3:Y1=0:X2=191:Y2=Q+3
2090 GOSUB300
2100 NEXTQ
2110 FORT=0TO2*PI-.001STEP2*PI/N
2120 Z=Z+1
2130 A(Z)=COS(T)*50+96:B(Z)=SIN(T)*50+96
2140 NEXTT:GOTO1090
3000 '
3010 'design three
3020 GOSUB200
3030 FORT=0TO PI/2 STEPPI/90
3040 X1=FIX(COS(T)*45):Y1=FIX(SIN(T)*45)
3050 X2=FIX(COS(T)*191):Y2=FIX(SIN(T)*191)
3060 GOSUB300
3070 X1=191-X1:Y1=191-Y1
3080 X2=191-X2:Y2=191-Y2
3090 GOSUB300
3100 NEXTT
3110 FORI=1TO4000:NEXTI:RUN
4000 '
4010 'design four
4020 GOSUB200
4030 X1=120:Y1=120
4040 FORQ=1TO32
4050 X2=X1+5*Q+3:Y2=Y1
4060 GOSUB300
4070 X1=X2:Y1=Y2+5*Q+3
4080 GOSUB300
4090 X2=X1-5*Q-6:Y2=Y1
4100 GOSUB300
4110 X1=X2:Y1=Y2-5*Q-6
4120 GOSUB300
4130 NEXTQ
4140 FORI=1TO4000:NEXTI:RUN
5000 '
5010 'design five
5020 GOSUB200
5030 FORT=0TO2*PI STEPPI/40
5040 X1=FIX(COS(T)*95+127):Y1=FIX(SIN(T)*95+96)
5050 A=T+3*PI/4
5060 X2=FIX(COS(A)*95+127):Y2=FIX(SIN(A)*95+96)
5070 GOSUB300
5080 NEXTT
5090 FORI=1TO4000:NEXTI:RUN
6000 '
6010 'design six
6020 GOSUB200
6030 FORT=0TO8.5*PI STEPPI/15
6040 X1=FIX(COS(T)*4*T+127):Y1=FIX(SIN(T)*4*T+96)
```

Program Listing 1 Continues

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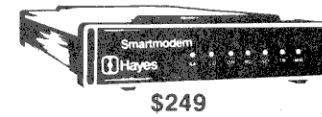

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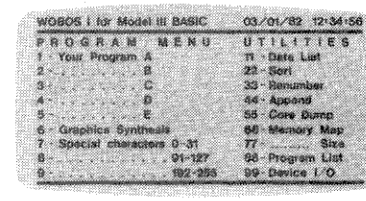

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Program Listing 1 Continued

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6050 A=T+2*PI/3
6060 X2=FIX(COS(A)*4*A+127):Y2=FIX(SIN(A)*4*A+96)
6070 GOSUB300
6080 NEXTT
6090 FORI=1TO4000:NEXTI:RUN
7000 '
7010 'design seven
7020 GOSUB200
7030 M=3:F=2
7040 FORT=0TO2*PI STEPPI/60
7050 R=COS(F*T)*95
7060 X1=FIX(COS(T)*R+127):Y1=FIX(SIN(T)*R+96)
7070 A=T+PI/M
7080 R2=COS(F*A)*95
7090 X2=FIX(COS(A)*R2+127):Y2=FIX(SIN(A)*R2+96)
7100 GOSUB300
7110 NEXTT
7120 FORI=1TO4000:NEXTI:RUN
8000 '
8010 'design eight
8020 GOSUB200
8030 M=2:F=2:GOTO7040
9000 '
9010 'design nine
9020 GOSUB200
9030 M=4:F=4:GOTO7040
10000 '
10010 'design ten
10020 GOSUB200
10030 FORT=0TO2*PI STEPPI/15
10040 R=T*17
10050 GOSUB12000
10060 NEXTT
10070 FORI=1TO4000:NEXTI:RUN
11000 '
11010 'design eleven
11020 GOSUB200
11030 R=1
11040 FORT=0TO3.24STEPPI/28
11050 R=R*1.17557
11060 GOSUB12000
11070 NEXTT
11080 FORI=1TO4000:NEXTI:RUN
12000 '
12010 'sub for ten and eleven
12020 X1=FIX(COS(T)*R+127):Y1=FIX(SIN(T)*R+96)
12030 X3=X1:Y3=Y1
12040 A=T+2*PI/3
12050 X2=FIX(COS(A)*R+127):Y2=FIX(SIN(A)*R+96)
12060 GOSUB300
12070 B=T+4*PI/3
12080 X1=FIX(COS(B)*R+127):Y1=FIX(SIN(B)*R+96)
12090 GOSUB300
12100 X2=X3:Y2=Y3
12110 GOSUB300
12120 RETURN
13000 '
13010 'to add a touch of "color",
13020 'change line 220 to read---
13030 '  "220 .........SCREEN1,1"
13040 '
13050 'to speed things up a bit,
13060 'type this before running---
13070 'POKE 65495,0
13080 'to slow back down, type--
13090 'POKE 65494,0
```

Program Listing 2

```
5 CLS:POKE65495,0
10 PRINT:PRINT"THREE DIMENSIONAL GRAPHICS FOR  THE TRS-80 COLOR
```

Program Listing 2 Continues

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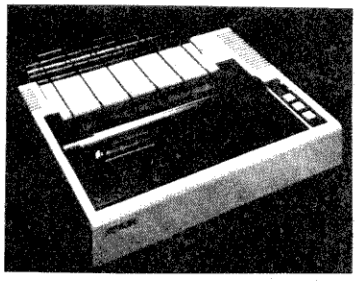

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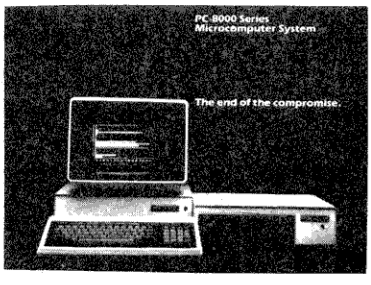

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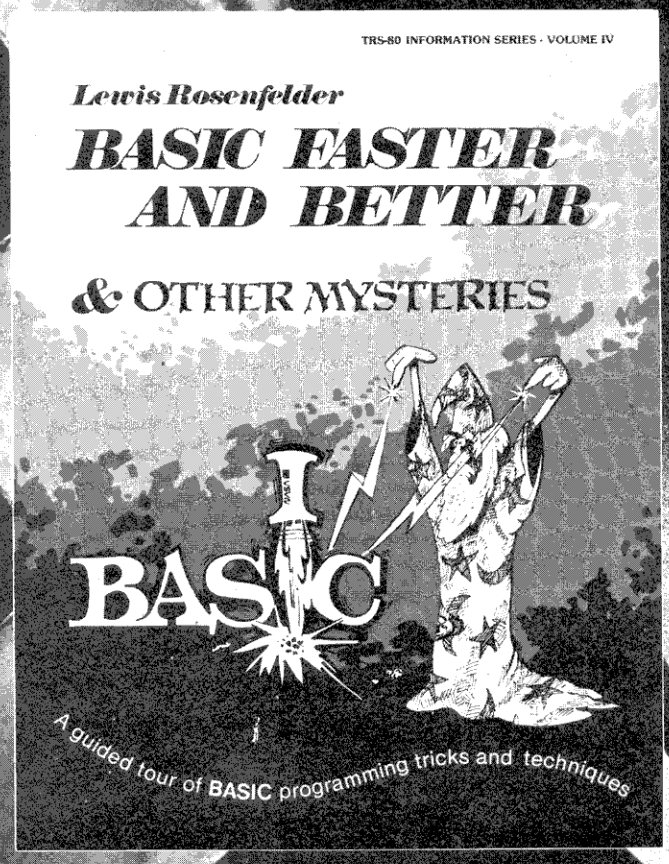

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3) All entries must be at least 6"x 4" and no larger than 8"x 10" in size.

4) Art or photographs, if used, must have been created by the entrant.

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6) This contest is valid from January 1, 1982 until May 1, 1982. Entries must be postmarked no later than May 1, 1982.

7) Participation in the Epson "Softwear" Sweepstakes is open to any except the following: employees of Epson America, Inc., its service agencies, or their families.

8) Winners will be notified by mail no later than June 1, 1982. A list of winners will be made available by sending a stamped, self-addressed envelope to Epson America, Inc., 3415 Kashiwa Street, Torrance, CA 90505.

9) Entries will be maintained on file at Epson America, Inc. until January 1, 1983.

10) Prizes are as follows: First prize includes round-trip economy air transportation for two to Tokyo, from the airport nearest the winner's place of residence, and six nights standard hotel accommodations, double occupancy. Trip does not include airport departure taxes, hotel service charges, cost of transportation or other expenses incurred before leaving the airport of initial departure, returning to Tokyo airport and returning home from the airport of initial departure; nor does it include meals or gratuities. Second prize consists of one Epson MX-100 Printer. Third prize consists of his and hers Seiko Quartz Watches. Additional prizes include 25 Micro-Nine Printheads, 50 Epson Digital Watches, and 100 Epson Ribbon Cartridges.

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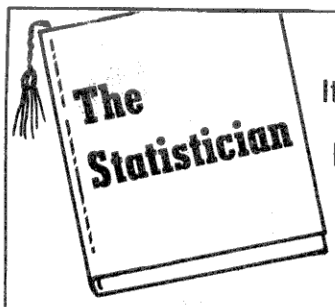
Program Listing 2 Continued

```
COMPUTER":PRINTSTRING$(32,"-");
15 PRINT:PRINT"ORIGINAL PROGRAM BY BOB BOOTHE":PRINT:PRINT"COLOR
 COMPUTER VERSION BY ROY GREEN 1981"
20 SCREEN0,1
25 FORI=1TO2000:NEXT
30 PRINT:PRINT"READING DATA":SCREEN0,1
40 PI=3.1415926
50 DIMX(100,2),Y(100,2),Z(100,2)
60 N=1
70 READX(N,1),Y(N,1),Z(N,1),X(N,2),Y(N,2),Z(N,2)
80 IFX(N,1)<>1000THENN=N+1:GOTO70
90 N=N-1
100 CLS:PRINTN"DATA LINES WERE READ"
110 PRINT:PRINTTAB(3)"1--ROTATE AROUND X AXIS"
120 PRINTTAB(3)"2--ROTATE AROUND Y AXIS"
130 PRINTTAB(3)"3--ROTATE AROUND Z AXIS"
140 PRINTTAB(3)"4--STRETCH OR SHRINK":PRINTTAB(3)"5--DISPLAY"
150 PRINTTAB(3)"6--END PROGRAM"
160 PRINT:INPUT"ENTER FUNCTION NUMBER";F
170 IFF<1 OR F>6THEN160
180 ON F GOTO190,190,190,500,600,800
190 INPUT"ENTER THE NUMBER OF DEGREES TO  ROTATE";D:PRINT"CALCUL
ATING..."
200 FORQ=1TON:FORB=1TO2:IFX(Q,B)=0OR Y(Q,B)=0ORZ(Q,B)=0THEN900:N
EXT:NEXT
210 ON F GOTO220,300,380
220 FORQ=1TON:FORB=1TO2
230 T=ATN(Z(Q,B)/Y(Q,B))+D*PI/180
240 IFY(Q,B)<0THENT=T+PI
250 R=SQR(Z(Q,B)[2+Y(Q,B)[2)
260 Y(Q,B)=COS(T)*R
270 Z(Q,B)=SIN(T)*R
280 NEXT:NEXT
290 CLS:GOTO110
300 FORQ=1TON:FORB=1TO2
310 T=ATN(Z(Q,B)/X(Q,B))+D*PI/180
320 IFX(Q,B)<0THENT=T+PI
330 R=SQR(Z(Q,B)[2+X(Q,B)[2)
340 X(Q,B)=COS(T)*R
350 Z(Q,B)=SIN(T)*R
360 NEXT:NEXT
370 CLS:GOTO110
380 FORQ=1TON:FORB=1TO2
390 T=ATN(Y(Q,B)/X(Q,B))+D*PI/180
400 IFX(Q,B)<0THENT=T+PI
410 R=SQR(Y(Q,B)[2+X(Q,B)[2)
420 X(Q,B)=COS(T)*R
430 Y(Q,B)=SIN(T)*R
440 NEXT:NEXT
450 CLS:GOTO110
500 INPUT"(ENTER A FACTOR FOR X, Y, AND Z  IN THAT ORDER";X,Y,Z
510 IFX=0ORY=0ORZ=0THENPRINT"ZERO IS INVALID. TRY AGAIN."ELSEPRI
NT"CALCULATING..."
520 FORQ=1TON:FORB=1TO2
530 X(Q,B)=X(Q,B)*X:Y(Q,B)=Y(Q,B)*Y:Z(Q,B)=Z(Q,B)*Z:NEXT:NEXT
540 CLS:GOTO110
600 CLS:PMODE4,1:PCLS1:SCREEN1,0
610 HY=Y(1,1):LY=HY:HZ=Z(1,1):LZ=HZ
620 FORQ=1TON:FORB=1TO2
630 IFY(Q,B)>HY THENHY=Y(Q,B)
640 IFY(Q,B)<LY THENLY=Y(Q,B)
650 IFZ(Q,B)>HZ THENHZ=Z(Q,B)
660 IFZ(Q,B)<LZ THENLZ=Z(Q,B)
670 NEXT:NEXT
680 W=HY-LY:IFHZ-LZ>W THENW=HZ-LZ
690 SY=-(HY+LY)/2:SZ=-(HZ+LZ)/2
700 FORQ=1TON
710 X1=INT(127.5+(Y(Q,1)+SY)/W*209):Y1=INT(95.5-(Z(Q,1)+SZ)/W*19
0)
720 X2=INT(127.5+(Y(Q,2)+SY)/W*209):Y2=INT(95.5-(Z(Q,2)+SZ)/W*19
0)
730 LINE(X1,Y1)-(X2,Y2),PRESET
740 NEXT
750 Z$=INKEY$:IFZ$=""THEN750
760 IFZ$="M"THENCLS:GOTO110:ELSE750
800 POKE65494,0:END
900 S=.001:FORQ=1TON:FORB=1TO2:X(Q,B)=X(Q,B)+S:Y(Q,B)=Y(Q,B)+S:Z
(Q,B)=Z(Q,B)+S:NEXT:NEXT:GOTO200
3000 'data
3010 DATA0,100,10,0,0,0
3020 DATA87,50,10,0,0,0
3030 DATA87,-50,10,0,0,0
3040 DATA0,-100,10,0,0,0
3050 DATA-87,-50,10,0,0,0
3060 DATA-87,50,10,0,0,0
3070 DATA0,100,10,0,125,100
3080 DATA87,50,10,108,63,100
```

Program Listing 2 Continues



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Program Listing 2 Continued

```
3090 DATA87,-50,10,108,-63,100
3100 DATA0,-100,10,0,-125,100
3110 DATA-87,-50,10,-108,-63,100
3120 DATA-87,50,10,-108,63,100
3130 DATA0,100,10,87,50,10
3140 DATA87,50,10,87,-50,10
3150 DATA87,-50,10,0,-100,10
3160 DATA0,-100,10,-87,-50,10
3170 DATA-87,-50,10,-87,50,10
3180 DATA-87,50,10,0,100,10
3190 DATA0,125,100,108,63,100
3200 DATA108,63,100,125,0,100
3210 DATA125,0,100,108,-63,100
3220 DATA108,-63,100,0,-125,100
3230 DATA0,-125,100,-108,-63,100
3240 DATA-108,-63,100,-108,63,100
3250 DATA-108,63,100,0,125,100
3260 DATA59,94,100,200,63,115
3270 DATA200,63,115,225,0,110
3280 DATA225,0,110,200,-63,115
3290 DATA200,-63,115,59,-94,100
3300 DATA89,40,20,103,40,80
3310 DATA103,40,80,103,-40,80
3320 DATA103,-40,80,89,-40,20
3330 DATA89,-40,20,89,40,20
3340 DATA92,30,30,92,10,30
3350 DATA92,10,30,101,30,70
3360 DATA101,30,70,101,10,70
3370 DATA101,10,70,92,30,30
3380 DATA92,-10,30,92,-30,30
3390 DATA92,-30,30,101,-30,70
3400 DATA101,-30,70,101,-10,70
3410 DATA101,-10,70,92,-10,30
3999 DATA1000,,,,,,
```

Program Listing 3

```
10 CLEAR100:CLS:PRINT"SUPERMAZE":PRINTSTRING$(32,"-");
20 PRINT"COPYRIGHT 1980"
30 PRINT"BY HOWARD BATIE"
40 PRINT"HERNDON, VA"
50 PRINT:PRINT"COLOR COMPUTER VERSION
60 PRINT"COPYRIGHT 1981"
70 PRINT"BY ROY GREEN"
80 PRINT"ATHENS, GA":SCREEN0,1
90 FORI=1TO2000:NEXT
100 CLEAR:DIMA(104),D(23)
110 FORI=0TO23:READD(I):NEXT
120 CLS:PRINT"WHICH MAZE DO YOU WANT"
130 LL=0:FORI=0TO5:PRINT@64+I*64,"MAZE #"D(4*I+LL)"IS"D(4*I+LL+1
)"BY"D(4*I+LL+2),"MINIMUM # OF MOVES IS"D(4*I+LL+3)
140 LL=0:NEXT
150 PRINT@22,"";:INPUTMN
160 IFMN>6ORMN<1THENPRINT@22,"      ";:GOTO150
170 CLS:IFMN=1THEN190
180 FORI=0TO(105*(MN-1))-1:READAA:NEXT
190 FORI=0TO104:READA(I):NEXT
200 E=0:X=A(100):D=2
210 CLS:PRINT@32,"YOU ARE IN A"A(103)"BY"A(104)"MAZE WITH"
220 PRINT"ELECTRIFIED WALLS.  FIND YOUR   WAY OUT IN THE LEAST N
UMBER OF  MOVES."
230 PRINT"MINIMUM NO. OF MOVES IS"A(102)"FOR"
240 PRINT"THIS MAZE."
250 PRINT:PRINT"MOVE FORWARD BY TYPING 'F',"
260 PRINT"TURN RIGHT BY TYPING 'R'"
270 PRINT"OR TURN LEFT BY TYPING 'L'."
280 PRINT:PRINT"TURNS TO THE RIGHT OR LEFT DO   NOT COUNT AS MOV
ES."
290 PRINT:INPUT"PRESS enter TO START";Z
300 GOSUB1600
310 CLS:PLAY"T50O5ABC"':PRINT@202,"MOVES:"Q;
320 'FORI=1TO500:NEXT
328 '
329 'set up graphics screen
330 PMODE4,1:PCLS1:SCREEN1,0
340 ON E+1 GOTO 350,400,450,500,550
348 '
349 'draw left wall or hall
350 IFVAL(MID$(B$,4,1))=0THEN390
360 LINE(208,5)-(208,180),PRESET
370 LINE(208,5)-(215,0),PRESET
380 LINE(208,180)-(215,191),PRESET:GOTO690
390 LINE(208,5)-(255,180),PRESET,B:GOTO690
400 IFVAL(MID$(B$,4,1))=0THEN440
410 LINE(188,20)-(188,148),PRESET
420 LINE(188,20)-(208,5),PRESET
430 LINE(188,148)-(208,180),PRESET:GOTO690
440 LINE(188,20)-(208,148),PRESET,B:GOTO690
450 IFVAL(MID$(B$,4,1))=0THEN490
460 LINE(171,32)-(171,121),PRESET
470 LINE(171,32)-(188,20),PRESET
480 LINE(171,121)-(188,148),PRESET:GOTO690
490 LINE(171,32)-(188,121),PRESET,B:GOTO690
500 IFVAL(MID$(B$,4,1))=0THEN540
510 LINE(156,43)-(156,97),PRESET
520 LINE(156,43)-(171,32),PRESET
530 LINE(156,97)-(171,121),PRESET:GOTO690
540 LINE(156,43)-(171,97),PRESET,B:GOTO690
550 IFVAL(MID$(B$,4,1))=0THEN590
560 LINE(145,51)-(145,80),PRESET
```

Program Listing 3 Continues

```
570 LINE(145,51)-(156,43),PRESET
580 LINE(145,80)-(156,97),PRESET:GOTO690
590 LINE(145,51)-(156,80),PRESET,B
688 '
689 'draw right wall or hall
690 ON E+1 GOTO700,750,800,850,900
700 IFVAL(MID$(B$,6,1))=0THEN740
710 LINE(47,5)-(47,180),PRESET
720 LINE(47,5)-(40,0),PRESET
730 LINE(47,180)-(40,191),PRESET:GOTO950
740 LINE(47,5)-(0,180),PRESET,B:GOTO950
750 IFVAL(MID$(B$,6,1))=0THEN790
760 LINE(69,20)-(69,148),PRESET
770 LINE(69,20)-(47,5),PRESET
780 LINE(69,148)-(47,180),PRESET:GOTO950
790 LINE(69,20)-(47,148),PRESET,B:GOTO950
800 IFVAL(MID$(B$,6,1))=0THEN840
810 LINE(87,32)-(87,121),PRESET
820 LINE(87,32)-(69,20),PRESET
830 LINE(87,121)-(69,148),PRESET:GOTO950
840 LINE(87,32)-(69,121),PRESET,B:GOTO950
850 IFVAL(MID$(B$,6,1))=0THEN890
860 LINE(103,43)-(103,97),PRESET
870 LINE(103,43)-(87,32),PRESET
880 LINE(103,97)-(87,121),PRESET:GOTO950
890 LINE(103,43)-(87,97),PRESET,B:GOTO950
900 IFVAL(MID$(B$,6,1))=0THEN940
910 LINE(114,51)-(114,80),PRESET
920 LINE(114,51)-(103,43),PRESET
930 LINE(114,80)-(103,97),PRESET:GOTO950
940 LINE(114,51)-(103,80),PRESET,B:GOTO950
950 IFQ=0THEN970
960 IF((X+(E*Y)=A(100))*(D=4))+((X+(E*Y)=A(101))*(D=2))THEN1100
968 '
969 'if wall ahead then draw and stop for move
970 IFVAL(MID$(B$,3,1))=1THEN990
980 GOTO1050
990 ON E+1 GOTO 1000,1010,1020,1030,1040
1000 LINE(47,5)-(208,180),PRESET,B:GOTO1100
1010 LINE(69,20)-(188,148),PRESET,B:GOTO1100
1020 LINE(87,32)-(171,121),PRESET,B:GOTO1100
1030 LINE(103,43)-(156,97),PRESET,B:GOTO1100
1040 LINE(114,51)-(145,80),PRESET,B:GOTO1100
1050 E=E+1:IFE>4THEN1100
1060 GOSUB1600
1070 GOTO340
1098 '
1099 'check for move or turn
1100 M$=INKEY$:IFM$=""THEN1100
1110 E=0:IFM$="F"THEN1150
1120 IFM$="R"THEN1220
1130 IFM$="L"THEN1260
1140 GOTO1100
1149 'move forward
1150 IF(X=A(100))*(D=4)THEN1300
1160 IF(X=A(101))*(D=2)THEN1350
1170 GOSUB1640
1180 IFVAL(MID$(B$,3,1))=1THEN1310
1190 Q=Q+1:X=X+Y
1200 GOSUB1600
1210 GOTO310
1219 'turn right
1220 D=D+1:IFD<5THEN1240
1230 D=1
1240 GOSUB1600:PLAY"ADB"
1250 GOTO330
1259 'turn left
1260 D=D-1:IFD>0THEN1280
1270 D=4
1280 GOSUB1600:PLAY"DAC"
1290 GOTO330
1298 '
1299 'ending messages
1300 CLS:PRINT@204,"YOU LOSE":PLAY"O1GL2C":PRINT@232,"OUT AT ENT
RANCE!":GOTO1360
1310 SCREEN0,0:FORZ=1TO30:CLS:PRINT@201,"ZZZAAAPPP!!!":PLAY"O5T1
50E":CLS0:PLAY"C":NEXT
1320 CLS:PRINT@201,"ZZZAAAPPP!!!"
1330 PRINT"YOU JUST RAN INTO....                    THE ELECTRIFIE
D WALL!!!!"
1340 GOTO1360
1350 CLS:PRINT@198,"YOU WIN IN"Q"MOVES":PRINT@229,A(102)"IS MINI
MUM SCORE":PLAY"T6O3L4CFAL4.O4CL8.O3AL1O4C"
1360 PRINT:PRINT
1370 PRINT"DO YOU WANT TO TRY AGAIN? (Y/N)"
1380 M$=INKEY$:IFM$=""THEN1380
1390 IFM$="Y"THENRESTORE:GOTO100
```

Program Listing 3 Continues

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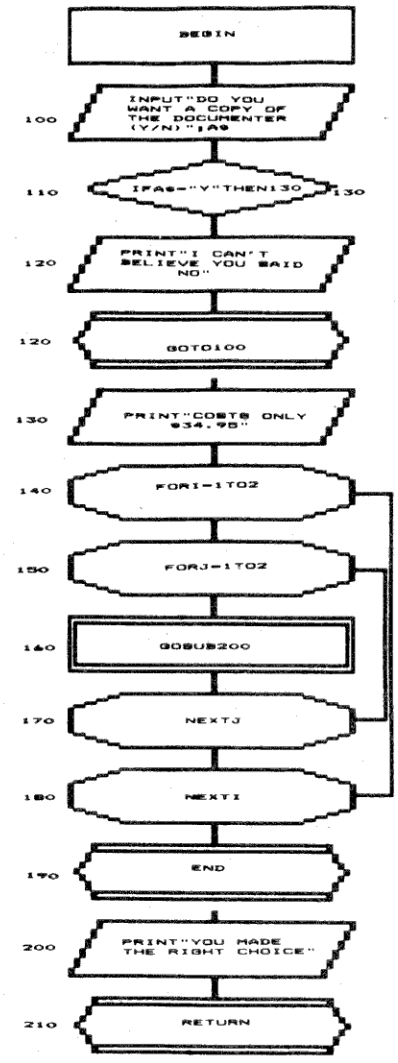

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1400 IFM$="N"THEN1420
1410 GOTO1380
1420 CLS:PRINT"OK. COME BACK WHEN YOU'RE READY.":END
1598 '
1599 'update direction
1600 IFD=1THENY=-10
1610 IFD=2THENY=1
1620 IFD=3THENY=10
1630 IFD=4THENY=-1
1640 B$=STR$(A(X+(Y*E)))
1650 IFD=1THEN1710
1660 FORI=2TOD
1670 B4=VAL(MID$(B$,4,1)):B5=VAL(MID$(B$,5,1))
1680 B6=VAL(MID$(B$,6,1)):B3=VAL(MID$(B$,3,1))
1690 P=10000+B4*1000+B5*100+B6*10+B3
1700 B$=STR$(P):NEXT
1710 RETURN
2000 'array d
2010 DATA1,8,7,14,2,8,8,20,3,7,10,23,4,10,8,29,5,10,10,38,6,10,1
0,45
3000 'array a
3010 'maze one
3020 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,0,0
3030 DATA11001,11010,11100,11011,11100,11011,11000,11100,0,0,100
11,11100,10111,11001,10010,11110,10101,10101,0,0,11101,10101,110
11,10100,11101,11001,10110,10001,0,0,10000,10000,11100,10011,101
00,10101,11011,10110,0,0
3040 DATA10111,10101,10011,11000,10000,10010,11010,11100,0,0,110
01,10010,11100,10101,10011,11100,11101,10101,0,0,10011,11010,101
10,10011,11110,10011,10010,10110,0,0,60,57,14,8,7
3050 'maze two
3060 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
3070 DATA11101,11011,11000,11010,11000,11010,11100,11101,0,0
3080 DATA10011,11010,10000,11110,10011,11010,10100,10101,0,0
3090 DATA11001,11100,10001,11100,11001,11110,10001,10100,0,0
3100 DATA10101,10101,10111,10101,10101,11001,10110,10111,0,0
3110 DATA10000,10000,11010,10000,10100,10001,11010,11100,0,0
3120 DATA10101,10111,11101,10101,10101,10011,11100,10011,0,0
3130 DATA10001,11110,10001,10100,10011,11110,10101,11101,0,0
3140 DATA10011,11010,10110,10011,11010,11110,10011,10110,0,0,60,
77,20,8,8
3150 'maze three
3160 DATA11001,11010,11100,11011,11000,11000,11100,0,0,0
3170 DATA10000,11100,10111,11101,10101,10101,10111,0,0,0
3180 DATA10101,10011,11000,10000,10110,10101,11101,0,0,0
3190 DATA10011,11100,10111,10111,11001,10010,10100,0,0,0
3200 DATA11101,10001,11000,11100,10101,11011,10110,0,0,0
3210 DATA10011,10110,10101,10111,10001,11110,11101,0,0,0
3220 DATA11001,11000,10110,11001,10010,11110,10101,0,0,0
3230 DATA10101,10101,11101,10101,11011,11000,10110,0,0,0,10001,1
0010,10100,10001,11010,10100,11001,0,0,0,10111,11011,10110,10011
,11110,10011,10110,0,0,0,10,86,23,7,10
3240 'maze four
3250 DATA11011,11010,11000,11100,11001,11010,11000,11110,11011,1
1100,11001,11110,10101,10111,10011,11100,10101,11011,11100,10101
,10101,11101,10011,11000,11010,10110,10101,11011,10100,10101,101
00,10011,11000,10110,11001,11110,10001,11100,100
3260 DATA10001,11100,10001,11010,10100,11001,10100,10111,10001,1
1100,10101,10111,10101,11011,10110,10101,10101,11001,10110,10011
,10001,11010,10110,11101,11101,10101,10001,10110,11101,11101,100
11,11010,11010,10110,10011,10110,10011,11010,100
3270 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,30,59,29,10,8
3280 'maze five
3290 DATA11001,11010,11100,11011,11100,11001,11110,11011,11100,1
1101,10100,11101,10001,11000,10110,10101,11001,11000,10010,10100
,10101,10011,10110,10101,11101,10011,10100,10111,11101,10001,100
01,11010,11000,10010,10110,11101,10011,11000,101
3300 DATA10011,11110,10101,11001,11010,10100,11101,10101,11011,1
0110,11001,11010,10100,10111,11011,10000,10110,10101,11001,11100
,10101,11011,10110,11101,11101,10101,11011,10010,10100,10111,100
01,11010,11000,10110,10011,10000,11000,11110,100
3310 DATA10101,11101,10101,11011,11100,10101,10101,11001,10000,1
1110,10011,10110,10011,11010,10010,10110,10011,10110,10011,11110
,10,29,38,10,10
3320 'maze six
3330 DATA11001,11000,11010,11100,11001,11100,11011,11100,11011,1
1100,10111,10101,11101,10101,10111,10101,11001,10000,11010,10100
,11000,10010,10110,10001,11000,10110,10101,10011,11110,10101,101
01,11011,11000,10110,10011,11110,10011,11100,110
3340 DATA10011,11110,10101,11011,11000,11110,11101,10101,10111,1
0101,11001,11010,10000,11110,10101,11101,10011,10100,11101,10101
,10011,11110,10101,11001,10100,10011,11010,10000,10110,10101,110
01,11010,10100,10111,10001,11010,11010,10100,110
3350 DATA10011,11100,10011,11110,10101,11101,11101,10101,10011,1
1010,11011,10010,11010,11010,10010,10010,10110,10011,11010,11110
,20,89,45,10,10
```
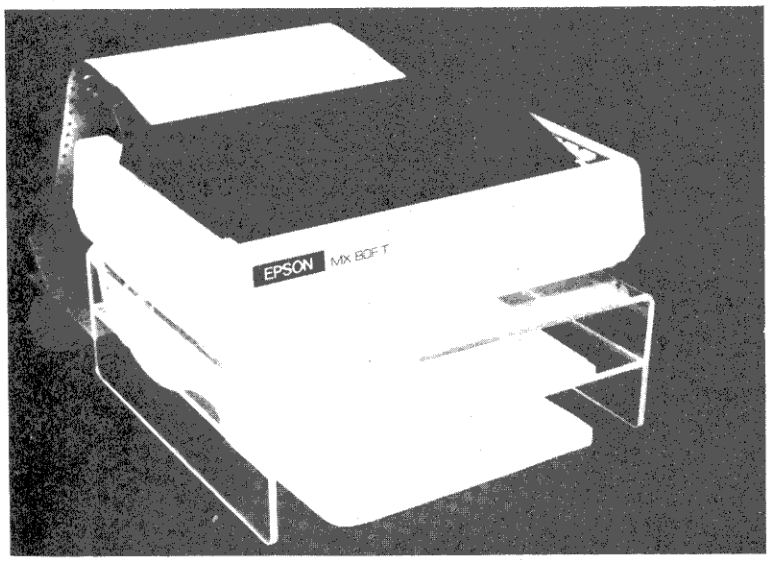

MX-80/100 OWNERS



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Large w/shelf (300021) **49.95**

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LOAD 80

Use prime numbers to label the items in a DB.

Priming the Data Base

Stuart F. Ring
106 Marble Drive
Rochester, NY 14615

Did you ever wonder how much you spent in a given month on house maintenance? Would you like a list of tax deductable family medical expenses? Create data files and search through them quickly for information on any topic or combination of topics, using numbers formed as the products of prime numbers with this routine. A prime number is a number having no factor except itself and one: 2, 3, 5, 7 and 211 are prime numbers.

Theory

A product of a set of prime numbers is unique; no other set of prime numbers can form that product. For example, $2 \times 3 \times 5 = 30$ cannot be formed by multiplying any other combination of prime numbers.

The Key Box

Basic Level II
Model I or III
16K RAM

File Creation

To create files for fast sequential searches, label each file record with a number which is the product of a set of prime numbers. Let this number represent the topics in that record.

Let's create a filing system for monthly expenses (see Fig. 1). We label the data (in this case the dollar amount for monthly expense) with the product of prime numbers representing a topic. For example, let the prime number 2 be used for house expense; let 3 represent a modifier (adjective) such as maintenance; and let 5 represent another modifier such as the month of July. Label record data with products of these prime numbers. The label for an expenditure of $10 for house paint in July would be $2 \times 3 \times 5 = 30$ and the file record would be Record Number 0-30-$10 (as in Fig. 1).

By being inventive in assigning prime numbers to topics and modifiers, a single number can closely resemble a sentence description of the record data. This is a very concise way to store information about a record. This compactness is especially useful for the home microcomputer system, using minimal memory.

The Search

Having successfully labeled and stored the information, use the uniqueness of the prime number product to retrieve it. Divide each record label by the prime number representing the topic we wish to retrieve. If the result is an integer, the record label had that number as one of its factors and we have a match. If the result is not an integer there is no match.

To search for items pertaining to combinations of topics, multiply the prime numbers for each search topic and its modifiers. Divide each label by the resulting product; if an integer results we have a match for that combination. If the result is not an integer there is no match and we continue our search through the file.

Take our $10 expenditure for house paint with the prime number product 30 as an example. The prime number for housing expenditures is 2; dividing 30 by 2 gives the integer 15 and a match. If our search were for medical expenses with a topic prime number of 11, the result would not be an integer and we would not have a match. If our search were specifically housing expenditures in July the search label would be $2 \times 5 = 10$ and the search quotient (30 divided by 10) would be the integer 3.

Using the products of prime numbers to label data enables us to store all catagorizing information in one double-precision number, much more concise than word labels. Searches for combinations of topics are no more time-consuming than searching for data on a single topic. The accuracy of this program is limited by the accuracy of the search division. Round off or truncation errors will cause the process to fail. The Basic program in this article handles four-level description labels using TRS-80 Level II double-precision numbers. Be sure to test your accuracy before expanding this concept ad infinitum. Any categorized information is a likely candidate for this approach.

Program Operation

The TRS-80 Level II Basic program included with this article is a data base of records of home expenses. As listed, it stores 500 records consisting of a double-precision label, S#, and the data, S1. The program stores and retrieves records from tape. When in use, all records are in memory.

The program asks if you want

to read the tape records, add new records to the file, search the file, or quit.

The program requests up to four topics (prime numbers) and the dollar amount for the record to be added. To correct a record, call Fix; the program asks for the record number, prime number product and dollar amount for the corrected record. This Fix routine assumes that you arrive at the Fix prime number product on your calculator, and that you use Fix because of a keystroke error. If you expect to change records frequently, alteration should be an element in the main menu.

The Search portion of the program asks for up to four topics (prime numbers representing key-words). After the search is complete, a list of the results is displayed. This list includes the record number, product of the key-word prime numbers, the dollar amount, and a cumulative total of the dollar amounts.

After adding records or searching your data base, Quit asks if you want to create a tape. The tape file is then completely rewritten. It is good practice to make one or more backup copies.

Table 1 lists the prime numbers and their corresponding key-words. When a search is performed the topics, not the prime numbers, are listed. Change this table to suit your applications.

The tape files created include a record count, and ten-record data blocks. This file structure reduces the number of relay actuations and compresses the tape length.

The multiple line calculation of the prime number product is necessary to prevent loss of significant digits during multiplication. Check the accuracy of this product (and the division in the search process) if you change the number of search levels or expand the prime number (key-word) table.

Do not overlook the power of the multi-level searches. Be creative selecting topics and modifiers for your key-word list. It will take some experience to develop the most useful key-words for your application.■

Record Number	Topic(s)/Label	Data
0	PN1 × PN2 × PN3 × PN3	$
1	PN4	$
2	PN2 × PN5	$
3	PN1 × PN7 × PN5	$
.	-	-
.	-	-

Fig. 1. Monthly Expense File.

2	Sue	97	
3	Stu	101	
5	Matt	103	
7	Andy	107	
11	House	109	
13	Car	113	
17	Medical	127	
19	Dental	131	
23	Gasoline	137	
29	Gas	139	
31	Electricity	149	January
37	Water	151	February
41	Entertainment	157	March
43	Clothes	163	April
47	Medicine	167	May
53	Garbage	173	June
59	Telephone	179	July
61	Insurance	181	August
67	Maintenance	191	September
71	Toys	193	October
73	Donations	197	November
79		199	December
83		1	Null
89			

Table 1. Prime Numbers and Key Words.

```
10 CLEAR:
20 'PRIME NUMBER PRODUCT SEARCH ROUTINE BY S.F. RING
30 CLS:PRINT "HOME DATA BASE":PRINT
40 DIM S#(500),S1(500),PN(50),PA$(50):DEFINT I-N
50 PN(0)=2:PN(1)=3:PN(2)=5:PN(3)=7:PN(4)=11:PN(5)=13:PN(6)=17:PN
(7)=19:PN(8)=23:PN(9)=29:PN(10)=31:PN(11)=37:PN(12)=41:PN(13)=43
:PN(14)=47:PN(15)=53:PN(16)=59:PN(17)=61:PN(18)=67:PN(19)=71:PN(
20)=73:PN(21)=79:PN(22)=83:PN(23)=89:PN(24)=97:
60 PN(25)=101:PN(26)=103:PN(27)=107:PN(28)=109:PN(29)=113:PN(30)
=127:PN(31)=131:PN(32)=137:PN(33)=139:PN(34)=149:PN(35)=151:PN(3
6)=157:PN(37)=163:PN(38)=167:PN(39)=173:PN(40)=179:PN(41)=181:PN
(42)=191:PN(43)=193:PN(44)=197:PN(45)=199:PN(46)=1
70 PA$(0)="SUE":PA$(1)="STU":PA$(2)="MATT":PA$(3)="ANDY":PA$(4)=
"HOUSE":PA$(5)="CAR":PA$(6)="MEDICAL":PA$(7)="DENTAL":PA$(8)="GA
SOLINE":PA$(9)="GAS":PA$(10)="ELECTRICITY":PA$(11)="WATER":PA$(1
2)="ENTERTAINMENT":PA$(13)="CLOTHES":
80 PA$(14)="MEDICINE":PA$(15)="GARBAGE":PA$(16)="TELEPHONE":PA$(
17)="INSURANCE":PA$(18)="MAINTAINANCE":PA$(34)="JANUARY":PA$(35)
="FEBUARY":PA$(36)="MARCH":PA$(37)="APRIL":PA$(38)="MAY":PA$(39)
="JUNE":PA$(40)="JULY":PA$(41)="AUGUST"
90 PA$(42)="SEPTEMBER":PA$(43)="OCTOBER":PA$(44)="NOVEMBER":PA$(
45)="DECEMBER":PA$(46)="NULL":PA$(19)="TOYS":PA$(20)="DONATIONS"

100 INPUT "DO YOU WISH TO READ IN DATA? YES OR NO";D$
110 IF D$="NO" GOTO 170
120 INPUT "HIT ENTER WHEN RECORDER IS READY";D$
130 INPUT #-1,N
140 FOR I=0 TO N STEP 10
150 INPUT #-1,S#(I),S1(I),S#(I+1),S1(I+1),S#(I+2),S1(I+2),S#(I+3
),S1(I+3),S#(I+4),S1(I+4),S#(I+5),S1(I+5),S#(I+6),S1(I+6),S#(I+7
),S1(I+7),S#(I+8),S1(I+8),S#(I+9),S1(I+9)
160 NEXT I
170 CLS:INPUT "DO YOU WISH TO ADD DATA, SEARCH, OR QUIT?
                                ENTER 'ADD', 'SEARCH', OR 'QUIT'";A$
180 IF A$="ADD" GOTO 470
190 IF A$="SEARCH" GOTO 230

200 IF A$="QUIT" GOTO 650
210 GOTO 170
220 'SEARCH ROUTINE
230 CLS: PRINT "SEARCH":PRINT
240 RESTORE:D$="NO"
250 DATA 1,1,1,1: READ N1,N2,N3,N4
260 INPUT "ENTER UP TO FOUR TOPICS";N1,N2,N3,N4
270 P1#=N1*N2
280 P2#=N3*N4
290 P#=P1#*P2#
300 NR=0:  SM=0: CLS:
310 GOSUB 840
320 PRINT  "SEARCH TOPICS ":PRINT:PRINT  Q1$,Q2$,Q3$,Q4$:PRINT
330 PRINT "RECORD","PRODUCT","$ AMOUNT","$ SUM"
340 FOR I=0 TO 499
350 IF S1(I)=0 GOTO 430
360 RS#=S#(I)/P#
370 IF (RS#-FIX(RS#)) <> 0 THEN NEXT I
380 NR=NR+1
390 SM=SM+S1(I)

400 PRINT I,S#(I),S1(I),SM
410 NEXT I
420 GOTO 440
430 PRINT "THAT'S ALL"
440 INPUT "ENTER 'EXIT' IF YOU ARE FINISED ELSE HIT 'ENTER'";D$
450 IF D$<>"EXIT" GOTO 230 ELSE GOTO 170
460 'ROUTINE TO ADD MORE FILE DATA
470 CLS: PRINT "ADD DATA":PRINT
480 D$="NO"
490 FOR I=0 TO 499 :'FIND LAST RECORD
500 IF S1(I)=0 THEN I1=I ELSE NEXT I
510 READ N1,N2,N3,N4:DATA 1,1,1,1
520 RESTORE
530 PRINT:INPUT "ENTER UP TO FOUR TOPICS FOR EACH RECORD";N1,N2,
N3,N4
540 INPUT "ENTER DOLLAR AMOUNT";S1(I1)
550 P1#=N1*N2
560 P2#=N3*N4
570 S#(I1)=P1#*P2#
580 PRINT "THIS IS RECORD NUMBER  ";I1
590 I1=I1+1

600 PRINT "ENTER  'FIX'  IF YOU NEED TO CORRECT A RECORD"
610 INPUT "ENTER 'EXIT' IF FINISHED ELSE HIT 'ENTER'";D$
620 IF D$="FIX" GOSUB 770
630 IF D$<>"EXIT" GOTO 510 ELSE GOTO 170
640 'QUIT ROUTINE - SAVE THE DATA
650 CLS:INPUT "DO YOU WANT TO SAVE THE DATA";X1$
660 IF  X1$="YES" THEN GOTO 670 ELSE END
670 FOR I=0 TO 499:'FIND LAST RECORD
680 IF S1(I)=0 THEN B=I ELSE NEXT I
690 N=FIX(B/10)*10 + 10

700 INPUT "SAVE DATA - HIT ENTER WHEN THE TAPE IS READY";D$
710 PRINT #-1,N
720 FOR I=0 TO N STEP 10
730 PRINT #-1,S#(I),S1(I),S#(I+1),S1(I+1),S#(I+2),S1(I+2),S#(I+3
),S1(I+3),S#(I+4),S1(I+4),S#(I+5),S1(I+5),S#(I+6),S1(I+6),S#(I+7
),S1(I+7),S#(I+8),S1(I+8),S#(I+9),S1(I+9)
740 NEXT I
750 END
760 'ROUTINE TO REPAIR A RECORD
770 CLS:PRINT "FIX ROUTINE"
780 INPUT "ENTER RECORD NUMBER";IK
790 PRINT "NUMBER","PRODUCT","AMOUNT"
800 PRINT IK,S#(IK),S1(IK)
810 INPUT "ENTER NEW PRODUCT, AMOUNT";S#(IK),S1(IK)
820 D$="GO"
830 RETURN
840 FOR K=0 TO 50
850 IF N1=PN(K) THEN Q1$=PA$(K)
860 IF N2=PN(K) THEN Q2$=PA$(K)
870 IF N3=PN(K) THEN Q3$=PA$(K)
880 IF N4=PN(K) THEN Q4$=PA$(K)
890 NEXT K
900 RETURN
```

Program Listing

LOAD 80

The Key Box

Basic Level II
Model I or III
16K RAM

Author Boothe is up to his graphic tricks again.

Save All Humans

Bob Boothe
4651 Browndeer Lane
R.H.E., CA 90274

I first saw a game similar to this on a Wang computer at a computer show. The animation was very well done, so I decided to experiment with the TRS-80's block graphics.

The program takes about twenty seconds to initialize the strings representing the running men, the ship and the enemy saucer.

The game uses your skill level (from 0 to 100) to compute the number of ships, the number of enemies and the size of the enemy ships. You get one to seven ships to fight 10 to 30 enemies in six different enemy vessels.

Your object is to protect the humans from the attacking flying saucers. Move your ship with the left and right arrows, and fire with the spacebar.

Four figures make up each step of the runner. Either pause the game while the men are running or break the program and Print G$(1), G$(2), G$(3), G$(4) to see each figure. Lines 420 to 590 contain graphics data for the figures. Lines 610 to 700 concatenate the data into string variables and lines 720 to 820 display the running figures.

Control characters 24, 25, 26, 27 move the cursor without destroying characters. Three sequences of four graphics characters, a CHR$(26) (moving the cursor vertically down one line) and four CHR$(24)'s (backspaces) make up each figure.

Lines 320 to 360 combine random graphics blocks into a rectangle and repeat several rectangles on top of each other to produce the explosion. Problems arise when the strings print over any edge of the screen; I treated the human at the right edge separately.

When all of the humans are killed the program clears the string space and packs strings into circle patterns. Wait about forty seconds and the program will display its work, or press Enter to play another game.

I used integer Basic, variables instead of constants and made multi-statement lines, but the game still moves rather slowly. A compiled version of the program might be challenging.■

Program Listing

```
100 ' THIS PROGRAM WAS WRITTEN BY BOB BOOTHE
110 '                              4651 BROWNDEER LANE
120 '  DATE = JULY 25, 1981        R. H. E., CA  90274
130 REMBRANDT WAS A PAINTER
140 CLEAR 2000:CLS
150 DEFINT A-Z:F3=15360:TT=2000:T2=32
160 INPUT"WHAT IS YOUR RATING (0=REALLY BAD, 100=ACE)";R
170 IFR<0ORR>100THENR=50
180 PRINT@128,"YOUR DUTY IS TO PROTECT THE POPULATION OF THIS PL
ANET FROM AN"
190 PRINT"INVASION FROM OUTER SPACE.  YOU WILL BE GIVEN A SMALL
FLEET OF"
200 PRINT"FLYING SAUCERS WITH WHICH YOU MUST DESTROY THE LARGER
ENEMY"
210 PRINT"FLEET.  THE ENEMIES ARE RANDOMLY BOMBING THE PLANET FR
OM ABOVE."
220 PRINT"YOUR SHIP WILL BE AT BOTTOM.  TO MOVE YOUR SHIP, HOLD
DOWN THE"
230 PRINT"ARROW KEYS.  THE SPACE BAR IS USED TO FIRE. REMEMBER,
YOUR JOB"
240 PRINT"IS TO PROTECT THE HUMANS BELOW YOUR SHIP.  --GOOD LUCK
--"
250 TS=INT((100-R)/15)+1:TE=INT(R/5)+10
260 IFR<40THENE$=" "+CHR$(184)+CHR$(190)+CHR$(191)+CHR$(188)+CHR
$(144)+" ":GOTO290
270 IFR<70THENE$=" "+CHR$(184)+CHR$(190)+CHR$(189)+CHR$(180)+" "
:GOTO290
280 IFRND(4)=1THENE$="  "+CHR$(181)+CHR$(191)+CHR$(186)+" ":ELSE
IFRND(3)=1THENE$="  "+CHR$(157)+CHR$(140)+CHR$(174)+" ":ELSEIFRN
D(2)=1THENE$="  "+CHR$(153)+CHR$(140)+CHR$(166)+" ":ELSEE$="  "+
CHR$(187)+CHR$(140)+CHR$(183)+" "
290 PRINT@0,"HUMANS REMAINING =  0   YOUR SHIPS = 0   ENEMY SHIP
S =  0"
300 TH=13
310 PRINT@36,TS;:PRINT@54,TE;
320 FORQ=1TO6:RESTORE:FORE=1TO4:FORW=1TO4:READG:X$=X$+CHR$(G):NE
XT:X$=X$+STRING$(4,24):NEXT:NEXT:X$=" "+X$+"    "
330 DATA 145,137,32,145, 160,129,150,144, 134,134,160,164, 136,1
76,137,138
340 A=4:FORQ=1TO8:GOSUB1710:HX$=HX$+A$+CHR$(26):GOSUB1710:HX$=HX
$+A$+CHR$(26):GOSUB1710:HX$=HX$+A$+STRING$(2,27):NEXT
350 HX$=HX$+"    "+STRING$(4,24)+CHR$(26)+"    "+STRING$(4,24)+C
HR$(26)+STRING$(4,176)
360 A=3:FORQ=1TO10:GOSUB1710:SH$=SH$+A$+CHR$(26):GOSUB1710:SH$=S
H$+A$+CHR$(26):GOSUB1710:SH$=SH$+A$+STRING$(2,27):NEXT
370 SH$=SH$+"    "+STRING$(3,24)+CHR$(26)+"    "+STRING$(3,24)+CHR
$(26)+STRING$(3,176)
380 MI(1)=63:MI(2)=191:MI(3)=319
390 MA(1)=122:MA(2)=250:MA(3)=378
400 S(1)=TT:S(2)=TT:S(3)=TT
410 EL(1)=TT:EL(2)=TT:EL(3)=TT
420     DATA  32, 32, 32, 32
430     DATA  32, 32, 32, 32
440     DATA 176,176,176,176
450 DATA  32, 32,136,156
460 DATA  32,160,186,191
470 DATA 178,179,184,190
480     DATA  32, 32,172,132
490     DATA  32, 32,191,149
500     DATA 184,190,184,190
510 DATA  32,136,156, 32
520 DATA  32,174,191,132
530 DATA 184,190,186,177
540     DATA  32,172,132, 32
550     DATA  32,191,149, 32
560     DATA 187,191,176,176
570 DATA  32,172,132, 32
580 DATA 135,191,151,133
590 DATA 184,181,189,176
600 DIM G$(5)
610 FOR F=0TO5
620 FOR L=0TO2
630 FOR B=1TO4
640 READ C
650 G$(F)=G$(F)+CHR$(C)
660 NEXT
670 IFF=1ANDL<>2THENG$(F)=G$(F)+" "+CHR$(26)+STRING$(5,24):GOTO6
90
680 IF L<>2THENG$(F)=G$(F)+CHR$(26)+STRING$(4,24)
690 NEXT
700 NEXT
710 PRINT@960,STRING$(63,176);:SET(126,47):SET(127,47)
720 FOR M=1TO12
730 PRINT@18,M;
740 FL=827+M*5
750 SL=890:IFINT(M/2)=M/2THENSL=SL-1
```

Program continues

Program continued

```
760 FOR P=SLTOFLSTEP-2
770 FOR F=1TO4
780 PRINT@P,G$(F);
790 NEXT
800 NEXT
810 PRINT@FL,G$(5);
820 NEXT
830 PRINT@18,13;
840 PRINT@892,LEFT$(G$(5),4);
850 PRINT@956,MID$(G$(5),10,4);
860 PRINT@1020,MID$(G$(5),19,3);
870 PRINT@64," ":FORQ=1TO7:PRINT:NEXT
880 SL=796:S$=" "+CHR$(156)+CHR$(156)+CHR$(191)+CHR$(172)+CHR$(1
72)+" "
890 FOR ES=1TO3
900 IFSL=0THENPC=PC+1:PRINT@36,TS-1;:IFPC<12THEN970ELSEPC=0:TS=T
S-1:SL=796:IFTS=0THEN1520
910 K=PEEK(15168):IFKANDT2THENSL=SL-1
920 IFKAND64THENSL=SL+1
930 IFSL>826THENSL=826
940 IFSL<767THENSL=767
950 PRINT@SL,S$;
960 Z$=INKEY$:IFZ$=" "THENIFB=<64THENB=SL-61:IFPEEK(B+F3)<>T2THE
N1150ELSEPOKEB+F3,191:GOTO980
970 IFB>63THENPOKEB+F3,T2:B=B-64:IFB>63THENIFPEEK(B+F3)<>T2THEN1
170ELSEPOKEB+F3,191
980 IF TE<3THENIFEL(ES)=TTTHEN1050ELSE1000
990 IFEL(ES)=TTTHENEL(ES)=RND(2)*1000-1000:GOTO1010
1000 EL(ES)=EL(ES)+D(ES)
1010 IFEL(ES)<MI(ES)THENEL(ES)=MI(ES):D(ES)=1
1020 IFEL(ES)>MA(ES)THENEL(ES)=MA(ES):D(ES)=-1
1030 IFRND(30)=1THEND(ES)=-D(ES)
1040 PRINT@EL(ES),E$;
1050 SW=SW+1:IFSW<3THEN1140
1060 FORQ=1TO3:IF(S(Q)>959)AND(S(Q)<1024)THENPOKES(Q)+F3,176
1070 NEXT
1080 IFS(1)>959THENIF(EL(2)<EL(1)+122OREL(2)>EL(1)+134)AND(EL(3)
<EL(1)+246OREL(3)>EL(1)+266)THENS(1)=EL(1)+67:IFPEEK(S(1)+F3)<>T
2THENS(1)=TT:GOTO1100ELSEPOKES(1)+F3,191:GOTO1100
1090 IFS(1)<960THENPOKEF3+S(1),T2:S(1)=S(1)+64:IFPEEK(F3+S(1))<>
T2THEN1200ELSEPOKES(1)+F3,191
1100 IFS(2)>959THENIF(EL(3)<EL(2)+122OREL(3)>EL(2)+134)THENS(2)=
EL(2)+67:IFPEEK(S(2)+F3)<>T2THENS(2)=TT:GOTO1120ELSEPOKES(2)+F3,
191:GOTO1120
1110 IFS(2)<960THENPOKEF3+S(2),T2:S(2)=S(2)+64:IFPEEK(F3+S(2))<>
T2THEN1230ELSEPOKES(2)+F3,191
1120 IFS(3)>959THENS(3)=EL(3)+67:IFPEEK(S(3)+F3)<>T2THENS(3)=TT:
GOTO1140ELSEPOKES(3)+F3,191:GOTO1140
1130 IFS(3)<960THENPOKEF3+S(3),T2:S(3)=S(3)+64:IFPEEK(F3+S(3))<>
T2THEN1260ELSEPOKES(3)+F3,191
1140 NEXT:GOTO890
1150 POKEB+F3,T2:IFS(1)=BTHENS(1)=TTELSEIFS(2)=BTHENS(2)=TTELSEI
FS(3)=BTHENS(3)=TT
1160 B=0:GOTO980
1170 POKEB+F3,T2:IFS(1)=BTHENS(1)=TT:GOTO1160ELSEIFS(2)=BTHENS(2
)=TT:GOTO1160ELSEIFS(3)=BTHENS(3)=TT:GOTO1160
1180 TE=TE-1:PRINT@54,TE;:PRINT@EL(INT((B+100)/128)),X$;:IFTE=0T
HEN1340
1190 EL(INT((B+100)/128))=TT:B=0:GOTO980
1200 POKES(1)+F3,191:IFS(1)=BTHENPOKES(1)+F3,T2:S(1)=TT:B=0:GOTO
1100
1210 IFS(1)>767ANDS(1)<832THENPRINT@SL,X$;:S(1)=TT:SL=0:GOTO1120

1220 BN=1:GOSUB1290:GOTO1100
1230 POKES(2)+F3,191:IFS(2)=BTHENPOKES(2)+F3,T2:S(2)=TT:B=0:GOTO
1120
1240 IFS(2)>767ANDS(2)<832THENPRINT@SL,X$;:S(2)=TT:SL=0:GOTO1140

1250 BN=2:GOSUB1290:GOTO1120
1260 POKES(3)+F3,191:IFS(3)=BTHENPOKES(3)+F3,T2:S(3)=TT:B=0:GOTO
1120
1270 IFS(3)>767ANDS(3)<832THENPRINT@SL,X$;:S(3)=TT:SL=0:GOTO1140
1280 BN=3:GOSUB1290:GOTO1140
1290 DL=S(BN):IFDL>959THENRETURN
1300 TH=TH-1:PRINT@18,TH;
1310 S(BN)=TT:IFDL>895THENDL=DL-64
1320 DL=DL-832:DL=INT(DL/5)*5+832:IFDL<892THENPRINT@DL,HX$;:IFTH
=0THEN1720ELSERETURN
1330 POKE16319,T2:PRINT@DL,SH$;:IFTH=0THEN1720ELSERETURN
1340 FORQ=1TO3:IFS(Q)>0ANDS(Q)<960THENPOKES(Q)+F3,T2
1350 NEXT
1360 PRINT@SL,"      ";
1370 PRINT@257,"   * * * * YOU HAVE SAVED THE WORLD FROM DESTRUC
TION * * * *";
1380 PRINT@404,"THE HUMANS JUMP FOR JOY";
1390 R=R+TH*3-3+TS*TS:IFR>100THENR=100
1400 PRINT@516,"YOUR NEW RATING IS";R;"  PRESS <ENTER> TO PLAY A
GAIN"
1410 S=896:FORL=1TOTH
1420 IFPEEK(S+F3)=135THENJ(L)=S-128:S=S+5ELSES=S+5:GOTO1420
1430 NEXT
1440 J$=" "+CHR$(176)+CHR$(144)+CHR$(26)+STRING$(3,24)+CHR$(141)
+CHR$(190)+CHR$(156)+CHR$(133)+CHR$(26)+STRING$(4,24)+CHR$(152)+
CHR$(131)+CHR$(137)+CHR$(144)+CHR$(26)+STRING$(4,24)+STRING$(4,1
76)
1450 G$(5)="    "+CHR$(26)+STRING$(4,24)+G$(5)
1460 J=RND(TH)
1470 PRINT@J(J),J$;
1480 FORQ=1TO145:NEXT
1490 PRINT@J(J),G$(5);
1500 Z$=INKEY$:IFZ$<>CHR$(13)THEN1460
1510 RUN
1520 FORQ=1TO3:IFS(Q)>0ANDS(Q)<960THENPOKES(Q)+F3,T2
1530 NEXT:PRINT@263,"YOUR ENTIRE FLEET OF SHIPS HAS BEEN DESTROY
ED"
1540 PRINT@399,"THE SURVIVORS RUN FOR SHELTER";
1550 R=INT(R*.9)-TE:IFR<0THENR=0
1560 PRINT@523,"YOU HAVE BEEN DEMOTED TO A RANK OF";R;
1570 PRINT@590,"PRESS <ENTER> TO REDEEM YOURSELF"
1580 FORM=1TO13
1590 IFPEEK(16251+M*5)<>135THEN1690
1600 SL=826+M*5:IFM=13THENSL=SL-1
1610 FL=833:IFM=1THEN1690
1620 FORP=SLTOFLSTEP-2
1630 FORF=1TO4
1640 PRINT@P,G$(F);
1650 NEXT
1660 NEXT
1670 PRINT@FL,G$(0);
1680 TH=TH-1:PRINT@18,TH;:NEXT
1690 NEXT
1700 Z$=INKEY$:IFZ$=CHR$(13)THENRUNELSE1700
1710 A$="":FORW=1TOA:A$=A$+CHR$(128+RND(63)):NEXT:A$=A$+STRING$(
A,24):RETURN
1720 PRINT@268,"THE ENTIRE POPULATION HAS BEEN DECIMATED";
1730 PRINT@396,"tHE PLANET WILL BE DESTROYED IN 40 SECONDS";
1740 R=INT(R*.9)-TE:IFR<0THENR=0
1750 PRINT@528,"YOUR RANK HAS BEEN LOWERED TO";R;
1760 PRINT@591,"PRESS <ENTER> TO PLAY ANOTHER GAME";
1770 CLEAR:DIMC$(6)
1780 FORR=1TO6
1790 SX=0:SY=R:LX=0:LY=0
1800 FORT=.1TO6.4STEP1/R
1810 IFLX<SXTHENC$(R)=C$(R)+CHR$(25):LX=LX+1:GOTO1810
1820 IFLX>SXTHENC$(R)=C$(R)+CHR$(24):LX=LX-1:GOTO1820
1830 IFLY<SYTHENC$(R)=C$(R)+CHR$(26):LY=LY+1:GOTO1830
1840 IFLY>SYTHENC$(R)=C$(R)+CHR$(27):LY=LY-1:GOTO1840
1850 C$(R)=C$(R)+CHR$(128+RND(63))+CHR$(24):SY=INT(COS(T)*R):SX=
INT(SIN(T)*R*5):NEXT
1860 Z$=INKEY$:IFZ$=CHR$(13)THENRUN
1870 NEXT
1880 CLS:FORR=1TO6:PRINT@480,C$(R);:NEXT
1890 Z$=INKEY$:IFZ$=CHR$(13)THENRUN
1900 GOTO1880
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64K of RAM for the Color Computer.

RAM Wars

Shawn A. McClenahan
11347 Emelita Street #4
North Hollywood, CA 91601

The TRS-80 Color Computer has a major shortcoming—a limited amount of RAM memory. With piggy backing RAM chips or inserting Spectral Associates' innovative Ramcharger board you can expand the memory from a dismal 4K to a comfortable 32K bytes. However, piggy backing takes careful soldering skills, perhaps the ingenious use of single pin sockets fashioned from 16 pin IC sockets for the Row Address Strobe (RAS) line connections, and a muffin fan atop the case to forestall overheating. Installing Spectral's excellent board depends on how carefully Tandy put the IC sockets on the main board. I went through four Tandy boards, and the sockets were not properly aligned on any. If you have successfully implemented one of the above modifications, the efficient code and memory handling of the 6809 MPU allows your 32K to approach the 48K of some other machines. But, considering the derision of some 48/56/64K machine users, many Color users seek ever more RAM. Some are never satisfied. Thus the "RAM Wars" began.

Fearlessly I answered the call to battle and took a Spectral Associates 8K Eprom board, changed eprom pin 21 to the R/W* line and mounted four 200 nanosecond (nsec) TMM2016, 2K by 8 static RAM chips, mapped from &HC000 to &HDFFF. This is for an adaptation of TSC's FLEX 9.0 DOS and is mounted on my 12 slot expansion board. I used the fast static chips to allow faster, address dependent, clock speed (POKE 65495,0 or LDX #$FFD7; STA, X),

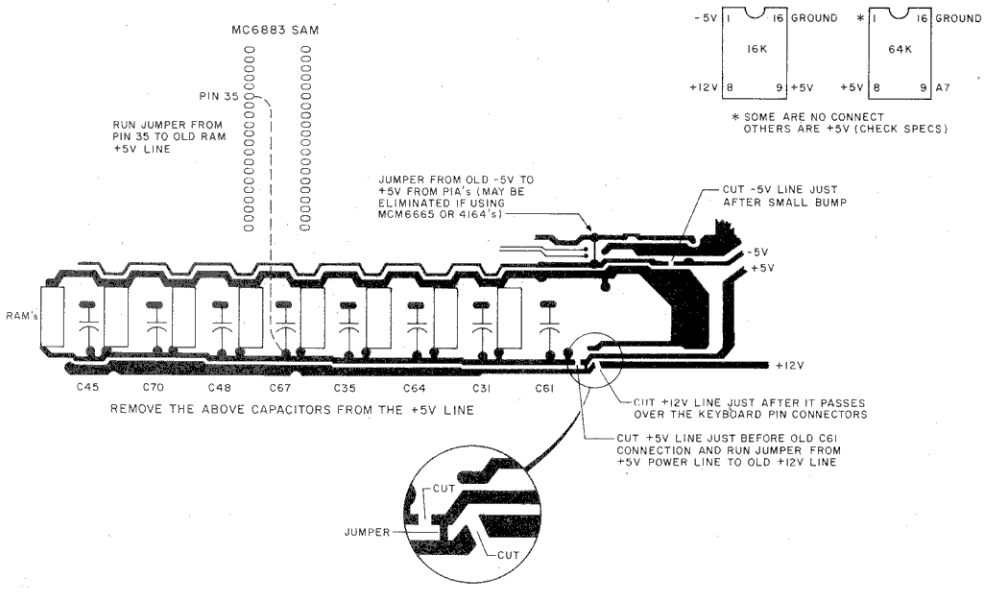

Fig. 1A

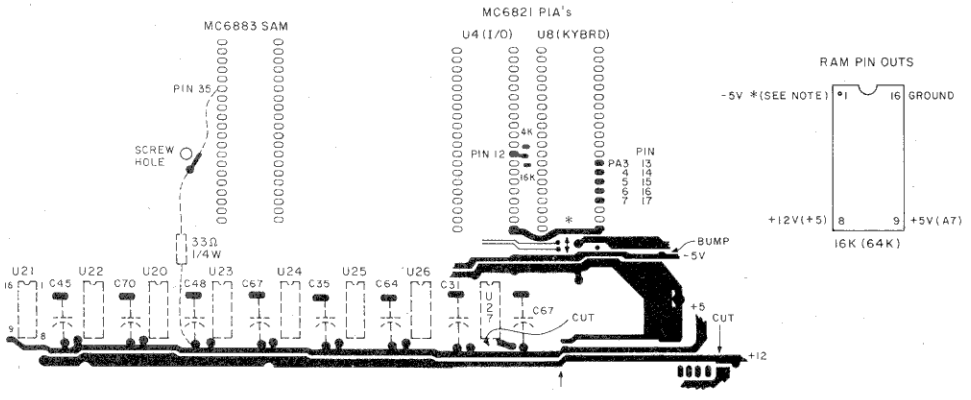

Fig. 1B

The Key Box

Color Computer

and a minimum of hardware. I have heard of some putting 8K RAM in the Extended Basic ROM memory area and using the address decoder disable bus pin (SLENB* pin 40) to switch between RAM and ROM. With 32K below that you have 40K of contiguous memory.

If you put another 16K RAM on the external bus, you can have 56K. This large amount of external hardware places an added load on the Color Computer's none too massive power supply. The solution is to add an external power supply.

Enter into the battle the available-for-free-just-for-the-asking Motorola MC6883 SAM information sheet. Ever since I read those two 32K byte pages of RAM were possible in lower 32K memory I have lusted for the answer. It was obvious that 64K RAM chips were necessary (use dynamic chips in the Color Computer). Change a few traces (the 64K chips use only +5V and need one more address line) and remove the capacitors from what used to be the +5V line (it becomes the new address line MA7). See Fig. 1. If you modified the video display for dual 32K RAS, return it to the original configuration as you are back to just one RAS line again. This means you can put a video display anywhere in the 64K RAM area. Plus, the 64K chips use less power than the 16K. Trace changes are for the A-B series of boards. The E series has three jumpers that can be changed easily for 64K chips.

But it is not that simple. According to a Motorola warning the MC6883 must be set for the RAM size chips you are using before you write to any RAM. Since the Color Computer writes to lower RAM as part of the initialization process, it seems prudent to ensure it knows it has 64K RAM chips buried within. If you do not, it is unlikely the chips will be destroyed, but refresh will not be proper and you will lose data on reset.

You cannot change the Basic ROM but you can fool the machine into seeing something it thinks came from the ROM. In the Color Computer the ROM on powerup or reset configures the two MC6821s (PIAs), clears &HFF22 and then steps through the even MC6883 SAM control registers (STA ,X++) clearing them as an added precaution on powerup and to reinitialize the system on reset. After this the X register contains &HFFEO. Next it ANDs the contents of &HFF22 (ANDA#4, the A register containing the contents of &HFF22 from a previous LDA 2,X). If the memory size jumper is grounded

- Remove the motherboard from the case and detach the ground shield.
- Cut the +5V trace just under chip U27 (arrow).
- Cut the +12V trace where it crosses over the right side of the keyboard connectors.
- Cut the −5V line just after the bump, or disable entirely by removing R67 (1.2K ohms) at the far lower left side of the board.
- Remove capacitors C45, 70, 48, 67, 35, 64, and 31 from the top of the board. C61 may be left in place.

There may be two holes in this area that you can use.

- Scrape the green film from the area indicated by the up arrow, and then solder a jumper from the +5V line to the old +12V line.
- Drill a hole just large enough to pass a 33 ohm resistor lead through (#58 drill—.042") right below the screwhole to the left (from the bottom) of the MC6883 SAM. Check to make sure no traces are cut and that you clear the plastic post underneath the board. Solder one end of the 33 ohm resistor into the hole formerly occupied by C48 on the old +5V line. Pass the other end through the hole and solder an insulated wire from that end to the pin 35 pad of the SAM. Make sure the lead will not interfere with the reinstallation of the RF ground shield.
- With the most commonly available 64K RAMs pin 1 need not be connected to anything. However, some chips need +5V. If after checking the specifications for your chips you find you need +5V on pin 1, solder a jumper from the old −5V line to +5V line at double arrows.
- Re-install ground shield and motherboard in case.

Fig. 1

CONVERT YOUR SERIAL PRINTER TO PARALLEL

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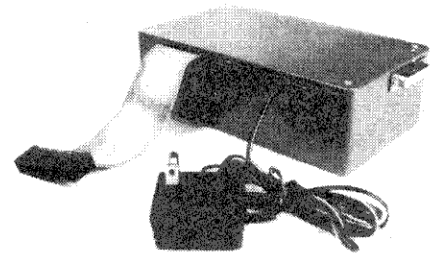

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(4K) the result is zero and it skips one instruction (BEQ AO6C). If the jumper is to +5V (16K), the result is not zero, the next instruction is executed (STA -5,X), the X register is backed up five places from &HFFEO resulting in the A register being loaded into &HFFDB. The MC6883 SAM is now set for 16K dynamic RAM. If you change the last instruction to STA -3,X (A71D) the MC 6883 would be set for 64K dynamic RAM. All you need change is one byte at &HAO6B so the CPU sees byte 1D on the data bus instead of 1B.

One external solution is to decode the address bus so that at &HAO6B you deselect the internal ROM, using the SLENB* bus line, and put byte 1D on the data bus. You can mount a device like that shown in Fig. 2 externally on the expansion bus but it requires another edgeboard connector to replace the one taken to allow further system expansion. The easy solution, short of a double-sided printed circuit board with plated holes, is to wire wrap the circuit on a Vector 4609 proto-board. I used this method on the buffered card to my expansion unit. If you try to mount this unit internally, be prepared for any number of placement/mounting/location problems—not to mention soldering about 20 jumpers to the motherboard. Since the data does not have to be stable until 90 nsec before the E clock falls you have plenty of time for decoding and will be online with byte 1D even before E rises. Further, this solution allows the use of either the slow or fast clock speeds (&HAO6B will be addressed only at the slow speed).

The second solution is to mount a board into the ROM socket itself but instead of putting a whole byte on the bus it swaps the D1 and D2 lines from the ROM (thus 1B, 0001 1011 becomes 1D, 0001 1101). This solution uses three chips, a double sided PC board (preferably with plated holes), and does not need jumpers. (See Fig. 3.) A four chip solution would put a whole byte on the data bus like Fig. 2 but the extra chip would be needed to deselect the ROM or its output. The immediate problem with four chips is that there is nowhere to put all of them—three is tight enough. I have not worked out this design or PC layout because it does not offer any advantage over solution Two. If I add up the worst case propagation delays for the decoder and multiplexor versus the maximum access time of the MC68A364 ROM chip there is a strong possibility that, at the fast clock speed, there will be a loss of data coming from the ROM. At the slow (normal) clock speed there is no problem with timing but since the ROM D1 and D2 lines must always go through the 74LS257 multiplexor there can be timing problems

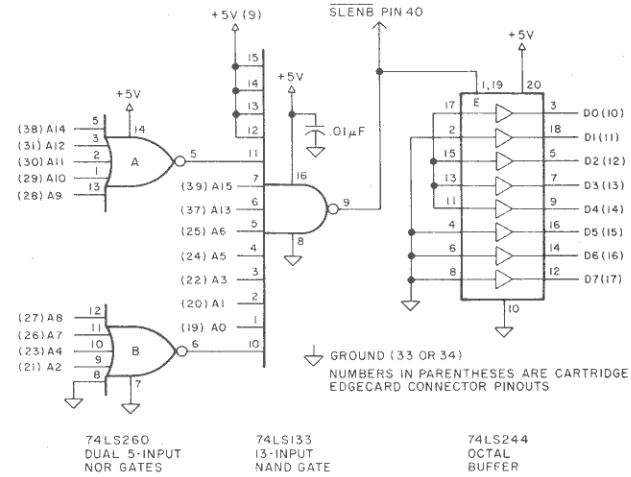

Fig. 2

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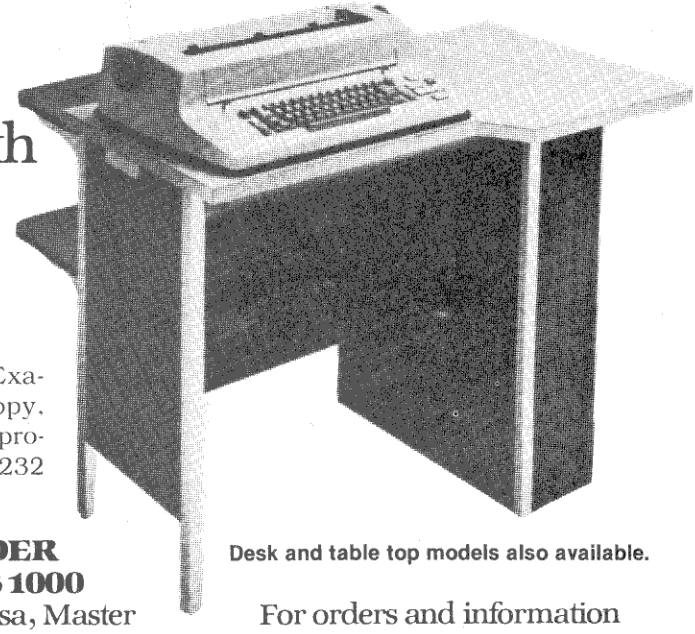

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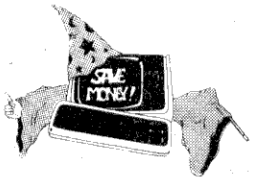

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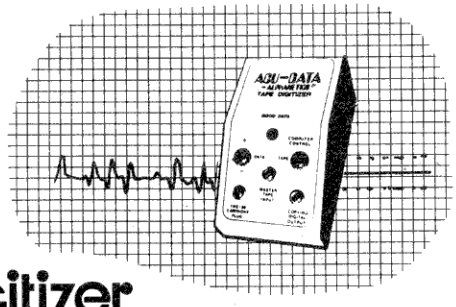

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*From a review in September-October 1980 Elementary Electronics. Reprints available upon request. ✓113

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at the fast clock speed (1.8MHz).

However, if you foresee using the Color Computer only at the normal clock speed, constructing the ROM satellite board is straightforward. Use a regular, low profile 24 pin socket for the ROM and use the thinnest diameter pins you can find (try the GC Electronics line of PC connectors) for easier and safer insertion into the onboard ROM socket. Solder the pins so that they do not interfere with mounting the ROM on the satellite board and so that they come down far enough out of the board. Since most of us do not have facilities for plating holes, be ready to solder connections on both sides of the board. You may want to use Molex IC pins for remounting the ROM as these would be easier to get to for soldering on top of the board. To conserve space solder the 74LS chips directly to the board. Use a capacitor for decoupling the power line. Fig. 4 is a suggested printed circuit layout.

You could apply the above deselection principle for changing other ROM functions. You may like the Color Computer to jump to another location when you insert a cartridge. If so, change &HA10B from C0 to anything from 00 to FF. At this new location (or even still at &HC000) you may insert another initialization routine to set the Color Computer for 64K static RAM (requires two different registers set, and therefore another ROM) and to always run at the fast clock speed. To get back try JMP A10D. You may even try a circuit that executes this jump to a different location only on powerup or reset.

Now that you have your Color Computer's traces all set and the auto-initializer constructed and inserted it is simple to bank select between the upper and lower 32K banks of RAM. In Basic POKE &HFFD5,0 to get to the upper page and POKE &HFFD4 to get back to the lower page. In assembly language LDX #$FFD5:STA ,X for the upper and LDX #$FFD4:STA ,X for the lower (it does not matter what the contents of register A are). Keep in mind that on powerup or after reset you will always be in the lower page (#0) and will then have to jump to the upper page (#1). Since the Color Computer will not find the proper pointers in the upper page of RAM it is not presently usable for Basic. At the present time proper utilization depends on having a driver routine in external RAM or ROM even for machine language use.

It appears I have answered my own question about whether future Color Computer Basic ROMs will support 64K. While at the Glendale Computer Center I saw a 32K RAM machine that had a 1.1 Basic ROM. When I PEEKed &HA06B I got 2 back. Radio Shack changed the initialization routine. When I got back to North Hollywood my Radio Shack Computer Store representative read me a bulletin about the new 32K upgrade kit using a different ROM. The clincher was that this ROM (part number AXX3052), which also corrects the multiple keypress problem, sends eight bit words out on the serial port (and hopefully corrects the DLOADM command). It would only be sold with the 32K upgrade kit.

I ordered this ROM, inserted it, powered up and disassembled it. This ROM initializes for 4K, 16K and 32K/64K. The routine steps through the SAM registers as before and then stores

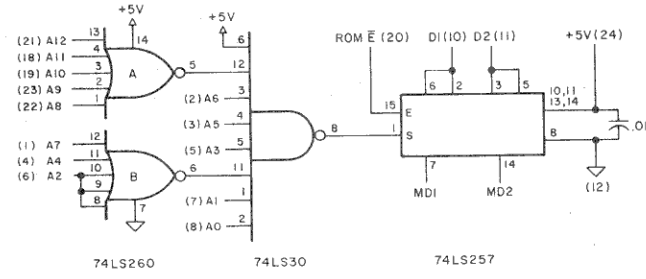


Fig. 3

hex F8 in the keyboard PIA output register (&HFF03). It then checks &HFF22s bit 2. If this bit is zero, the Computer initializes for 4K; if not, it goes to the next instruction. &HFF03 is then cleared and &HFF22 bit 2 is again checked. If not zero, it goes to the next instruction which decrements the U register by two. With the next instruction storing the A register another three bytes below, making the back up total five, &FFDB is set and the CPU initializes for 16K RAMs. If the result of the second test is zero, it branches over the minus 2 decrement, executes the STA -3,U, backing up only three bytes, setting &HFFDD and we have 64K auto-initialization.

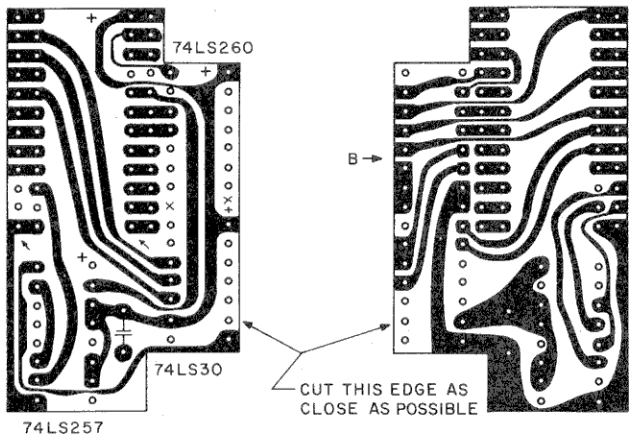
The ROM checks &HFF03 to see if 30K/64K is in the machine and so you must run a jumper from PIA U8 to PIA U4. The byte stored at &HFF03 for the test had a value of &HF8 with a bit pattern of 1111 1000. Therefore run that jumper from pin 12 of U4 to any one of pins 13, 14, 15, 16, or 17 of U8.

However, since future programs will probably have subroutines to see what size RAM you have and since I do not know for sure which of the above U8 pins is the right one I suggest the following. Remove the 4K/16K jumper, wire wrap the center post, cut the wire with enough room to go to any of the above pins going directly over U8, strip the insulation off the end and push it into the socket next to U8 pin 17. This may change in the future if Tandy goes to 64K chips. You can easily make the correct selection with the above method.

A memory management operating system is not available yet. When 64K prices drop enough Tandy may offer to pull your 4/16/32Ks and plug in 64Ks (plus installation charges and a new ROM). There is a monitor available from Sound Center Radio Shack, NM, that provides some functions for using 64K.

No, the other designs are not now obsolete. Tandy may yet implement the "no sale" provision, forcing you to a satellite or outboard arrangement for your auto-initialization. The principles are still quite useful.

Warning! You take full responsibility for any modifications to your machine. Since Radio Shack refuses to repair any Color Computer with cut traces invest in a service manual and a supply of spare chips. When you have the Tandy part numbers from the service manual you can order them from National Parts (1-817-870-5662). The courteous people there are just another reason Tandy is the biggest name in little computers. This is an exceptional service. Do not abuse it with small orders or try to order whole computers. Be moderate or they will be forced to close down. ■



COMPONENT (TOP) SIDE (ROM FITS IN ROW MARKED BY ARROWS - SHIFT LEFT)

BOTTOM SIDE - DON'T FORGET, YOU MAY HAVE TO SOLDER ON BOTH SIDES.

Fig. 4. Use a very fine-tipped iron, thin solder, and the smallest diameter drill bit. Boards are 1:1 full scale. To avoid connecting spare inputs, cut Bridge B and run a jumper from X to X (see top board).

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Swinging from rock music to computers.

Jake's Wampeters

by John P. Mello Jr.

This is the first in a series of articles featuring personalities in the realm of the TRS-80. The people featured will be well-known or unusual, but all will have made a mark in the field that affects the state of the art. We welcome comments from you, and would like to hear who you'd like to see featured—Eds.

There's a wacky irony in Jake Commander's life that reminds one of Bokonism, a fictitious religion created by Kurt Vonnegut, Jr. in his novel *Cat's Cradle*. Bokonism says there are pivots in a person's life called wampeters, one waning, one waxing, at any point in time. Jake Commander's wampeters have been rock music and computers.

Born in Birmingham, England, Jake, at 15, began playing in a band called the Andycaps, after the famous British working-class comic strip character. But the seed of his interest in computers may have been planted in him long before that—at age two and a half:

"I remember a doll's house with a keyboard in it. I remember that really well. It was one of my first recollections."

His grandfather had made the dollhouse for Jake's mother. It had eight chimneys. Each room in the house had a ceiling light and fireplace fronted with red cellophane. When a chimney was pressed, the light in a room's ceiling and fireplace would glow.

"My first keyboard," Jake said. When an interviewer suggested today's tykes need no silicon surrogates, *80 Micro's* technical consultant quipped, "Yeah, but they don't have as much fun as I had with that doll house."

Jake's father had an engineering background. "That definitely influenced my outlook," he said. And by the time he was eight, he was dabbling in electronics, building things and wondering why they didn't work.

"It was all tubes back then so you'd just get electrocuted," he recollected. "Some of the shocks were unbelievable. I'm almost immune to electricity now." Asked if the shocks discouraged his experimentation, he replied: "No. It was part of the fun. Losing count of how many electric shocks you had was like getting a medal or something."

While undergoing homebrewed shock therapy, Jake was also teaching himself to play the guitar. "Anything that I've ever learned that's been worthwhile." he observed, "I've taught myself."

Although 11 year-old Jake passed a now defunct exam called "The 11-plus," aimed at separating the wheat from the chaff in the intelligence department, he found dubious benefits in formal measures of intelligence: "The only kid in my class that didn't pass the 11-plus is now the guiding light of the Electric Light Orchestra and a multi-millionaire."

Jake couldn't wait to leave school and at 16, a year after joining the Andycaps, he landed a job in Britain's General Post Office

Jake Commander and friends.

"We started building all this stuff in my dad's shed. . . It was like the Houston space center."

which, in addition to its postal chores, handles telecommunications in the country. During this period, Jake and his friends built an outlaw radio station.

They got 100 feet of scrap wire from the local telephone exchange where Jake worked, tied an old sneaker on the end of it, threw it over the roof of Jake's house and began transmitting their band over it. "The transmitter had so many harmonics in it," Jake said, "you could hear us all the way down the medium wave."

The GPO prepared to capture the culprits responsible for the outlaw transmissions. "They sent out a detector van with a scanning unit looking for us," Jake explained, "but we had so many contacts in the field, we knew when they were in range. We'd just pull the sneaker back over the roof and wouldn't transmit until they were out of the way again." Finally, in a last ditch attempt to deceive the GPO, Jake said he and his friends started broadcasting in French.

Jake tired of public service after a year and left the GPO to become a rock star. The time was 1966 and lots of lads Jake's age thought the road to success lay in emulating four rockers from Liverpool. "We played Germany when I turned 18," Jake said. "That was like a really important thing as far as bands went. You know, follow the Beatles, go to Hamburg and come back a star."

"It was a grueling experience," he recalled. "We were supposed to play a number of clubs in the Hamburg area but ended up playing one. We couldn't stand it after two weeks.

"On the weekend, you played until the last customer went. And the last customer went when the hell he felt like it.

"You could see what it did to bands. It really gelled them. I remember one Saturday night. The last customer left at six in the morning. We'd played six sets—an hour on, an hour off—12 hours.

"We were paid $50 a week. We thought we were rich. When I was 18, that was pretty good money."

Back in England, the Andycaps continued doing their gigs in "proper night clubs," places where it was either amateur night—someone from the audience trying to crash the stage and sing with the band—or Friday Night at the Fights or both. However, Jake's worst encounter didn't come in a club:

"We were playing at a school hop when the local Hells Angels came in.

"I was going through my tough period at the time—going through a 'Jake Commander is going to be tough guy' type of thing. So I was ready to defend the band's honor and all that.

"There wasn't any stage. We were playing on the floor and there was nothing between us and the audience.

"One of the bikers came up and says, 'Play a Stones number.' We only knew one—'Lady Jane'—not exactly a raunchy one. We started playing that but that was not their idea of what they wanted to hear.

"One of them began wobbling the microphone in front of the rhythm player's nose so he couldn't sing into it. So the bass player came up and stopped it.

"That was it.

"A couple of them grabbed the bass player. I thought: These swines are going to get it now. And I took my real nice semi-acoustic guitar and went bolting over there at the speed of light and just cracked this kid over the head with my guitar.

"There was this terrible splintering crunch and this kid flew—like he was running backwards—because of the momentum with which I hit him. His gang parted like the Red Sea and the kid went flying through them landing in the seats.

"We were paid $50 a week. We thought we were rich."

"Then the chairs started flying.

"And I'm standing there wondering what the hell's going to happen next when this great big kid comes up to me. He looked about eight foot tall. He picked up a microphone stand with a heavy metal base.

"I put my guitar down as he threw the things at me and I caught it and the momentum of that just threw me backwards straight over the drums and I landed, just like the best of slapstick, with my head inside the bass drum.

"I thought: I'm staying here. This is the place to be. I could hear the place erupting. Then there was a lull and I got up and as I did I met a chair coming through the air end over end and it bounced off my head and I went straight back down into the drum.

"Then somebody had the good sense to yell the word police. That was all it took. The place cleared."

When it became apparent immediate rock stardom was not in the cards for the Andycapps, Jake got another job earning $30 a week as a cost clerk in an office. At that time, Jake and a friend decided to be space vandals.

"All our buddies," Jake explained, "were going around doing things like throwing stones through windows. What we were going to do was throw the biggest radio signal we could muster at the moon and bounce the thing back. It would be like throwing a brick at the moon."

He added, "People bounce signals off the moon all the time now, but at that time it wasn't common at all to say the least."

"We started building all this stuff in my dad's shed," he continued. "It was like the Houston space center. There were all these oscilloscopes; converted tvs doing strange things; monitoring gear."

The pair planned to cap the project with a giant dish antenna on the shed's roof and use a computer to track the moon's position. Jake enrolled in a $50 course he believed would teach him how to build a computer, but when he received the course materials, they dealt with only programming. He was disappointed about that and upset about shelling out $50 for it, so he persuaded his office manager he'd started the course to improve his job performance. The company paid for part of the course until Jake later left the firm to work in a tv repair shop.

When it dawned on his father his son was serious about constructing a dish antenna on the roof of a building the family didn't own, he clamped down on the project, so Jake and his buddy planned to let the city of Birmingham become an accessory in the act.

The duo obtained from the city an allotment—public land rented to indigents for gardening. "We put up a hut," Jake said, "so we could have our own little lab on this allotment and nobody would know. They'd think we were gardening when really we were bouncing signals off the moon."

Once again hearing the siren's lure of rock stardom, Jake quit his office job. Relations between him and his parents worsened and young Commander moved into the allotment hut. "I felt like a vagrant living in this hut," he remembered. "I started doing the computer course as a means of telling myself I wasn't a tramp or a vagrant. It was kind of a psychological safety net for me."

Then one night, after a good gig with the Andycaps, it became apparent in what direction fate was poking Jake:

"Now [the computer programming course] was the only thing I had left, so I carried on with it."

"I walked up the hill to the hut and the door was ajar. I got in there and vandals had been in and just completely wrecked the place. I found food everywhere and burned things and ripped up things. That's a horrible thing to get back to.

"I just stood in the doorway, trying to take it all in, trying to make it real and not matter too much. And all I've got in there is a battery—no light bulb—and they tore that to pieces, so there wasn't even light to see how bad it really was."

The next day Jake got a mattress and started living in the band's van, but two weeks later he returned to the hut to gather up all his worldly goods:

"We went there and the door was ajar again. Everything was gone. They'd taken my clothes, everything. All the little things I owned were stolen.

"That was a real weird experience, standing in the doorway for a second time realizing that everything you owned you were wearing.

"They did messy things like burn ball point pens. There'd be half burned ballpoint pens stuck on something with blue ink everywhere. It was really messy. It made my life feel the same way.

"There were all these pieces of paper scattered everywhere, some of them soaked in kerosene because I'd had a kerosene stove. When I collected them together, they were the computer programming course completely intact.

"That was a real trick of fate. If that'd gone, there would have been no way I could have carried on with it. Now it was the only thing I had left, so I carried on with it."

Eventually, Jake left the Andycaps and joined "Ochre Daydream," and left the tv repair job to work in a paint factory on electrophoretic paint. Then he "met" D.D. McCracken.

McCracken's book, *Digital Computer Programming*, was the final stage of Jake's course. "The great thing about the book," Jake observed, "was it didn't teach you how to program a particular computer. . . you were learning a computer McCracken made up in his head that displayed all the general characteristics of a computer.

"That book taught me everything I needed to know about programming until this day.

"About halfway through the book, it started pulling me in. I started getting a kick out of it. I started to find it was really getting to my blood.

"It was like the ultimate game. People talk about what's the best game—Star Raiders or this, that or the other—but to me, the Basic programming language itself is a game people enjoy playing."

By the time he received his diploma, Jake was hot to be a programmer, but he was in for a rude discovery:

"At the time, programming was a real cliquey type of job. It was one of those Catch-22 things: If you wanted to be a programmer, you had to be a programmer.

"There was a bit of a scam happening at the time. Because programming was supposed to be this glamorous job, people were offering programming courses for $400. You could spend a month at a programming school and get a diploma that was worth nothing more than the paper it was written on. My degree was like that, except it only cost me $50, not $400."

After unsuccessfully trying to find a programming job, Jake went to the Labor Exchange—the British version of the unemployment office. There he was advised to become a computer operator and use that job as an "entree" into programming. Jake was skeptical of that suggestion. "The one thing that stuck in my mind from the McCracken book," he recalled, "was this image of computer operators as nothing more than someone who picks up a pack of punch cards, puts them into a reader, and presses a button."

Shelving his doubts, he accepted their advice and they made a referral. When he arrived at the factory gate, Jake had to take a double dose of nasty medicine. Not only did he have to start as an operator, but he had to work for a company making items not bandied about the pub—sanitary napkins.

But then Jake looked at the firm's main-

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"He wanted to be a machine language programmer, 'a programmer's programmer.' "

frame: "I was in love with it. There was all this electronic gear and tapes clicking and whirring and printers going and paper tapes being read and punch cards read and punched."

Jake also discovered another asset to the job: "It was the upper echelon of the place. Everybody looked up to it like everybody in there was really strange. It was nice to have that. So, you see, I was going to be a star again."

Although hired as an operator, Jake didn't start as one. "When you joined a computer installation such as that," Jake remembered, "you get the bum job and the bum job there was loading tapes, but even that was taken with great pride by these guys.

"You had to get those tapes up there fast because an operator's standing there ready to start the whole ballgame. At the moment, the computer's doing nothing and idle time was like an anathema.

"As tape loader, you had to make sure that as soon as a tape finished and was dismounted by a program, you would have the next tape on the tape deck and in position. You'd whirl around. It took two of us. It became an art. You stuck something up, then took something down; meanwhile you started to know which program would dismount which tape when, you'd get really good at it. You'd get a real team going and get programs going back to back. Sometimes you could almost overlap the programs. It was amazing.

"The first day of doing that, it was such an alien job to me, my head was spinning. I came out of that job and I couldn't believe it. It was like I'd been to a fairground or something. I was totally fascinated again. I was really sucked into it all."

Jake's enthusiasm endeared him to the engineers in the computer room and they let him play with the mainframe during rare idle moments. "I could make things happen," he said. "I could put in a small program—maybe 20 words; there was no such thing as bytes, just 24-bit words—and make a printer print a line of A's or something or make a tape block read one block of tape and see all the lights go on. I really did get a kick of power out of that."

Jake married three months after landing the computer job and began climbing the ladder in the computer room. His sights were clear now: He wanted to be a machine-language programmer, "a programmer's programmer."

But when he reached his goal after two years, "the wind suddenly went out of my sails because I suddenly got to my destination." Then the music bug and a new itch—an urge to see America—got into his blood.

Jake was ripe for a change. Not only had he become a machine-language programmer, but he was bitter about being victimized by a software pirate in the computer room. "Someone with a little more savvy than I had about the rights of a program took a program I'd written and sold it," he said, "got 2,000 pounds for it."

"It was about 11 o'clock at night and I was ready to go to bed," Jake recalled, "when my friend from the Electric Light Orchestra calls up. He only had half a band to appear on a tv show the next day and he wanted to know if I wanted to stand in as a cello player.

"I'm a guitarist, right? I haven't a clue what to do with a bow and a thing with no frets on it.

"Nevertheless, I went down to the BBC studios and we tanked up on whiskey and Coke. Then I put on an ape mask and vicar's collar and we faced the cameras and did it."

Jake became the sound engineer for the band, but that sent shock waves through his marriage, a marriage already veined with faults from the hours he had been putting in on the computer. "I did everything I possibly could to keep the marriage together," Jake observed, "including going back into computing for three months just to try and be a steady guy again, show my wife everything was hunky-dory and I'm-really-a-nine-to-fiver-darling-why-don't-you-realize-that?"

But his marriage cracked up anyway and Jake went back to music, becoming a sound engineer in a recording studio for two years, all the time his yen for the States growing. Then he bought a sports car that became a fateful part of his first trip to the "colonies."

The car was a Reliant Scimitar, the make Princess Anne currently motors in, with a three-liter, V engine. Jake remembered: "The only reason I could afford one was to buy a second-hand one. It was the only luxury I'd ever had in my life.

"Dad spent ages on the engine and it purred; it really purred. We could get the RPM on takeover so low it was untrue.

"A couple of days after we'd done the final work on the car, I wanted to see what the performance was going to be like—naught to 50, naught to 60. I got to the end of this motorway, came to a complete halt, waited until there were no cars around and just floored it. The thing literally took off like a rocket.

"It was beautiful. It shot off. I was sitting behind the wheel feeling good, zapping down there at 65 miles an hour about one-tenth of a second after I'd floored it. Then it lost power.

"I thought: overheating. The thing's over-

The ill-fated Reliant Scimitar.

"For $400, the TRS-80 Model I, Level I, 4K, was the best bargain in the book. . ."

heating already. I couldn't believe it. I took my foot off the gas pedal and tried it again. Nothing. The thing just wasn't responding.

"Suddenly, smoke starts pouring out of the dashboard, coming out of the air vents in the side.

"I thought: electrical short, turn off the ignition. Nothing.

"I put my foot on the brake. Nothing.

"I flipped the hood latch,thinking: If it's hot under there I'd better get some cold air down there quick. I flipped it. It came up half an inch, stayed on its latch and flames came out the side just like a Trans Am—only for real.

"I see this slip road coming up and I just pulled the hand brake like mad. It worked. I pulled over, got out of the car, lifted the hood up and there were these flames trickling out.

"I go into panic mode.

"I will do anything to stop these flames. I try to flag drivers down and they're doing what anybody does when they see somebody in distress: They pull into the fast lane and go zooming past you.

"A guy in the other lane coming the other way saw what was happening. He worked for a road repair firm and by law in England, they have to carry a fire extinguisher. He came bounding across the road with this great big fire extinguisher. It looked great. He tipped the thing upside down, hit the knob underneath, and nothing happened.

"Meanwhile, the flames in my car get a bit taller. It's looking a bit hot in there now.

"Then another guy runs up. He's got this tiny 50-cent fire extinguisher that you hit and shaving cream comes out. He starts spraying that from about eight feet away. I grabbed it off him and plunged in there trying to get it over the flames. They'd die down and just come back up again. It was hopeless.

"A guy gave me a lift to call for help and as we're going in one direction, a cop car goes the other way with its light going. Great, someone's called them, I thought, but it's going to look fabulous because it looks like I abandoned my car.

"When I got there, the police said stand back because they thought the tank was going to blow. It never did and the car burned. It burned beautiful with a thick black plume that went half a mile into the air."

A couple of those cars did the same thing to their owners his car did to him, Jake noted. He explained there was a design defect in the roadster. Engine vibration, he said, could work the pipe, running from the gas pump to the carburetor, loose.

After someone stole the car's wreckage, Jake's insurance company settled with him and he decided to give in to a desire he'd had for awhile—to go to the United States.

He planned to spend three weeks in Los Angeles looking for a job as a record producer. But Electric Light Orchestra contacted him and asked him to be their monitor engineer for their latest American tour. "Suddenly," Jake observed, "a three week vacation to look for work turned into a three and a half month tour of the whole States."

When Jake returned to England, he found he had a yearning for the States that wouldn't quit, so he joined ELO on their tour of the world.

While in Australia, he picked up an issue of *Popular Electronics* dedicated to the new microcomputer craze. For $400, the TRS-80 Model I, Level I, 4K, was the best bargain in the book, Jake maintained. And when the band began their U.S. leg of the tour in Los Angeles, he immediately bought one.

". . . he had a yearning for the States that wouldn't quit."

"Me and the bass player, between gigs for the rest of the American tour, would be up in our hotel room with the tv undone in the back, programming away.

"The bass player wrote a few good programs. He turned out to have a real flair for programming."

Before the end of the tour, Jake had upgraded his Model I to Level II. The bass player wanted some of Jake's Level II programs to run on his Level I machine. Jake wrote a disassembler program to help accomplish that and by the end of the tour, he'd been bitten by the computer bug again.

By the time Jake got back to England, he was ready to move to the United States, but once again he was strapped for money. He realized microcomputers were going to be a boom industry, but he didn't realize they'd play a part in a scheme to get the capital he needed to return to "the land of opportunity."

"I went back to see some of my buddies on the mainframe," he recalled. "I said, You guys had better look out because why should anyone buy a computer terminal and rent time off you for $80 an hour when they can get a micro and do exactly the same thing?

"I thought it was going to hurt them. And within six months, the place had closed down."

That meant a lot of computer terminals could be had for a song and Jake capitalized on it. He developed a hardware interface allowing the terminals to be used as printers. He bought 20 terminals, modified them, and sold them for 250 pounds each. The only competition at the time was a Centronics printer selling for 600 pounds.

With the money from that scheme, Jake hopped a plane to L.A., again intending to be a record producer. But the record business was in the doldrums at the time, so he brought his disassembler program to a friend who was a Radio Shack dealer in Santa Monica. The dealer suggested Jake send the program to Tandy.

Months dragged on and Jake still didn't hear from Tandy. As his financial resources dwindled, he found an ad in *Microcomputing* for Instant Software in Peterborough, NH. Jake sent 20 programs there; eight of them returned immediately because they were games. But by September 1979, Instant Software had accepted the rest of Jake's programs.

January 1980 rolled around. Jake's programs still hadn't been released by Instant Software. With the dogs of destitution nipping at his heels, Jake decided to take a stab at landing a job with the Peterborough concern. After contacting Instant Software, he was offered a job interview. With his last $50 in his pocket, Jake boarded a Freddie Laker Airlines jet on a one-way ticket to New York City. There he met two Instant Software employees who brought him to the converted motel housing the firm.

Instant Software liked what they saw and hired Jake immediately. But soon Jim Perry, then managing editor of *80 Micro*, pirated Jake away from Wayne Green's software sister and since that time, the affable Englishman has been gracing the magazine's staff and its pages with his wizard's knowledge of microcomputers.

However, there are signs of the polarity in Jake's wampeters may be changing again. Rumor has it he is dusting off the cobwebs on his electric guitar and. . . ■

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(Actual QWERTY text above)

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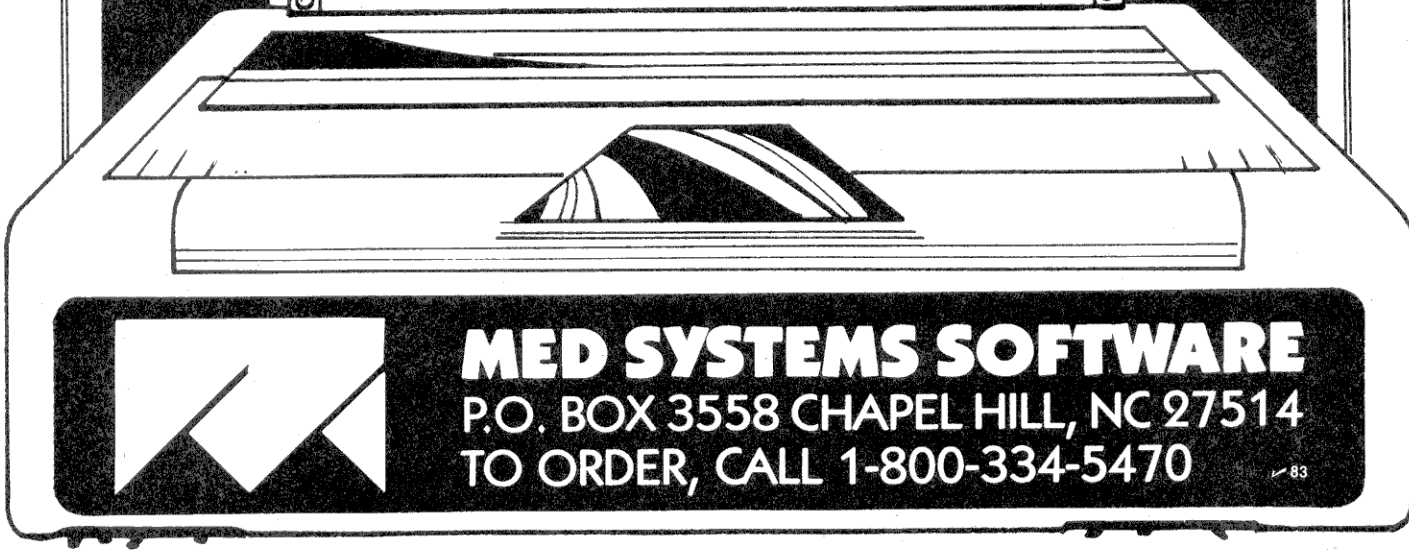
QWERTY 3.0 Manual (specify printer)	$10.00



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The Model II wins when compared to the IBM 5150.

Radio Shack vs IBM

Roger Van Ghent
125 Woodhull Road
Huntington, NY 11743

Comparisons of small business microcomputer systems help make the decision about which system to buy. This article compares IBM's 5150 Model 824 and Radio Shack's TRS-80 Model II.

Most computer systems are made up of the following major components: processor, memory, disk, tape, console, printer, communications, and software. My analysis covers each of these components in turn.

The Basic System

Table 1 shows the small business configuration plus display and printer options of the IBM 5150 Model 824. Table 2 shows the 64K small business configuration plus printer option of the Radio Shack TRS-80 Model II. Both models have power-up diagnostics, user manuals and 90-day warranties. Both vendors provide field service at special service centers and optional maintenance contracts. Radio Shack provides an on-site maintenance service option.

IBM 5150 Model 824

1	System unit with 40K bytes of Read Only Memory and 64K bytes of user memory
1	Keyboard
1	5 ¼" disk expansion drive adapter
2	5 ¼" 160K byte disk drives (total 320K bytes on line)
1	Asynchronous communications adapter
2	Additional expansion slots
1	Cassette attachment jack
1	Tone speaker
1	Monochrome display and printer adapter
1	Monochrome display
1	80 character per second dot matrix printer
1	Printer cable
1	Disk Operating System and advanced level Basic language software
1	Asynchronous communications support software

Total cost $4615.00

Table 1. IBM System.

The IBM system is less expensive than Radio Shack's by $483.00. If you substitute word processing quality printers for the matrix printers (a NEC Spinwriter 3530 33cps on the IBM system, and a Daisy Wheel II 43cps on the Radio Shack system) the prices are: IBM $6410, Radio Shack $5898, a difference of $515 in Radio Shack's favor.

Processor

Comparison criteria for processors are speed (in cycles per second), word size (in bits), addressing capacity and instruction set. One character can be stored in eight bits. An instruction takes 4-20 machine cycles and 1-6 words. Roughly 10 instructions execute one line of Basic code.

The IBM's processor is an Intel 8088 eight bit chip, which runs at 4.77 million cycles per second. It can perform a 16 bit multiplication or division and address one million bytes of memory.

The Model II's processor is a Zilog Z80A eight bit chip which runs at four million cycles per second. It can address up to 64K bytes of memory, the full capacity of the package.

IBM's chip is 20 percent faster and has substantially more addressing and computational capability. You cannot use the full addressing capability in IBM's package, however. Radio Shack's widely used microprocessor has high reliability and is compatible with virtually every program written for microprocessors.

Memory

Computer memory is measured in bytes (a byte is computerese for a character such as A-Z, 0-9, and other special marks or symbols). Not all of a computer's memory is available to an application program.

Starting with 64K bytes, IBM's disk operating system uses 12K. The advanced disk Basic programming language required for communications uses 30.5K and allows 33.5K bytes for user programs and data.

Starting with 64K, Radio Shack's operating system uses 10.25K bytes. Basic uses 18K and allows 35K bytes of usable memory.

Both systems have enough memory for approximately a 1000 line Basic program; IBM's operating sytem is slightly larger.

Disk

Both machines have floppy disk storage. The significant characteristics of disks are capacity and transfer rate.

The IBM system has two 5¼" disk drives, using removable minifloppy disks. Each disk holds 160,000 characters, a total of 320,000 characters of online storage. After the space required by the Disk Operating System and Basic is subtracted, available storage for programs and data is at most 277,500 characters (probably less due to disk overhead such as directory tracks). The IBM drive transfers data at 20,480 characters per second.

The Model II has one 8" double density disk drive, using removable floppy disk storing up to 509,184 characters each. When the directory tracks, operating system and Basic storage is subtracted, available space is 416,000 characters. The Radio Shack disk drive transfers data at 62,500 characters per second.

Radio Shack's disk holds at least 50 percent more information than both of IBM's and transfers that information 300 percent faster. Radio Shack's disk storage can be increased to a total of *35,000,000* characters.

Tape

The IBM 5150 supports cassette tape storage (the user supplies the tape deck), but this is not a practical option for a business computer. The Radio Shack Model II does not support tape.

Console

Both systems have similar keyboards, with calculator pads, a tilt (IBM's is adjustable), and user-defined function keys (IBM

"Much more software has been written for Radio Shack's small system than for IBM's."

has 10, Radio Shack has 2). IBM' keys repeat when held down; Radio Shack has a Repeat key.

The display units are both 80-character columns and 24 or 25 rows. Both allow double-size character display, line graphics, reverse image, and lowercase with true descenders. The IBM unit has high intensity, underlining and blink features. Radio Shack's screen is black and white, IBM's is green. Radio Shack's screen is built into the cabinet, IBM's plugs in separately. (IBM allows a tv instead of monochrome display, but does not sell the tv set or RF modulator.)

Printer

The IBM printer (an Epson printer) prints bidirectionally at 80 characters per second on pin fed continuous form fan-fold. The paper may be up to 10" wide, including tear-off pin feed strips.

The Radio Shack Line Printer VI prints bidirectionally at 100 characters per second. A removable tractor allows both pin fed and sheet fed paper. The paper can be from 4" to 14 7/8" wide (standard computer size).

The Radio Shack unit has a sheet feed feature and 25 percent greater speed than the IBM. The sheet feed feature is essential for word processing applications.

Radio Shack sells two less expensive printers (not recommended for business purposes) and two more expensive printers, one for heavy duty business use (such as label production, personalized form letters, large inventory reports), and a letter quality Daisy Wheel printer with proportional spacing and different type styles (ideal for word processing). IBM does not have any other printer, but other makes of printer (such as a NEC Spinwriter) can be attached if a parallel interface is added to the configuration.

Communications

A computer system communications ability is described in terms of its protocols (how it shakes hands with the computer it talks to), and rate, measured in bits per second. Both these systems support asynchronous communications (a commonly used protocol) through their RS-232C ports.

IBM's asynchronous communications support option, not included in the standard configuration, allows communications with other microprocessors and larger computers which support this protocol (most do). It allows transfer rates of 75-2400 bps.

The Model II comes with asynchronous software. In addition, Radio Shack sells two bisynchronous communications packages —3780 and 3270 protocols—allowing the TRS-80 to communicate with host computers (IBM 370 and 30 main frames) as a remote job entry terminal or as a special input terminal for software such as IBM's TSO, CICS, VM/CMS, and IMS. Transfer rates on this model can vary from 110 to 9600 bits per second.

Radio Shack's system provides a more complete set of communications software than the IBM system, and supports higher transfer rates.

Software

The measure of any computer system is its software. Both sytems use variants of Microsoft's Basic. IBM supports color graphics (requiring a color display) and tones; Radio Shack does not. Radio Shack has a compiler Basic (which runs much faster than either vender's interpretive Basic), a multi-key access Cobol (for busi-application programming), Fortran (for engineering and mathematical applications), and an Assembler. IBM has Pascal (a teaching language for computer professionals), but this language requires twice the memory (128 thousand bytes).

Both models allow automatic job stream execution at start up. Both systems have Accounts Receivable, Payable and General Ledger, Visicalc (a powerful calculating tool), and word processing. Radio Shack has the software shown in Table 3. IBM has only Microsoft Adventure, a game.

Much more software has been written for Radio Shack's small business system than for IBM's, and Radio Shack can support several higher level languages. IBM's system can support one higher level language if its memory is doubled (for $540).

In Conclusion

The IBM small business configuration is $483.00 less, the word processing configuration $515.00 more, than Radio Shack's. IBM's processor is 20 percent faster and has more addressing and machine instruction capability.

The Radio Shack's usable memory is slightly more than IBM's. Both machines will handle approximately a 1000 line Basic program. Radio Shack's disk stores at least 50 percent more information than both of IBM's combined, and transfers that information 300 percent faster. Much more disk storage can be added to the Radio Shack system.

The consoles and printers are very similar, but the Radio Shack printer has a sheet feed feature and is 25 percent faster.

Radio Shack sells more communications software and supports higher transfer rates than IBM does for its system.

Much more software has been written for Radio Shack's small business system than for IBM's: Radio Shack supports faster Basic, Cobol and Fortran compilers and an assembler. The IBM system supports Pascal if its memory is doubled.

The two machines are about equal in power and price, but Radio Shack supports a much faster and larger disk and much more development and application software than IBM's small business system. It also has more hardware options (printers, disks and plotters) to fit the user's needs. ■

Robert Van Ghent, a consulting software engineer, specializes in system analysis and design. Robert has managed application development projects in the media and banking industries, and is an expert in programmer productivity.

Radio Shack TRS-80 Model II

1	System unit with 64K bytes of memory
1	Keyboard
1	8" double density 500K byte disk drive
1	Video display
1	Bootstrap read only memory
4	Additional expansion slots
1	Parallel port (for printer)
2	RS-232C serial ports
1	External disk bay port
1	Line printer VI (100 character per second print speed)
1	Printer cable
1	TRSDOS (Disk Operating Sytem) and Basic language software

Total cost $5098.00

Table 2. Radio Shack System.

Payroll	Order Entry
Inventory Control	Sales Analysis
Profile II, a filing system	Mailing List
Medical Office System	Manufacturing Inventory System
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Table 3. Radio Shack Software.

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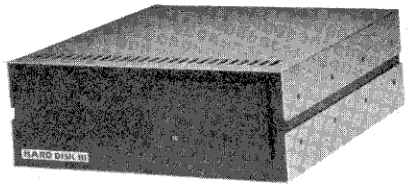

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Building an M-80

James Hawkes
College of Charleston
Charleston, SC 29401

Grady R. Reese
500 Tulip Street
Somerville, SC 29483

Why would a TRS-80 owner be interested in the M-80, a single board microcomputer utilizing the Z80 CPU? Possible control applications include home environmental systems, security systems, household appliances, and computer peripherals such as printers, plotters, and tape drives. The TRS-80 can handle these chores; nevertheless, most of us don't want to commit such an expensive machine to these mundane and time-consuming tasks.

The M-80 kit, available for only $99, does not have the convenience of a keyboard and a video display—not to mention disk and tape drives, printers, and the cache of development software which exists for the TRS-80. But anyone with a TRS-80 can use it as a terminal for developing programs directly on the M-80. Software can also be developed for the M-80 using TRS-80 editors, assemblers or compilers and then downloaded to the M-80 for execution.

M-80 Hardware

The heart of this micro is the Z80 microprocessor, the same microprocessor that controls the TRS-80. Thus, any properly designed machine language program written on the TRS-80 can be executed by the M-80.

The M-80 is operated on 2 MHz by a clock circuit consisting of five sections of U11, a CD4049 CMOS hex inverter which is used as an oscillator and buffer (see Fig. 1).

Address decoding is accomplished by U9, a 74LS154 four line to six line decoder. This device decodes the addresses from 0000 hex to 3C00 hex in 1K increments. Notice that this 16K address space is not uniquely assigned since the A15 address line is not used in the decoding scheme. This means that the memory from 0000 to 3C00 will duplicate itself in memory locations above 3C00.

Memory for the M-80 consists of two 2708 EPROMs and two 1K banks of 2114 static RAM. Two sections of U10, a 74LS32 quad 2 input OR gate, are used to select one of the two EPROMs. Also, one section of U10 is used to OR A14 and the MREQ (active low) signals from the CPU. In this design, both signals must be low to get a high from the OR gate, satisfying the G1 input of the decoder. A section of U11, the CD4049 inverter, is used to invert the CPU refresh (active low) signal for application to the G2 input. This prevents the static RAM's and EPROMs from participating in a refresh cycle. The one remaining section of U10 is not used and can serve as a spare gate.

The M-80 microcomputer provides input/output and 128 bytes of RAM with a multi-purpose chip, U1 (National Semiconductor's INS8154 RAM I/O). The 8154 contains 1024 bits of static memory organized into 128 bytes plus 16 lines of I/O on a 40 pin dual in line package. The 16 I/O lines are designed to provide two 8-bit parallel ports (A and B).

Port A can be configured in four parallel modes specified by placing appropriate values in the output definition registers: basic I/O (no handshaking); strobed input; strobed output; and strobed output with tristate. Port B can be used only in the basic mode—no handshaking is available.

In addition to reading and writing to ports A and B in 8-bit bytes, you may elect to set, clear, or read any individual byte in either port. This capability provides a means for serial communications and enhances effectiveness in control applications.

If your application requires additional memory or I/O devices there will be very little difficulty interfacing since the M-80 provides 16K of decoded address space of which only 4K is currently used. To further simplify interfacing, the excellent manual provides drawings detailing the use of many devices such as RS232 to TTL and TTL to RS232 converters (see Fig. 3), A/D D/A converters and port expansion circuits.

The power supply chosen for this project must provide plus five volts at 280 mA, + 12 volts at 60 mA, and minus five volts at 35 mA. An additional source of − 12 volts at 60 mA must be

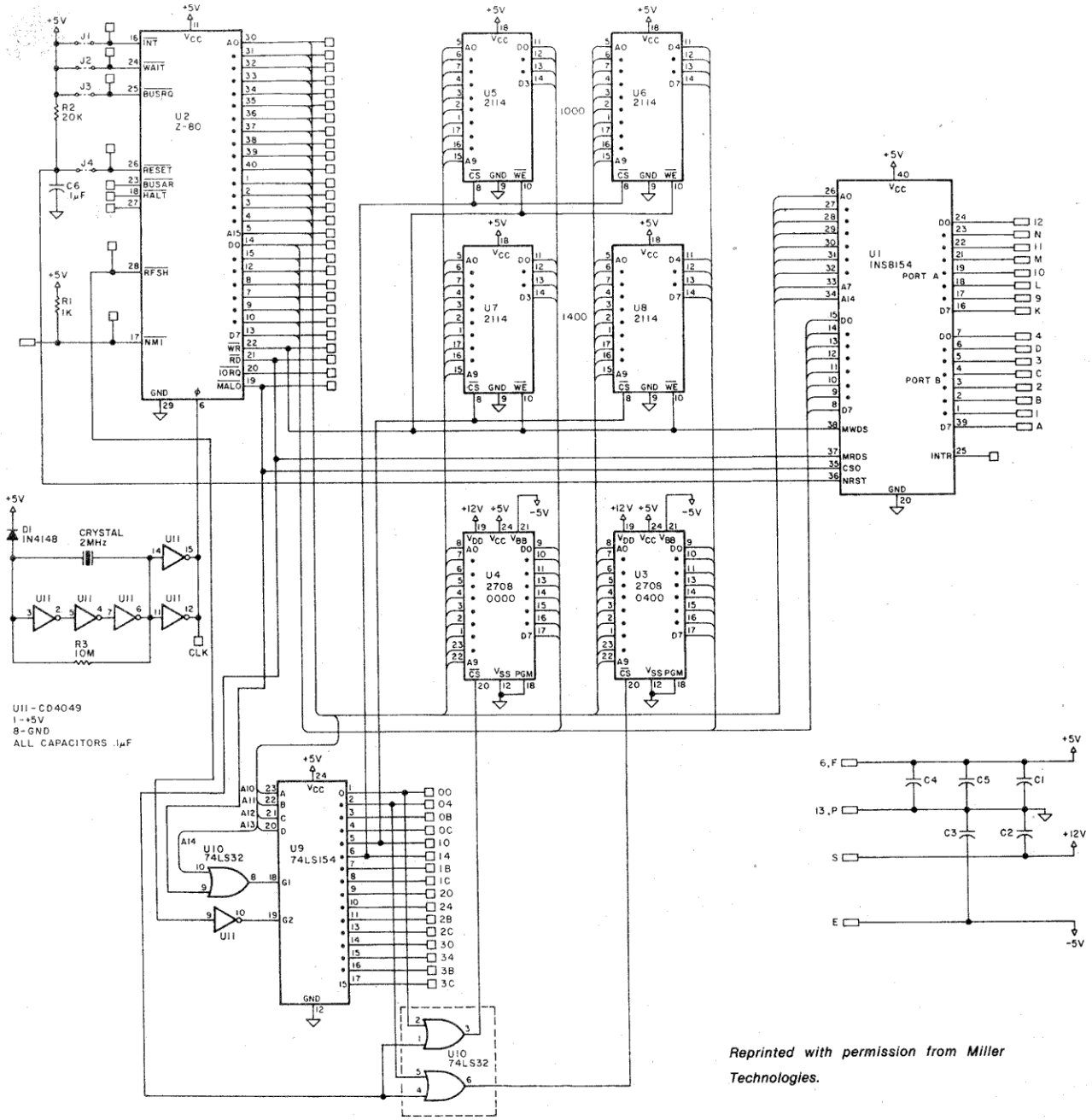

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Fig. 1.

available for the RS232 and TTL converter circuits described later. We used the power supply described by Don Walters in "The Mighty Five Way Power Supply" (*Kilobaud Microcomputing*, April 1980). The supply shown in Fig. 4 is included for those who prefer to build their own.

Software

To complement the versatility in hardware there is also excellent software available for the M-80 in the form of a 1K monitor and a 2K Basic.

The monitor has commands that allows memory to be dumped; data entered into memory; memory to be downloaded; execute a program; set a break point; proceed from a break point; set a bit; and test a bit. The documentation also provides the addresses of numerous subroutines in the monitor, greatly simplifying those tasks which might otherwise have to be written in machine language.

Also available on two 2708 EPROMs is a powerful 2K integer Basic interpreter modeled after Palo Alto Tiny Basic by Li-Chen Wang as presented in *Dr. Dobbs Journal*, May 1976. This Basic compares favorably with the 4K Basic offered by Radio Shack. The instruction set (see Table 1) is rather extensive given the comparatively small amount of code required for the interpreter.

The language permits 26 variables denoted by the letters A through Z. There is also a single

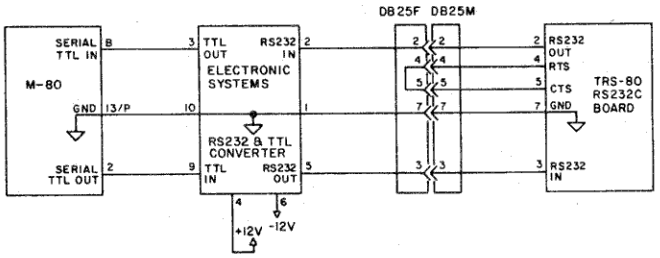

Fig. 2.

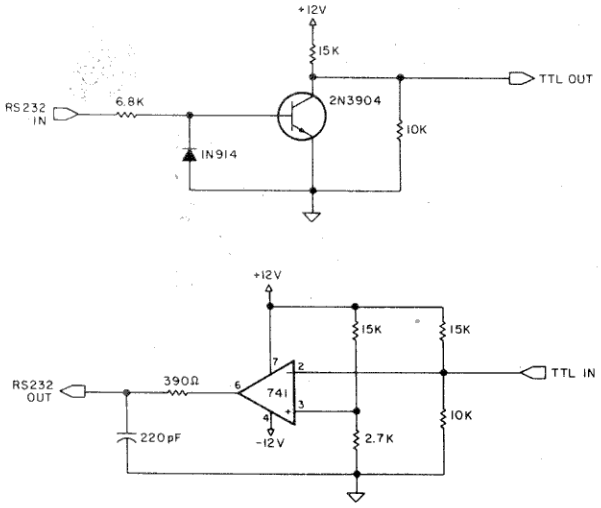

Fig. 3. RS232 and TTL converter.

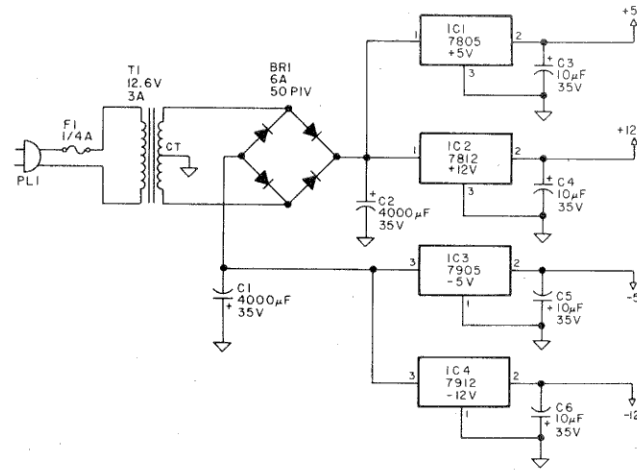

Fig. 4. Power Supply.

array, designated @( ), whose size is a function of available memory. To conserve memory, virtually all commands have one or two letter abbreviations.

The GOTO statement in the language is syntactically unconventional: It permits the user to compute the line which is the object of the statement. Thus, GOTO 3*X+2 will transfer control to the line whose value equals 3*X+2. Equally unusual is the ability to mix logical and arithmetic expressions in an assignment statement. For example LET C=D*(A>B)+6 will assign the value 6 to the variable C if the logical expression A>B is false and D+6 if A>B is true.

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Another useful feature is the ability to jump to a machine language routine and return to Basic, implemented by the CALL command.

Interface to the TRS-80

Both the machine language monitor and Basic were written to communicate in a serial mode with a host terminal. Thus, the M-80 can communicate with the TRS-80 through the RS232 board if the TTL I/O on pins two and three of the 8154 is converted to RS232 compatible signals. This can be done with the RS232 to TTL and TTL to RS232 converter circuits shown in the M-80 manual (see Fig. 3). Electronic Systems of San Jose, CA offers a 2-square inch printed circuit board containing both circuits for about $10 in kit form. Regardless of whether you construct or purchase the above circuit, we suggest you obtain a female DB25 connector to connect with the RS232 lines from the TRS-80. For the connection details, see Fig. 2.

Communicating

Any terminal program should work once it is properly configured for the serial protocol expected by the M-80 (8-bit word, no parity, and one stop bit). Even the Term program included with your RS232 package will do the job.

Although we eventually were able to use the ST80D package, our first efforts were not successful. Because ST80D was written to be used with a modem, the program expects the modem to transmit the Clear to Send signal when communication is established. As soon as we provided this signal, by connecting pins four and five inside the female DB25 cable connector used on the M-80, ST80D functioned perfectly.

By using the ST80D and its utilities, you will be able to download machine language or Basic software created on the TRS-80 to the M-80 for execution. This will ease development work and accelerate applications.

Applications

The M-80 is a perfect board for dedicated control applications such as heating and cooling systems, security systems, and watering systems. In addition, it could control a printer or plotter and execute specialized graphics software as directed by a host processor. Parallel processing would certainly make gaming applications far more powerful. Imagine the strength of the chess playing program, Sargon, if it had been written to be executed on a multiprocessor system.

Our experience with the M-80 has been very satisfying: We had the microcomputer up and running within 20 minutes of building the TTL to RS232 converter. Next we plan to build a control system for heating and cooling a home, using the M-80 as the controller. ■

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The most substantial estate tax changes in over 25 years became effective January 1, 1982. On August 13, 1981 President Reagan signed into law the Economic Recovery Tax Act, affectionately known by professionals as the Accountants' and Lawyers' Relief Act of 1981.

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Perhaps the most significant provision is an unlimited marital deduction. You may leave your spouse any amount of property without tax—provided all property qualifying for the marital deduction remaining when the survivor for the marital deduction dies will then be taxed (assuming, of course, that the second spouse has not remarried and left the estate to another surviving spouse!).

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Forecast the size of your estate and determine your probable tax liabilities in future years. If you desire to carry life insurance for payment of estate taxes, the program enables you to determine your needs during the transitional years as the new limits go into effect. The detailed schedule headings are the same as those on form 706, the Federal Estate Tax Return. If you are preparing a return with data taken directly from your schedules, the program will compute the tax for you.

Program Details

The program was written for a TRS-80 Model II in CBasic 2. Whole word variables make the program easy to follow or convert to Microsoft Basic for TRS-DOS. Control variable Y chooses the exemption, credit, maximum estate tax rate and value at which the maximum rate is effective for the computation year. The flags control screen and printer output. When PFLAG1 (for PRINT FLAG 1) is set, you get a screen summary of the items used to determine taxable estate. PFLAG2 controls printing of the credit for state death taxes. When PFLAG3 is set you get a printout. The remaining two print control flags implement your choice of printout for details of assets and deductions if they were entered.

You can enter assets or deductions individually, as a total, or work from the figure for taxable estate. You can prepare a

Estate Planning for Wife of John Client Computation Year 1994

Taxable Estate	$1,000,000.00	
Total Tax	$345,800.00	
Credit Against Tax	$192,800.00	
Net Estate Tax	$153,000.00	
State Death Tax Credit	$33,200.00	
Estate Tax Less State Death Tax Credit		$119,800.00

Table 1

Estate Planning for Wife of Eni Baude Computation Year 1998

Taxable Estate	$7,500,000.00	
Total Tax	$3,525,800.00	
Credit Against Tax	$192,800.00	
Net Estate Tax	$3,333,000.00	
State Death Tax Credit	$705,200.00	
Estate Tax Less State Death Tax Credit		$2,627,800.00

Table 3

Estate Planning for Wife of John Client Computation Year 1994

Taxable Estate	$675,000.00	
Total Tax	$220,550.00	
Credit Against Tax	$192,800.00	
Net Estate Tax	$27,750.00	
State Death Tax Credit	$17,000.00	
Estate Tax Less State Death Tax Credit		$10,750.00

Table 2

Estate Planning for Wife of Eni Baude Computation Year 1998

Taxable Estate	$6,600,000.00	
Total Tax	$3,075,800.00	
Credit Against Tax	$192,800.00	
Net Estate Tax	$2,883,000.00	
State Death Tax Credit	$586,800.00	
Estate Tax Less State Death Tax Credit		$2,296,200.00

Table 4

Model III
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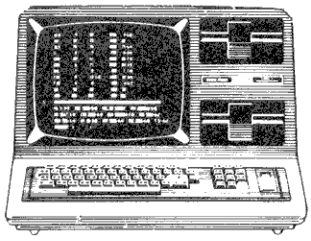

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COMPUTER - The Model III computer unit is an original unit which has extended BASIC and upper/lower case. It is packed in original factory packing, and is new and unused. Each computer, after having the drive systems and memory added, must pass a 24 hour burn-in test to assure maximum reliability.

DISK DRIVES - TCS offers standard 5 1/4" disk drives from TANDON, the same people that make the original drives for the Model III. These drives have band head positioning for long life, and have a fast 5 millisecond track to track access time. This means that if LDOS or one of the other fine disk operating systems is used, the track access time may be adjusted to allow faster operation of the entire system. Some brands of drives (Siemens, older Shugart) have access times as slow as 40 milliseconds, which can result in slow system speed especially when a considerable amount of random disk I/O is needed, such as programs manipulating large lists of data. This means that you should check track access capability before deciding on a particular drive. Each of our drives is tested fully for alignment, speed and proper operation before shipment.

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MOUNTING HARDWARE & CABLING - The disk drive mounting hardware is aluminum sheet construction for easy installation and the disk mounting holes are slotted to allow adjustment of the drives for exact alignment. The power and data cables are all included and are plug compatible with each unit. No soldering or tools are needed for installation other than a screwdriver.

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Estate Planning for Eni Baude Computation Year 1988

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Total Tax	$1,025,800.00	
Credit Against Tax	$192,800.00	
Net Estate Tax	$833,000.00	
State Death Tax Credit	$138,800.00	
Estate Tax Less State Death Tax Credit		$694,200.00

Table 5.

Estate Planning for Wife of Eni Baude Computation Year 1998

Taxable Estate	$3,750,000.00	
Total Tax	$1,650,800.00	
Credit Against Tax	$192,800.00	
Net Estate Tax	$1,458,000.00	
State Death Tax Credit	$144.400.00	
Estate Tax Less State Death Tax Credit		$1,313,600.00

Table 6.

Program Listing 1

```
REM-----------------------------------------
REM ESTATE TAX PLANNER
REM BY CHARLES R. PERELMAN
REM WRITTEN IN CBASIC2
REM-----------------------------------------
E$="************************"
D$="$$###,###,###.##"
DIM A$(20)
A$(1)="PLEASE PRESS NUMBER FOR ACTION DESIRED:"
A$(2)="SCHEDULE A - REAL ESTATE ":A$(3)="SCHEDULE B - STOCKS AND BONDS "
A$(4)="SCHEDULE C - MORTGAGES, NOTES AND CASH "
A$(5)="SCHEDULE D - INSURANCE ON DECEDENT'S LIFE "
A$(6)="SCHEDULE E - JOINTLY OWNED PROPERTY "
A$(7)="SCHEDULE F - OTHER MISCELLANEOUS PROPERTY "
A$(8)="SCHEDULE G - TRANSFERS DURING DECEDENT'S LIFE "
A$(9)="SCHEDULE H - POWERS OF APPOINTMENT ":A$(10)="SCHEDULE I - ANNUITIES "
A$(11)="SCHEDULE J - FUNERAL AND ADMINISTRATION EXPENSES "
A$(12)="SCHEDULE K - DEBTS OF DECEDENT "
A$(13)="SCHEDULE K - MORTGAGES AND LIENS "
A$(14)="SCHEDULE L - NET LOSSES DURING ADMINISTRATION "
A$(15)="SCHEDULE L - EXPENSES OF PROPERTY NOT SUBJECT TO CLAIMS "
A$(16)="SCHEDULE M - MARITAL DEDUCTION "
A$(17)="SCHEDULE O - CHARITABLE DEDUCTION "
A$(18)="ENTER AMOUNT FOR EACH SCHEDULE WITHOUT COMMAS."
A$(19)="ENTER 0 FOR NONE."

3 PRINT CHR$(12):PRINT E$;"  ESTATE TAX PLANNER  ";E$:PRINT:PRINT
  INPUT"WHAT IS THE NAME OF YOUR CLIENT? ";LINE CLIENT$
5 INPUT"IN WHAT YEAR IS TAX TO BE DETERMINED?  ";YEAR:Z=YEAR-1981
IF Z<=0 THEN PRINT:PRINT\
"*** THIS PROGRAM IS ONLY FOR YEARS AFTER 1981.  PLEASE REENTER. ***":\
FOR X=1 TO 500:NEXT:PRINT CHR$(12):GOTO 5
IF Z=1 THEN Y=1:EXEMPTION=225000:CREDIT=62800:MAX=4000000:MAX.RATE=.65
IF Z=2 THEN Y=2:EXEMPTION=275000:CREDIT=79300:MAX=3500000:MAX.RATE=.60
IF Z=3 THEN Y=3:EXEMPTION=325000:CREDIT=96300:MAX=3000000:MAX.RATE=.55
IF Z=4 THEN Y=4:EXEMPTION=400000:CREDIT=121800:MAX=2500000:MAX.RATE=.50
IF Z=5 THEN Y=5:EXEMPTION=500000:CREDIT=155800:MAX=2500000:MAX.RATE=.50
IF Z>5 THEN Y=6:EXEMPTION=600000:CREDIT=192800:MAX=2500000:MAX.RATE=.50
```

Program continues

printout for presentation to clients.

CHR$(12) clears the screen. CONCHAR% is similar to INKEY$ in Microsoft Basic, except it returns the ASCII value of the keyboard entry. CHR$(127) erases the prior character and clears the number of your choice from the screen. LPRINTER sends all Print commands to the printer rather than to the screen. CONSOLE reactivates the screen.

After entering items on the detailed schedules, you can restart this portion of the program if you made a mistake. An error trap is provided if the taxable estate does not exceed the threshold for estate tax in the computation year.

If your estate is large enough to be subject to the maximum rate, line 520 routes the program to lines 2100–2400 for tax computation. When I examined the tax tables, I found that brackets were $250,000 or $500,000 apart. Therefore, when you have an estate subject to a rate less than the maximum, you will divide by

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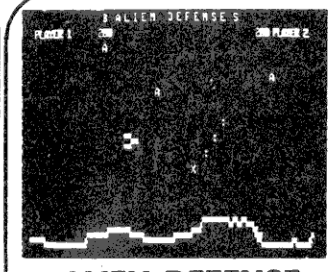

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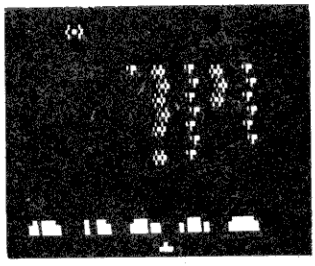

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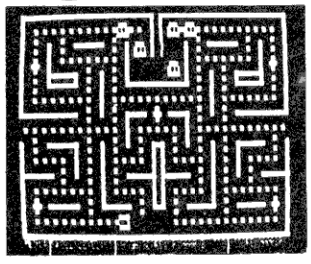

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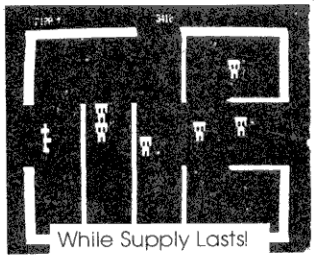

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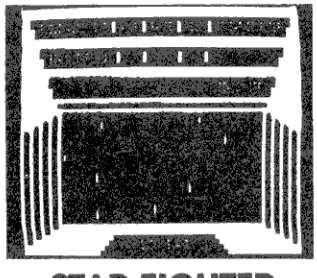

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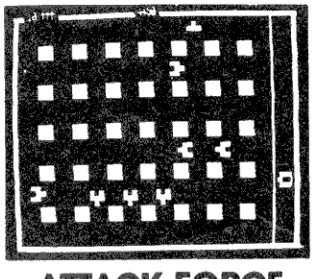

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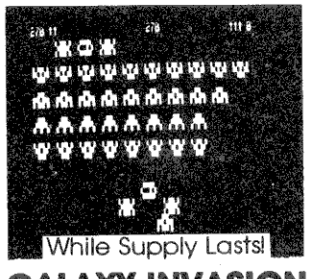

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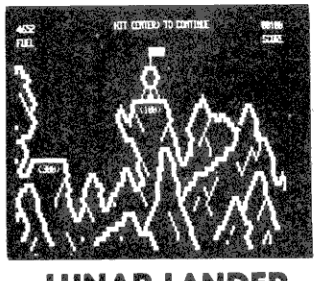

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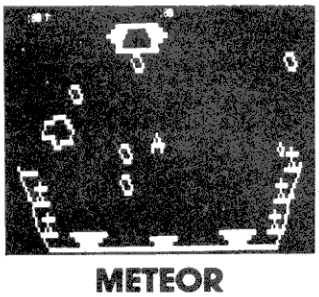

METEOR MISSION 2
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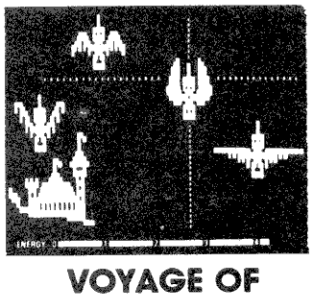

VOYAGE OF VALKYRIE
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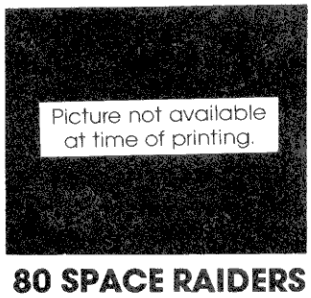

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Program continued

```
10 PRINT CHR$(12)                          REM ASSET ENTRY ROUTINE
PRINT:PRINT A$(1):PFLAG1=0:PFLAG2=0:PFLAG3=0:PFLAG4=0:PFLAG5=0
PRINT"1.  ENTER DETAILED ASSET INFORMATION"
PRINT"2.  ENTER SUMMARY FIGURE FOR ASSETS"
PRINT"3.  ENTER TOTAL TAXABLE ESTATE"
15 Y%=CONCHAR%
IF Y%=(32) THEN 15
IF Y%<(49) OR Y%>(51) THEN PRINT CHR$(127):\
   PRINT"PRESS NUMBER FROM 1 TO 3 PLEASE":FOR X=1 TO 500:NEXT:GOTO 10
PRINT CHR$(127):CHOICE=Y%-48:ON CHOICE GOTO 100,200,500

20 PRINT CHR$(12):PRINT A$(1)       REM DEDUCTIONS ENTRY MENU
PRINT"1.  ENTER DETAILED DEDUCTIONS DATA"
PRINT"2.  ENTER SUMMARY FIGURE FOR DEDUCTIONS"
GOSUB 1500
IF ERROR.FLAG=1 THEN 20

ON CHOICE GOTO 300,400

100 PRINT CHR$(12):PFLAG1=1:PFLAG4=1      REM DETAILED ASSET SCHEDULES
PRINT A$(18):PRINT A$(19):PRINT
PRINT A$(2);TAB(50);:INPUT " $";RL.EST:PRINT A$(3);TAB(50);:INPUT " $";STOCKS
PRINT A$(4);TAB(50);:INPUT " $";CASH:PRINT A$(5);TAB(50);:INPUT " $";INSURANCE
PRINT A$(6);TAB(50);:INPUT " $";JOINT:PRINT A$(7);TAB(50);:INPUT " $";MISC
PRINT A$(8);TAB(50);:INPUT " $";TRANSFERS
PRINT A$(9);TAB(50);:INPUT " $";POWERS
PRINT A$(10);TAB(50);:INPUT " $";ANNUITIES
TOT.ASSETS=RL.EST+STOCKS+CASH+INSURANCE+JOINT+MISC+TRANSFERS+POWERS+ANNUITIES
PRINT:PRINT"TOTAL ASSETS= ";:PRINT USING D$;TOT.ASSETS
30 PRINT"IF SCHEDULE ENTRIES ARE CORRECT, PRESS 1 TO CONTINUE.  PRESS 2 TO "
PRINT"START DETAILED SCHEDULE AGAIN."
GOSUB 1500
IF ERROR.FLAG=1 THEN 30
ON CHOICE GOTO 20,100

200 INPUT"WHAT IS TOTAL VALUE OF ASSETS  $";TOT.ASSETS:PFLAG1=1:PFLAG4=0:\
GOTO 20

300 PRINT CHR$(12):PFLAG1=1:PFLAG5=1      REM DETAILED DEDUCTION SCHEDULES
PRINT A$(18):PRINT A$(19):PRINT:PRINT A$(11);TAB(60);:INPUT " $";FUN.ADM
PRINT A$(12);TAB(60);:INPUT " $";DEBTS
PRINT A$(13);TAB(60);:INPUT " $";MORTGAGES
PRINT A$(14);TAB(60);:INPUT " $";LOSSES
PRINT A$(15);TAB(60);:INPUT " $";EXPENSES
PRINT A$(16);TAB(60);:INPUT " $";MARITAL
PRINT A$(17);TAB(60);:INPUT " $";CHARITABLE
TOT.DED=FUN.ADM+DEBTS+MORTGAGES+LOSSES+EXPENSES+MARITAL+CHARITABLE
PRINT:PRINT"TOTAL DEDUCTIONS =  ";:PRINT USING D$;TOT.DED
40 PRINT"IF SCHEDULE ENTRIES ARE CORRECT PRESS 1, TO CONTINUE."
   PRINT"PRESS 2 TO  START DETAILED SCHEDULE AGAIN."
GOSUB 1500
IF ERROR.FLAG=1 THEN 40
TAXABLE.EST=TOT.ASSETS-TOT.DED
ON CHOICE GOTO 510,300

400 INPUT"WHAT IS TOTAL VALUE OF DEDUCTIONS?  $";TOT.DED:PFLAG1=1:\
   PFLAG5=0:TAXABLE.EST=TOT.ASSETS-TOT.DED:GOTO 510

500 INPUT"WHAT IS VALUE OF TAXABLE ESTATE?  $";TAXABLE.EST
PFLAG4=0:PFLAG5=0
510 IF TAXABLE.EST-EXEMPTION<=0 THEN PRINT "TOTAL ASSETS = ";TAB(50);:\
  PRINT USING D$;TOT.ASSETS:PRINT"TOTAL DEDUCTIONS = ";TAB(50);:\
  PRINT USING D$;TOT.DED:PRINT"TAXABLE ESTATE = ";TAB(50);:PRINT USING D$;\
  TAXABLE.EST:PRINT"EXEMPTION EQUIVALENT= ";TAB(50);:PRINT USING D$;\
EXEMPTION:PRINT:PRINT" ***NO TAX.  TAXABLE ESTATE DOES NOT EXCEED CREDIT ***":\
  PRINT:GOSUB 1600:ON CHOICE GOTO 3,5000
520 IF TAXABLE.EST>=MAX THEN W=(TAXABLE.EST-MAX)*MAX.RATE:\
  ON Y GOSUB 2100,2200,2300,2400,2400,2400
IF TAXABLE.EST>EXEMPTION AND TAXABLE.EST<MAX THEN V=INT(TAXABLE.EST/250000):\
  S=250000:ON V+1 GOSUB 3100,3200,3300,3400,3500,3600,3700,3800,3900,4000,\
   4100,4200,4300,4400,4500,4600
600 PRINT:PRINT A$(1):PRINT"1.  COMPUTE STATE DEATH TAX CREDIT.":PRINT\
    "2.  COMPLETE COMPUTATION WITHOUT STATE TAX CREDIT."
   GOSUB 1500
   IF ERROR.FLAG=1 THEN 600
   PRINT CHR$(12):ON CHOICE GOTO 4700,700

700 PRINT TAB(20);"ESTATE PLANNING FOR ";CLIENT$
    PRINT TAB(20);"COMPUTATION YEAR ";YEAR:PRINT
  IF PFLAG1=1 THEN PRINT"TOTAL ASSETS=";TAB(30);:PRINT USING D$;TOT.ASSETS
  IF PFLAG1=1 THEN PRINT"TOTAL DEDUCTIONS=";TAB(30);:PRINT USING D$;\
   TOT.DED:PFLAG1=0
    PRINT:PRINT"TAXABLE ESTATE=";TAB(30);:PRINT USING D$;TAXABLE.EST
    PRINT:PRINT"TOTAL TAX=";TAB(30);:PRINT USING D$;TOTAL.TAX
    PRINT"CREDIT AGAINST TAX=";TAB(30);:PRINT USING D$;CREDIT
    PRINT:PRINT"NET ESTATE TAX=";TAB(30);:PRINT USING D$;TOTAL.TAX-CREDIT
    IF PFLAG2=0 THEN PRINT TAB(31);"==============="
    IF PFLAG2=1 THEN PRINT:PRINT"STATE DEATH TAX CREDIT=";TAB(30);:\
```

Program continues

$250,000 before computing tax with lines 3100–4600. This technique simplified the coding. When you compute the state death tax credit at line 4700, setting U = 100000 saves space and typing time.

Planning Examples

The first example demonstrates the effectiveness of a "tax exemption" trust. Every estate plan for husband and wife should consider this device. Without any planning, the use of the exemption to avoid tax on the first death is lost. By placing the maximum amount which will escape tax without use of the marital deduction into the "tax exemption" trust on the first death, this amount escapes estate tax completely on the death of both husband and wife. The surviving spouse may receive all income. If he or she is the trustee, subject to required standards, the survivor may control investment of funds and withdraw principal needed for support.

Example 1: John Client dies in 1984 with a taxable estate of $1,000,000. He leaves all property to his wife. There is no tax on John's death since all of the property qualifies for the marital deduction. His wife dies 10 years later with an estate of $1,000,000. Table 1 is the tax upon death of the wife. If a "tax exemption" trust were used on John's death, $325,000 would go into that trust. His wife's taxable estate at her later death would then be $675,000 (assuming no growth). Table 2 shows that the tax is $109,050 lower than without the trust.

The second example illustrates further sophistication for a larger estate. In addition to the use of a "tax exemption" trust, a "qualified terminable interest" (QTI or "cutie") trust is used. The QTI trust enables you to elect upon the first death whether to pay tax on the money in the QTI trust or to postpone that tax until the second death. With Estate Planner you get an immediate printout of the results of implementing this estate planning option.

Example 2: Joe Businessman leaves an estate of $5,000,000 in

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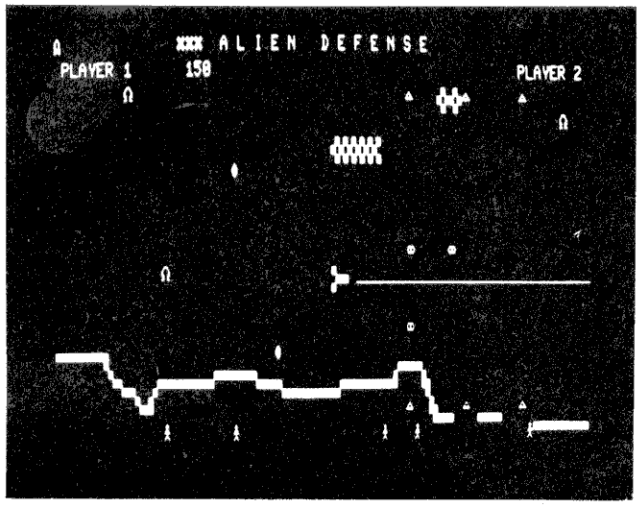

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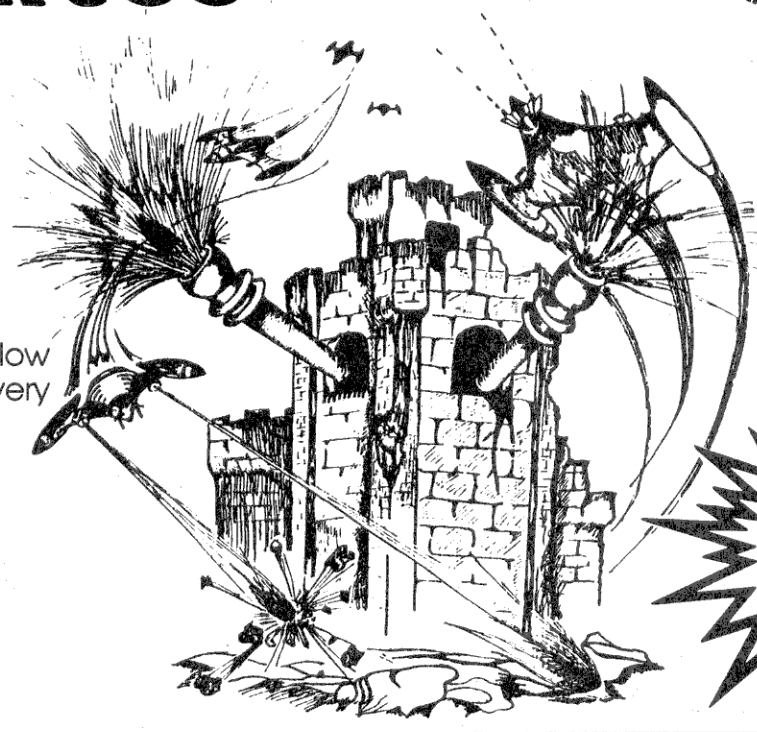

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Program continued

```
    PRINT USING D$;STATE.CR:PRINT"ESTATE TAX LESS STATE DEATH TAX CREDIT=";\
    TAB(50);:PRINT USING D$;TOTAL.TAX-CREDIT-STATE.CR:\
    PRINT TAB(52);"==============="
IF PFLAG3=1 THEN PFLAG3=0:CONSOLE:GOTO 900:

800 PRINT:PRINT"TO PRINT SUMMARY, PLEASE TURN ON PRINTER AND PRESS 1."
PRINT"TO CONTINUE WITHOUT PRINTOUT,  PLEASE PRESS 2."
GOSUB 1500
IF ERROR.FLAG=1 THEN 800
ON CHOICE GOTO 810,900
810 LPRINTER WIDTH 80:PFLAG3=1:GOTO 700

900 IF PFLAG4=0 AND PFLAG5=0 THEN GOTO 950  ELSE PRINT A$(1):PRINT\
   "1.  PRINT DETAILED SCHEDULES.  (PLEASE TURN ON PRINTER)":\
    PRINT"2.  CONTINUE PROGRAM"
 GOSUB 1500
 IF ERROR.FLAG=1 THEN 900
ON CHOICE GOTO 910,950
910 IF PFLAG4=0 THEN GOTO 920 ELSE LPRINTER WIDTH 80:\
PRINT TAB(32);"ASSET SCHEDULE":PRINT
PRINT A$(2);TAB(50);:PRINT USING D$;RL.EST:PRINT A$(3);TAB(50);:\
PRINT USING D$;STOCKS:PRINT A$(4);TAB(50);:PRINT USING D$;CASH:PRINT A$(5);\
TAB(50);:PRINT USING D$;INSURANCE:PRINT A$(6);TAB(50);:PRINT USING D$;JOINT:\
PRINT A$(7);TAB(50);:PRINT USING D$;MISC:PRINT A$(8);TAB(50);:PRINT USING D$;\
TRANSFERS:PRINT A$(9);TAB(50);:PRINT USING D$;POWERS:PRINT A$(10);TAB(50);:\
PRINT USING D$;ANNUITIES:PRINT:PRINT"TOTAL ASSETS= ";:PRINT USING D$;TOT.ASSETS
920 IF PFLAG5=0 THEN CONSOLE:GOTO 950 ELSE LPRINTER WIDTH 80:PRINT:PRINT\
TAB(32);:PRINT"DEDUCTION SCHEDULE":PRINT A$(11);TAB(60);:PRINT USING D$;\
FUN.ADM:PRINT A$(12);TAB(60);:PRINT USING D$;DEBTS:PRINT A$(13);TAB(60);:\
PRINT USING D$;MORTGAGES:PRINT A$(14);TAB(60);:PRINT USING D$;LOSSES:PRINT\
A$(15);TAB(60);:PRINT USING D$;EXPENSES:PRINT A$(16);TAB(60);:PRINT USING D$;\
MARITAL:PRINT A$(17);TAB(60);:PRINT USING D$;CHARITABLE
PRINT"TOTAL DEDUCTIONS= ";:PRINT USING D$;TOT.DED:CONSOLE
950 GOSUB 1600:ON CHOICE GOTO 3,5000

1500 Y%=CONCHAR%
     IF Y%=(32) THEN 1500
     IF Y%<(49) OR Y%>(50) THEN PRINT CHR$(127):ERROR.FLAG=1:\
       PRINT"PRESS NUMBER 1 OR 2 PLEASE":FOR X=1 TO 500:NEXT:RETURN
     PRINT CHR$(127):CHOICE=Y%-48:ERROR.FLAG=0:RETURN
1600 PRINT A$(1):PRINT"1.  DO ANOTHER COMPUTATION.":PRINT"2.  END PROGRAM."
     GOSUB 1500
     IF ERROR.FLAG=1 THEN 1600
     RETURN

2100 TOTAL.TAX=W+1880800:RETURN
2200 TOTAL.TAX=W+1575800:RETURN
2300 TOTAL.TAX=W+1290800:RETURN
2400 TOTAL.TAX=W+1025800:RETURN

3100 TOTAL.TAX=62500+(TAXABLE.EST-225000)*.32:RETURN
3200 TOTAL.TAX=70800+(TAXABLE.EST-S)*.34:RETURN
3300 TOTAL.TAX=155800+(TAXABLE.EST-2*S)*.37:RETURN
3400 TOTAL.TAX=248300+(TAXABLE.EST-3*S)*.39:RETURN
3500 TOTAL.TAX=345800+(TAXABLE.EST-4*S)*.41:RETURN
3600 TOTAL.TAX=448300+(TAXABLE.EST-5*S)*.43:RETURN
3700 TOTAL.TAX=555800+(TAXABLE.EST-6*S)*.45:RETURN
3800 TOTAL.TAX=668300+(TAXABLE.EST-7*S)*.45:RETURN
3900 TOTAL.TAX=780800+(TAXABLE.EST-8*S)*.49:RETURN
4000 TOTAL.TAX=903300+(TAXABLE.EST-9*S)*.49:RETURN
4100 TOTAL.TAX=1025800+(TAXABLE.EST-10*S)*.53:RETURN
4200 TOTAL.TAX=1158300+(TAXABLE.EST-11*S)*.53:RETURN
4300 TOTAL.TAX=1290800+(TAXABLE.EST-12*S)*.57:RETURN
4400 TOTAL.TAX=1433300+(TAXABLE.EST-13*S)*.57:RETURN
4500 TOTAL.TAX=1575800+(TAXABLE.EST-14*S)*.61:RETURN
4600 TOTAL.TAX=1728300+(TAXABLE.EST-15*S)*.61:RETURN

4700 U=100000:PFLAG2=1:T=TAXABLE.EST       REM STATE DEATH TAX CREDIT COMP
    IF T<3*U THEN STATE.CR=1200+.024*(T-2*U)
    IF T>=3*U AND T<5*U THEN STATE.CR=3600+(.032*(T-3*U))
    IF T>=5*U AND T<7*U THEN STATE.CR=10000+(.04*(T-5*U))
    IF T>=7*U AND T<9*U THEN STATE.CR=18000+(.048*(T-7*U))
    IF T>=9*U AND T<11*U THEN STATE.CR=27600+(.056*(T-9*U))
    IF T>=11*U AND T<16*U THEN STATE.CR=38800+(.064*(T-11*U))
    IF T>=16*U AND T<21*U THEN STATE.CR=70800+(.072*(T-16*U))
    IF T>=21*U AND T<26*U THEN STATE.CR=106800+(.08*(T-21*U))
    IF T>=26*U AND T<31*U THEN STATE.CR=146800+(.088*(T-26*U))
    IF T>=31*U AND T<36*U THEN STATE.CR=190800+(.096*(T-31*U))
    IF T>=36*U AND T<41*U THEN STATE.CR=128800+(.104*(T-36*U))
    IF T>=41*U AND T<51*U THEN STATE.CR=290800+(.112*(T-41*U))
    IF T>=51*U AND T<61*U THEN STATE.CR=402800+(.12*(T-51*U))
    IF T>=61*U AND T<71*U THEN STATE.CR=522800+(.128*(T-61*U))
    IF T>=71*U AND T<81*U THEN STATE.CR=650800+(.136*(T-71*U))
    IF T>=81*U AND T<91*U THEN STATE.CR=786800+(.144*(T-81*U))
    IF T>=91*U AND T<101*U THEN STATE.CR=930800+(.152*(T-91*U))
    IF T>=101*U THEN STATE.CR=1082800+(.16*(T-101*U))
    IF STATE.CR>(TOTAL.TAX-CREDIT) THEN STATE.CR=(TOTAL.TAX-CREDIT)
    GOTO 700

5000 PRINT"*** END OF PROGRAM ***":STOP
```

1988 to his wife. She dies 10 years later and the value of the property has increased 50 percent to $7,500,000. There will be no estate tax on Joe's death. Table 3 shows the tax of $2,627,800 on his wife's death. If a "tax exemption" trust is used, the tax on her death is determined in Table 4. (Trust is now $900,000 and wife's estate $6,600,000.) The trust has saved $331,600 for the family. Total tax: $2,296,200.

Assume Joe and his wife plan with both a "tax exemption" trust and a "QTI" trust. The QTI trust receives half of Joe's estate, less the amount in the "tax exemption" trust ($2,500,000-$600,000 = $1,900,000). Joe's wife may elect to pay a tax of $694,200 on Joe's death (Table 5), by not qualifying the QTI trust for the marital exemption. The tax on her death will be $1,313,600. (Table 6). Total tax on both deaths: $2,007,800. The family has apparently saved an additional $288,400 over the use of the tax exemption trust alone.

However, things are not always what they seem. Payment of tax on Joe's death deprived his wife of $694,000 in cash. Invested at the very conservative rate of 6 percent per annum, the before-tax income on these funds during the ten years will exceed substantially the estate tax savings. Therefore, his wife elects upon Joe's death not to have the QTI trust taxed.

If you are a professional estate planner, accountant, insurance salesman, attorney or trust officer, this program demonstrates dramatically to your clients the savings to be realized with proper planning. Before the estate planning conference, if you know the approximate size of the estate, run the computations for both tax and QTI trusts. For the successful business or professional person, the program should convince you to update your estate plan to take advantage of the new provisions in the estate tax law. ■

Charles R. Perelman is an attorney/CPA who specializes in estate planning and other tax matters in Beverly Hills, CA.

Utilities

SUPER UTILITY PLUS

SUPER UTILITY PLUS

Copyright ©1981 Breeze Computing, Inc. SUPER UTILITY PLUS was written by Kim Watt and is the most powerful program of its kind on the market at this time. This program is a machine language, stand alone program that has its own I/O routines, does not use any ROM or DOS calls, and works on SINGLE or DOUBLE DENSITY systems. Super Utility Plus performs such a wide range of varied tasks, that it may truly be called "The King of Utilities". It is not required that the disk be in any drive after initialization of the program and user may custom configure the program to suit his individual system requirements.

ZAP does everything your present "zapping" utility does plus many additional enhancements. It will operate on SINGLE or DOUBLE DENSITY systems and will work with most major operating systems that are presently on the market. The screen printout on Zap displays one sector at a time in HEX and ASCII (as other "zapping" utilities), but also tells user the true and relative track and whether the disk in IBM format or not. Zap also has a search routine that will locate the highest or lowest configured track on the disk and others that will search the disk for byte list, ASCII string, word list, or even encripted code. Zap also allows you to display disk sectors, compare disk sectors, copy sector data, zero disk sectors, copy disk sectors, reverse sector data, sector searches, read ID address marks, or alter data address marks.

PURGE has a full screen editing kill control that allows you to kill files by positioning cursor and pressing one key. Also, Purge has several sub-utilities that allow you to zero out unused directory entries or zero out unused disk granules. In addition, user may kill files by naming the common category of the files, and may compute existing passwords, change the disk name, date, passwords, auto command, or even file parameters (name, passwords, protection levels). Lastly, Purge contains a complete disk directory that indicates all active and non-active files on the disk.

FORMAT is a utility that allows the user to format a disk with; standard format, format without erasing existing data, special format (custom format your disk most any way you want it), build a format track and optionally write it back to any track on your disk, and even contains a software bulk erase utility. The total formatting capabilities of this program are just about UNLIMITED and you may even reformat over a disk or add tracks to an existing disk without destroying existing disk data.

DISK COPY will copy most any standard disk, with or without formatting. The Special Disk Copy enables the user to make a backup of most TRS-80® readable disks that are presently on the market, regardless of any efforts that have been made to protect them from being "backed up". (NOTE: This program WILL NOT copy itself). This program's only intended use is for you to make backups of your legally purchased programs. Please DO NOT use this utility to make "bootleg copies" for others as authors of quality programs deser their royalties.

TAPE COPY enables the user to perform a wide variety of actions that include the ability to read, write, or verify tapes and even includes a Bit by Bity copying routine that will back up most ANY TRS-80® readable tape regardless of protection attempts made by authors. This utility also is for your own use only.

DISK REPAIR allows you to automatically repair the HIT and GAT sectors, and will automatically repair a Boot. This utility also does a complete Directory Check and will advise you of errors that exist. In addition, this utility allows the user to recover killed files (if the file was killed by this utility or by NEWDOS), read protect or un-read protect the directory, move it to a different location on the disk, or clear unused entries. Lastly, this utility advises you of all inactive file that are on the disk.

MEMORY supplies the ability to display, move, test, compare, zero, exchange, input or output a byte to any port, exchange, jump to, reverse, fill, string search, or even load/write and entire track or sectors to/from memory.

FILE contains the abilities to display file sectors, compare files, copy files, disk directory, free space, file locations, drive status, create files, and clear files from disk. These utilities give you a wide range of powerful complete reorganization of your entire disk with all the files re-written in their most contigious order.

CONFIGURE SYSTEM gives you the ability to custom configure Super Utility Plus to your system. You may select single or double density, in any combination, 5" drives, select your operating system boot of your choice, upper or lower case, high speed clock, single or double headed drives, or even configure your printer.

Now for Mod I or III **$74.95**

Sold on protected media.

BOSS III

The **B**ASIC **O**PERATED **S**INGLE **S**TEPPER

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for Mod III

This Machine Language utility is designed to aid you in creating and debugging programs written in BASIC. The utility allows you to trace the program flow, to single step the BASIC program, to observe the conditions of variables during program execution, and to push your basic program on the stack during program developmet. The utility is known to operate with Mod III, TRS-DOS or Mod III Rom BASIC.

Cassette (goes to disk) **$18.95**

TAPE COPY 2

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This program will load most any TRS-80 500 Baud system tape (standard Mod I speed) and load it into memory and save it at either 500 or 1500 Baud on the Mod III. NO KNOWLEDGE OF MACHINE LANGUAGE NEEDED. Now it gives you a way to back up a machine language program that loads at the lower speed and makes cassette loading into your new Mod III a much faster, more reliable process. Works with Mod I* & Mod III.

Only **$14.95**

*Mod I loads and saves at 500 Baud only.

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Do you reap only mysteries from your TRS-80 ROMs?
Your book has arrived!

MOD III ROM COMMENTED

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Not just a rehash of old information, but detailed comments on the ROMS in the latest machine from Tandy.

List **$22.50**

NEW

ZAPSIT

©1981 by Soft Sector Marketing, Inc. – Written for TRS-DOS & DOSPLUS by Larry Ashmun
Requires 32K Disk – Mod III

Zapsit is a stand alone machine language program that lets you examine, modify, copy disk sectors and much more. It does not use any of the resident DOS routines so that you are not limited to the restrictions of the particular DOS that you normally use. You do not have to have a system disk in DRIVE 0 once Zapsit is running.

Currently there are two versions of Zapsit – one for use with TRSDOS* and one for use with DOSPLUS**. They are the same except in the way that they format a disk and the way that they write DATA ADDRESS MARKS. Because of the differences, they are not interchangable. Writing to a TRSDOS diskette with the DOSPLUS version (or vice-versa) could make the diskette written too unuseable.

For all disk operations you will be asked a series of questions. Each question can be answered by pressing the ENTER Key or by entering a specific value. Pressing the ENTER Key will cause the DEFAULT value to be used. All default values are indicated on the screen at the time the question is asked.

When entering a specific numeric value it is assumed to be DECIMAL unless an H is appended to the number. When an H is appended, the number is assumed to be hexadecimal (base 16).

CAPABILITIES

Display/Modify Disk Sectors/Memory. Print to screen. Print sector to printer. Modify in Hex. Modify in ASCII.

Change Track & Sector Limits. Single density read and write. Double density read and write for 1-80 track, from 0-18 sectors. Single and dual sided drives.

Format a Disk. S = Standard Format. W = Format without Erase. If you press ENTER or S you will be asked which drive, what density. After answering these questions Zapsit will format the disk using the parameters specified. As each track is formatted all of the sectors are checked for readability before the next track is formatted. Any unreadable sectors are reported but the operation will not be aborted.

If you type W you will be asked which drive, what density to use and if you want any bad sectors reported to the printer. Before each track is formatted each readable sector on the track is read into a holding area. Unreadable sectors are reported and their holding area is zeroed. After all of the sectors for a track are stored, the track is reformatted and the data in the holding areas written to the appropriate sectors.

Verify a Disk. Verify a disk does just that. It verifies that every sector is readable. Any unreadable sectors are reported. You will be asked if you want the unreadable sectors reported to the printer.

Now you can verify that the format of your diskette is in good shape before you copy your important files to a diskette. This prevents loosing your data that you are trying to back up.

Copy Disk Sectors. Copy disk sectors allows you to: Copy sectors (Single or Double Density) from a disk to different sectors on the same disk. Copy sectors from a Double Density disk to a different Double Density disk. Copy sectors from a Single Density disk to a different Single Density disk. Copy sectors from a Single Density disk to a Double Density disk. Copy sectors from a Double Density disk to a Single Density disk. All copying to a Different disk must be done on a Two Drive System.

Zero Disk Sectors. Zero disk sectors allow you to write a value of your choice to the sectors specified.

Read a Track. Reading a track allows you to read an entire track into memory, with all of the address marks and information that you don't normally see with a sector read. The output can be to either the screen or printer.

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Most teachers find much of their time is spent calculating and recording grades. This program was designed to rectify that situation while in addition provide a computer printout of the grades. This program requires the use of total points and either curved grades or percent grades. In addition the grade records may be printed in alphabetical order, sorted by average grade or points accumulated, and saved on disk.

Records for up to 45 students, with 20 grades each can be accommodated. These numbers may be limited by available computer memory. The resulting printout will show the calculated weighted grade average and the appropriate letter grade. In addition to the weighted average, the percent grade and the total weighted points will be printed. If total points are used and grades curved, the letter grade is omitted. If de-

The Key Box

Disk Basic
48K RAM
NEWDOS 80, TRSDOS
2 Disk Drives
Printer

S$(S)	The student name, 20 spaces and each grade, five spaces
W(A)	Weighting for each assignment, any value
A$(A)	Assignment titles, up to four characters long
G$, G1$, G, G%, G!	Work areas for the grades
NS	Total number of students allowed
NA	Total number of assignments allowed
TS	Number of students in the class
TA	Number of assignments recorded
SP$	20 blanks used for filler when working with strings
L$	20 . . . used as leaders
C$(I)	Commands
GR$	* Fills in the missing grades
AV(A)	Average grades for assignments
IN$	Input area from line input
B($)	Letter grades allowed

Table 1

Program Listing 1

```
1 CLS:PRINT:PRINTTAB(20)"GRADE BOOK ":POKE16561,254:POKE16562,12
6:CLEAR6000:DEFINTA-C,E-V,X-Z:POKE16526,0:POKE16527,127:DATA205,
127,10,94,35,86,237,83,32,127,35,94:DATA35,86,237,83,215,127,35,
94,35,86,237,83:DATA217,127,35,126,50,219,127,33,0,0,34,213
2 DATA127,237,91,213,127,203,59,175,203,58,48:DATA2,203,251,237,
83,213,127,122,179,200,42:DATA32,127,237,82,34,209,127,33,0,0,34
,207:DATA127,42,207,127,34,205,127,42,205,127,237:DATA91,213,127
,25,34,211,127,235,33,0,0,25
3 DATA25,25,229,237,91,205,127,33,0,0,25,25:DATA25,237,75,215,12
7,9,235,225,9,229,213,58:DATA219,127,71,197,19,35,78,35,70,42,21
7:DATA127,9,235,78,35,70,42,217,127,9:DATA193,26,150,56,6,32,35,
19,35,16,246
4 DATA209,225,6,3,78,235,126,113,235,119:DATA35,19,16,246,42,213
,127,235,42,205:DATA127,175,237,82,34,205,127,48,155,24,2:DATA20
9,225,42,207,127,17,1,0,175,25,34,207,127:DATA237,91,209,127,237
,82,218,71,127,195,37,127:FORI=1TO205:READA
5 POKEI+32511,A:NEXT:NS=45:NA=20:T=0
DIMC$(11),S$(NS),W(NA),A$(N
A),AV(NA),X(3):Z=0:SP$=STRING$(20," "):L$=STRING$(20,"."):GR$="
   *":B$(1)=" 90":B$(2)=" 80":B$(3)=" 70":B$(4)=" 60":DATAHELP,P
RINT,LOAD,SAVE,NEW,QUIT,GRADES,SORT,NAMES
```

Program continues

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"I found it useful to observe the results before settling on a final weight"

sired, a worksheet for recording daily grades may be printed. (Fig. 1.)

Features

The program is command driven. If you are in doubt as to what command to enter, type Help for a list of allowable commands. Typing End will terminate a section without any action being taken. The major program sections are: Names; Grades; Sort; Load; Save; Print; Quit; and New.

Names

This section allows the user to enter a new class, change or delete a name in an existing class, or add a new student to the roster. The New operation allows the entry of students in a new class. Enter last name

"If you are in doubt. . . type Help. . ."

first, in any order. Since the sort program only takes about a second, it is entered automatically at the End. Names of up to 20 characters long may be entered; if longer, the name will be truncated to 20 characters. Commas may be entered in the disk version but not the tape version.

Grades

The options to this section are Enter, Change and Delete. Grades may be entered as a percentage by responding with 100 to the maximum points query. If the percent grade is needed, enter the raw score and the percent will be calculated and recorded. If a grade is missing and you do not want it averaged in as a zero, type in an *. If you wish to begin again, type in End and start over.

Prior to entering any grades, select a weighting for the assignment. Any value may be used. I found it useful to change this value and observe the results before settling on a final weight. To do this, break from the program and change W(A) for the assignment you want to a different value. Then run a new printout and compare the results.

In addition to the average grade and the letter grade, the total weighted points are printed. If you use total points for your classes the letter grade is deleted. To use this option change T = 0 to T = 1 in line 350.

Sort

The sort routine is entered automatically after a new class is entered. It may be called at any time, even after grades have been en-

Program continued

```
6 FORI=1TO9:READC$(I):NEXTI
7 PRINT:C$="":INPUT"COMMAND OR 'HELP'";C$:FORI=1TO9:IFC$(I)=C$TH
EN8ELSENEXT:PRINT"INVALID COMMAND -- TRY HELP"
8 ONIGOSUB10,11,66,67,29,30,31,46,49:GOTO7
9 CLS:PRINTC$(I):PRINTSTRING$(LEN(C$(I)),"-"):PRINT:RETURN
10 GOSUB9:PRINT:PRINT"VALID COMMANDS":PRINT"
        HELP     PRINT    LOAD     SAVE
        NAMES    GRADES   NEW    ":RETURN
11 GOSUB9:IFTS<1THENPRINT"NO STUDENTS":GOTO7ELSEPRINT"VALID COMM
ANDS":PRINT"
        REPORT            WORKSHEET":GOSUB64:IFIN$="END"THEN7ELSEI
FIN$="REPORT"THENCLS:PRINT"REPORT":PRINT"------":GOTO13
12 IFIN$="WORKSHEET"THENCLS:PRINT"WORKSHEET":PRINT"---------":GO
TO27
13 PRINT"TYPE IN DATE":GOSUB64:CLS:LPRINTIN$:LPRINTCL$;" FOR ";T
A;" ASSIGNMENTS..AND ";TS;" STUDENTS.....":LPRINT"ASSIGNMENT NO.
..........";:FORL=1TOTA:LPRINTLEFT$(SP$,5-LEN(STR$(L)))+STR$(L)
;:NEXT:LPRINT""
14 LPRINT"ASSIGNMENT TITLE.........";:FORL=1TOTA:LPRINTLEFT$(SP
$,5-LEN(A$(L)))+A$(L);:NEXT:IFTTHENLPRINT" TOTAL"ELSELPRINT"  AV
E.";"  TOTAL"
15 LPRINT:LPRINT"          ASSIGNMENT WEIGHT ";:FORA=1TOTA:LPRINT
RIGHT$("  "+STR$(W(A)),3)+"  ";:NEXT:LPRINT:FORS=1TOTS:N=0:D=0:F
ORA=1TOTA:G%=VAL(MID$(S$(S),16+(A*5),5)):IFTTHENN=N+G%*W(A):GOTO
17ELSEIFMID$(S$(S),16+(A*5),5)="    *"THENG%=-1
16 IFG%>=0THENN=N+G%*W(A):D=D+W(A):AV(A)=AV(A)+G%
17 NEXTA:A=A-1:IFTTHENG1$="      ":GOTO19ELSEIFG%=-1THENG1$=GR$:G
OTO18
18 G%=N/D+.5:G1$=STR$(G%):S$(S)=LEFT$(S$(S),20+A*5)+LEFT$(SP$,5-
LEN(G1$))+G1$
19 N$=STR$(N):IFS<10LPRINT" ";
20 IFTTHENS$(S)=LEFT$(S$(S),20+5*A):GOTO22ELSEN$=STR$(N):I=1:IFG
%<1THENG1$="    *":GOTO22
21 IFVAL(G1$)<VAL(B$(I))THENI=I+1:GOTO21ELSEG1$="    "+MID$("ABC
DF&",I,1)
22 S$(S)=S$(S)+LEFT$(SP$,6-LEN(N$))+N$+G1$:PRINT".";:IFTTHEN23EL
SELPRINTS;" ";S$(S)
23 NEXTS:IFTTHEN24ELSELPRINT"AVE. ";SP$;:FORA=1TOTA:AV(A)=INT(AV
(A)/TS+.5):G1$=STR$(AV(A)):AV(A)=0:LPRINT(LEFT$(SP$,5-LEN(G1$))+
G1$);:NEXTA:LPRINT:A=A-1
24 IFTTHENGOSUB46:LPRINT:FORS=TSTO1STEP-1:IF(TS+1)-S<10LPRINT" "
;
25 IFTTHENLPRINT(TS+1)-S;" ";S$(S):NEXTS
26 FORS=1TO60-TS:LPRINTCHR$(138):NEXT:RETURN
27 LPRINT:LPRINT"WORKSHEET FOR ";CL$:PRINT"PLEASE TYPE IN DATE":
GOSUB64:LPRINTIN$:FORI=1TOTS:IFI<10LPRINT" ";
28 LPRINTI;LEFT$(S$(I),20);"I.....I.....I.....I.....I.....I.....
I.....I.....I.....I.....I.....I.....I.....I":NEXT:FORI=1TO60-TS:
LPRINTCHR$(138):NEXT:GOSUB65:CLS:PRINT"WORKSHEET FINISHED":PRINT
"-----------------":GOTO7
29 RUN
30 POKE16561,255:POKE16562,255:END
31 GOSUB9:IFTS<1THENPRINT"NO STUDENTS":GOTO7ELSEPRINT:PRINT"VALI
D COMMANDS:
        ENTER            END              CHANGE":PRINT:C$="":INPU
T"COMMAND OR HELP";C$:IFC$="END"THEN7ELSEIFC$="ENTER"THEN33ELSEI
FC$="CHANGE"THEN40ELSECLS
32 PRINT"INVALID COMMAND":PRINT"--------------":GOTO7
33 IFTA=NATHENCLS:PRINT"NO MORE ROOM":PRINT"-----------":GOTO7E
LSETA=TA+1:A=TA:INPUT"INPUT TOTAL POINTS POSSIBLE";T1:PRINT"GRAD
E INPUTS FOR ASSIGNEMNT";" #  "TA:PRINT"4-LETTER NAME OF ASSIGNE
MNT"": ";
34 GOSUB64:G$=LEFT$(IN$,4):IFG$=""THEN34ELSEA$(A)=G$:PRINT"WEIGH
T OF "A$": ";:GOSUB64:IN$=LEFT$(IN$,4):W(A)=VAL(IN$):PRINT"ASSIG
NMENT  # :"TA" "A$(A);" WEIGHT: "W(A):PRINT"(TYPE * FOR INCOMPLE
TES)":PRINT"  #     NAME            GRADE"
35 FORS=1TOTS
36 PRINTS;LEFT$(S$(S)+". ",20);
37 GOSUB64:IFIN$=""THEN36ELSEIFIN$="*"THEN38ELSEIFVAL(IN$)>T1THE
NPRINT"> ";T1;"?? ":GOTO36ELSEIFVAL(IN$)<0THENPRINT"<0 ??":GOTO3
```

Program continues

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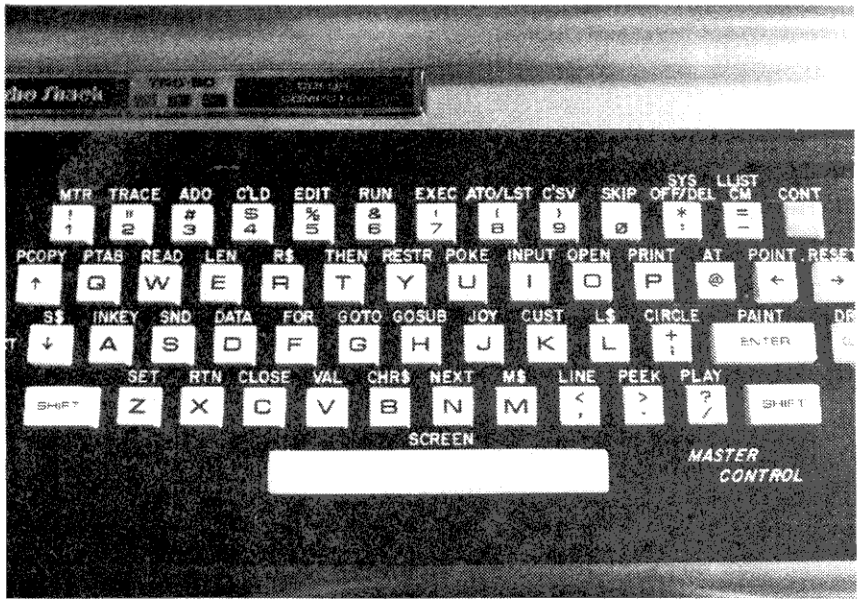

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Motor	4k	NE
Bomber	4k	NE
Football	16k	EXT
Kapow	4k	NE
Dodge	4k	NE
Tape 2		
Bounce	16k	EXT
Tank	32k	EXT
One Arm	4k	NE
Chute	16k	EXT
Where is it	16k	EXT
Lunar Lander	16k	EXT
Stock Market	4k	NE
Tape 3		
Multiply	16k	EXT
Divide	16k	EXT
Add Sub	16k	EXT
Simple Simon	4k	NE
Hangman	16k	NE
Beast	16k	NE
Count Down	4k	NE
Acey	16k	NE
Genie	16k	NE
Protect	16k	EXT
Tape 4		
Graphics	16k	EXT
Songs	16k	EXT
Joy	16k	EXT
Mortgage	16k	EXT
Checkbook	16k	EXT
Draw 1	16k	EXT
Morris	16k	EXT
Sound	16k	EXT
Tape 5		
Ram	16k	MA
Trace	16k	MA
MMaster	16k	MA
Demo	16k	NE
Disassembler	16k	NE
Basbug	16k	NE
Ohmlaw	4k	NE
Convert	4k	NE
Drawer 2	32k	EXT
Degrees	4k	NE
Tape 6		
Hurdler	32k	EXT
Entrap	16k	EXT
Search	16k	NE
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"Student grade averages are calculated as each name is printed to speed up the operation."

Program continued

```
7ELSEIFIN$="END"THENCLS:TA=TA-1:PRINT"GRADES ENDED":GOTO7ELSEIFT
<>100GOSUB39
38 IN$=LEFT$(SP$,5-LEN(IN$))+IN$:S$(S)=LEFT$(S$(S),20+((A-1)*5))
+IN$:NEXT:I=1:GOSUB9:GOTO7
39 G!=VAL(IN$):G!=((G!/T1)*100):G=G!:IN$=STR$(G):RETURN
40 PRINT"CHANGE GRADE FOR WHICH ASSIGNMENT #?":GOSUB64
41 IFIN$="END"THENCLS:PRINT"GRADE CHANGE ENDED":GOTO7ELSEINPUT"H
OW MANY POINTS MAXIMUM?";T1:A=VAL(IN$):IFA<1ORA>TATHENPRINT"NO S
UCH ASSIGNMENT!":GOTO40ELSEPRINT" ENTER STUDENT NUMBER ";:GOSUB6
4:IFIN$="END"THEN41ELSES=VAL(IN$)
42 IFS<1ORS>TSTHENCLS:PRINT"NO SUCH STUDENT":GOTO40ELSEPRINT"STU
DENT  ";S;"  ";LEFT$(S$(S),20);:PRINTMID$(S$(S),16+(5*A),5)
43 PRINT"CHANGE GRADE TO: ";:GOSUB64:IFIN$=""THEN43
44 IFIN$="*"THEN45ELSEIFT1<>100THEN39ELSEIFVAL(IN$)<0ANDIN$<>"
  *"THENPRINT"<0 ??":GOTO44ELSEGOSUB39
45 S$(S)=LEFT$(S$(S),15+(A*5))+LEFT$(SP$,5-LEN(IN$))+IN$+MID$(S$
(S),16+5+(A*5),5*(TA-A)):I=1:GOSUB9:GOTO7
46 GOSUB9:PRINT:INPUT"WHICH FIELD DO YOU WANT TO SORT ON, NAME,
AVERAGE, OR POINTS   ";IN$:IFIN$="AVERAGE"THEN47ELSEIFIN$="POINT
S"THEN47ELSED1=0:L1=LEN(S$(1)):GOTO48
47 D1=21+(5*A):L1=5
48 IFTS=0THENPRINT"NO RECORDS IN FILE":RETURNELSEX(0)=TS:X(1)=VA
RPTR(S$(1)):X(2)=D1:X(3)=L1:Z=USR(VARPTR(X(0))):FORI=1TOTS:PRINT
I;" ";S$(I):NEXT:RETURN
49 GOSUB9:PRINT:PRINT"VALID COMMANDS:":PRINT"
        ADD              CHANGE              DELETE              NEW":PRI
NT:C$="":INPUT"COMMAND OR HELP";C$:IFC$="END"THENCLS:I=1:GOSUB9:
GOTO7ELSEIFC$="ADD"THEN59ELSEIFC$="DELETE"THEN62
50 IFC$="CHANGE"THEN56ELSEIFC$="NEW"THEN51ELSE49
51 CLS:PRINT:PRINT:PRINT"NAME OF CLASS?  ";:GOSUB64:CL$=IN$:TS=0
:TA=0:PRINT"YOU MAY NOW TYPE IN NEW NAMES":PRINT"TYPE IN 'END' A
FTER LAST NAME IS ENTERED."
52 TS=TS+1:IFTS>NSTHENPRINT"CAN'T TAKE ANY MORE STUDENTS":GOTO54
53 PRINTTS":  ";:GOSUB64:IFIN$="END"THEN54ELSEIN$=LEFT$(IN$,20):
L=LEN(IN$):IFIN$=""THEN53ELSEIN$=IN$+LEFT$(L$,20-L):S$(TS)=IN$:G
OTO52
54 TS=TS-1:GOSUB46:FORI=1TO600:NEXTI:RETURN
55 CLS:PRINT""CL$"":IFTS<0THENPRINT"NO STUDENTS":PRINT"---------
--":GOTO7ELSEFORS=1TOTS:PRINTS;LEFT$(S$(S),20):NEXT:FORI=1TO600:
I=1:GOSUB9:GOTO7
56 CLS:PRINT"CHANGE":PRINT"------":PRINT"
TYPE IN STUDENT NUMBER:":GOSUB64:IFIN$="END"THENCLS:PRINT"DONE":
PRINT"----":GOTO7ELSES=VAL(IN$):IFS<1ORS>TSTHENPRINT"NO SUCH STU
DENT NUMBER":GOSUB65:GOTO49
57 IFS<=TSTHENPRINT"OLD NAME*   ";LEFT$(S$(S),20)
58 PRINT"NEW NAME IS? ";:GOSUB64:IFIN$=""THEN58ELSEIN$=LEFT$(IN$
,20):L=LEN(IN$):IN$=IN$+LEFT$(L$,20-L):S$(S)=IN$+MID$(S$(S),21,L
EN(S$(S))):GOSUB46:FORI=1TO600:NEXTI:CLS:PRINT"NAME CHANGED":PRI
NT"-----------":GOTO7
59 CLS:PRINT"ADD":PRINT"---":TS=TS+1:IFTS>NSTHENPRINT" TOO MANY
STUDENTS":TS=TS-1:GOTO49
60 PRINT"
ENTER NEW STUDENT NAME":GOSUB64:IFIN$=""THEN60ELSEG$="":FORI=1TO
TA:G$=G$+GR$:NEXT:S$(TS)=STRING$(20,32)+G$:IN$=LEFT$(IN$,20):L=L
EN(IN$):IN$=IN$+LEFT$(L$,20-L):S$(TS)=IN$+MID$(S$(TS),21,LEN(S$(
TS))):GOSUB46:FORI=1TO600:NEXTI:CLS
61 PRINT"NAME ADDED":PRINT"----------":GOTO7
62 CLS:PRINT"DELETE":PRINT"------":PRINT:PRINT"ENTER STUDENT NUM
BER TO BE DELETED":GOSUB64:S=VAL(IN$):IFS<1ORS>TSTHENCLS:PRINT"N
O SUCH STUDENT NUMBER":GOSUB65:GOTO49ELSEPRINT"IS THIS THE NAME
YOU WISH DELETED? (Y OR N) ";LEFT$(S$(S),20);
63 INPUTIN$:IFIN$<>"Y"THEN7ELSES$(S)=S$(TS)-TS=TS-1:CLS:PRINT"NA
ME DELETED":PRINT"------------":GOTO7
64 INPUTIN$:RETURN
65 FORII=1TO600:NEXTII:RETURN
66 CLS:GOSUB9:INPUT#-1,CL$:INPUT#-1,TS:INPUT#-1,TA:PRINT".";:FOR
S=1TOTS:INPUT#-1,S$(S):PRINT".";:NEXTS:PRINT:FORA=1TOTA:INPUT#-1
,A$(A):PRINT".";:NEXTA:PRINT:FORA=1TOTA:INPUT#-1,DR$:W(A)=VAL(DR
$):PRINT".";:NEXTA:PRINT:RETURN
```

Program continues

tered. When entering the sort routine the option is given of sorting on the name field, the average field or the total field.

The Sort portion of the program is the machine language sort published in Radio Shack's July 1980 Newsletter and modified by Dave Anderson and Joe Fugate. Their program, Flexfile, uses this very quick sort which may be relocated for 32 and 16K machines.

Delete: This allows the deletion of any name. Sort is not needed after this program option.

Add: New names may be added to the class. When names are added after grades have been recorded, the missing grades are entered as asterisks so they will not be counted in that student's average.

Load transfers the student file into the computer from disk. (Caution—remember the file name.) The program can easily be changed to operate on a tape system.

Save will store the student file on disk. The file name selected is automatically extended with a DAT to separate it from any other program files you might have.

Print either allows the printing of the grade report, or a work sheet with only the name and spaces for grades. Student grade averages are calculated as each name is printed to speed up the operation. In using total points, the printout will not occur until you have a chance to determine the order desired, by name or by point value.

Program Description

The string S$(S) stores the student name (first 20 spaces), and the associated grades (five spaces for each grade). The major variables used are in Table 1. The program treats this as a two dimensional string; S being the student, and A being the location of the grade in the string. This approach reduces the amount of memory required. With the remarks deleted the program should easily run in a 16K tape system. The only changes needed are the replacement of the load and save routine, and the Line Input.

Changes for Different Systems

The program is well documented with remarks for changes to make the system operate with different equipment configurations. The following is a summary of the changes required for different systems:

16K, Level II: POKE 16526,0: POKE 16527,127
Memory Size 32512
Change all 255's in machine language section to 127.

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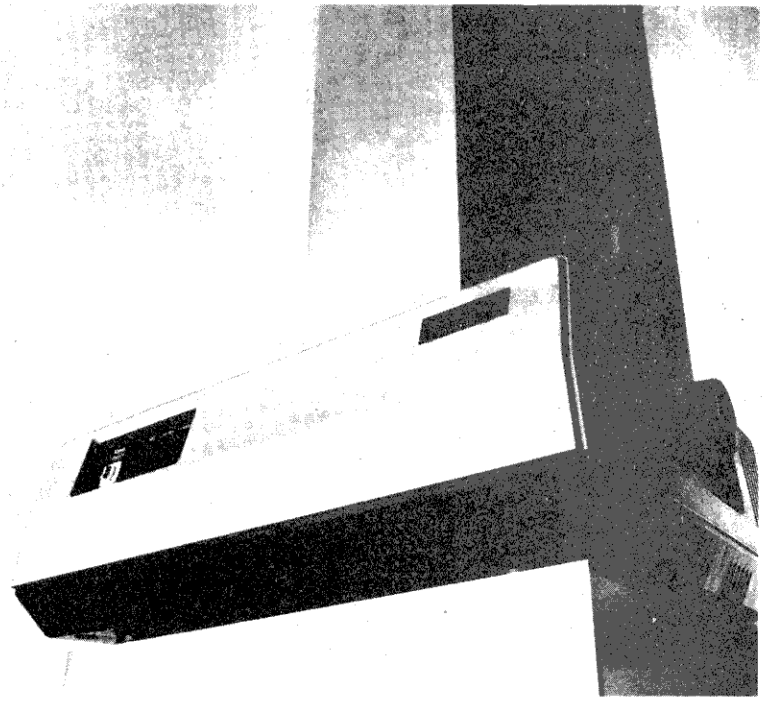

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"The resulting printout will show the calculated weighted grade average and appropriate letter grade."

Program continued

```
67 CLS:GOSUB9:IFTS<1THENPRINT"NO STUDENTS":GOTO7ELSEPRINT#-1,CL$
:PRINT#-1,TS:PRINT#-1,TA:PRINT".";:FORS=1TOTS:PRINT#-1,S$(S):PRI
NT".";:NEXTS:PRINT:FORA=1TOTA:PRINT#-1,A$(A):PRINT".";:NEXTA:PRI
NT:FORA=1TOTA:DR$=STR$(W(A)):PRINT#-1,DR$
68 PRINT".";:NEXTA:PRINT:RETURN
69 INPUT#-1,A$:PRINTA$:GOTO69
```

```
WORKSHEET FOR RKPY3RD
MARCH 13TH, 1981
 1 BARKER DELFA.......I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 2 BEITER DONNA.......I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 3 BRETSON KATHY......I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 4 BROWN PATTY........I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 5 COCOR IMOGENE......I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 6 CROSLEY DEBBIE.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 7 CURRY STACEY.......I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 8 JENKINS JEAN.......I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
 9 LANCER DAWN........I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
10 WHITE NANCY........I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
11 YOUNG BOBBY........I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I.....I
```

Fig. 1

Program Listing 2

```
10 CLS: CMD"T"
20 PRINT
30 PRINT TAB(20)"GRADE BOOK "
35 REM FOR 32K POKE 16561,254 AND 16562,190
       FOR 16K POKE 16561,254 AND 16562,126
40 POKE 16561, 254
50 POKE 16562, 254
60 CLEAR 6000
70 DEFINT A-C
80 DEFINT X-Z
```

Program continues

Change line 310, the POKE I-257,A
to: POKE I+32511,A
Disk entry point &H7F00

For 32K, disk system: POKE 16526,0:
POKE 16527,191
Memory Size 48895
Change all 255's in machine language section to 191's
Change line 310, the POKE I-257, A
to: POKE I-16641, A
Disk entry point &HBF00

Included in the program is a short sound routine that tells the operator when the computer is ready to accept the next grade. Due to the extensive use of strings to store student data, garbage collection would become a problem when entering grades. It is easy when typing fast to lose a grade. The Ready beep from the computer solves this problem.

The data for the sound program is included in line 295. The sound is called through the USR command in line 2455.

The 16K (packed) version of the Grades program is available from the author. ■

Ben Pugsley is a graduate of Boise State University holding a Bachelors and Masters degree in Business Education. He is currently teaching Introduction to Computers and Data Processing, and other business subjects at Meridian Sr. High, Meridian, Idaho.

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```
90 DEFINT E-V
95 REM FOR 32K DEF USR 1=&HBF00
       FOR 16K LEVEL II POKE 16526,0 AND POKE 16527,127
100 DEF USR 1=&HFF00: DEF USR =&HFFCD
110 DATA 205, 127, 10, 94, 35, 86, 237, 83, 32, 255, 35, 94
120 DATA 35, 86, 237, 83, 215, 255, 35, 94, 35, 86, 237, 83
130 DATA 217, 255, 35, 126, 50, 219, 255, 33, 0, 0, 34, 213
140 DATA 255, 237, 91, 213, 255, 203, 59, 175, 203, 58, 48
150 DATA 2, 203, 251, 237, 83, 213, 255, 122, 179, 200, 42
160 DATA 32, 255, 237, 82, 34, 209, 255, 33, 0, 0, 34, 207
170 DATA 255, 42, 207, 255, 34, 205, 255, 42, 205, 255, 237
180 DATA 91, 213, 255, 25, 34, 211, 255, 235, 33, 0, 0, 25
190 DATA 25, 25, 229, 237, 91, 205, 255, 33, 0, 0, 25, 25
200 DATA 25, 237, 75, 215, 255, 9, 235, 225, 9, 229, 213, 58
210 DATA 219, 255, 71, 197, 19, 35, 78, 35, 70, 42, 217
220 DATA 255, 9, 235, 78, 35, 70, 42, 217, 255, 9
230 DATA 193, 26, 150, 56, 6, 32, 35, 19, 35, 16, 246
240 DATA 209, 225, 6, 3, 78, 235, 126, 113, 235, 119
250 DATA 35, 19, 16, 246, 42, 213, 255, 235, 42, 205
260 DATA 255, 175, 237, 82, 34, 205, 255, 48, 155, 24, 2
270 DATA 209, 225, 42, 207, 255, 17, 1, 0, 175, 25, 34, 207, 255
280 DATA 237, 91, 209, 255, 237, 82, 218, 71, 255, 195, 37, 255
290 FOR I=1 TO 234
295 DATA 205,127,10,62,1,14,255,237,91,61,64,69,47,230,3,179,211,255,13,40,
4,16,246,24,242,37,32,241,201
300 READ A
305 REM FOR 32K POKE I-16641,A
        FOR 16K POKE I+32511,A
310 POKE I-257, A
320 NEXT
330 NS=45
340 NA=20
350 T=0
360 DIM S$(NS), W(NA), A$(NA), AV(NA), X(3)
370 Z=0
380 SP$=STRING$(20," ")
390 L$=STRING$(20,".")
400 GR$="    *"
410 B$(1)=" 90"
420 B$(2)=" 80"
430 B$(3)=" 70"
440 B$(4)=" 60"
450 DATA HELP, PRINT, LOAD, SAVE, NEW, QUIT, GRADES, SORT, NAMES
460 FOR I=1 TO 9
470 READ C$(I)
480 NEXT I
490 PRINT
495 REM COMMAND PROCESSING
500 C$=""
510 INPUT"COMMAND OR 'HELP'";C$
520 FOR I=1 TO 9
530 IF C$(I)=C$THEN 560
540 NEXT
550 PRINT"INVALID COMMAND -- TRY HELP"
560 ON I GOSUB 630, 680, 1580, 1810, 2100, 2110, 2140, 2880, 3080
570 GOTO 490
575 REM DISPLAY COMMANDS
580 CLS
590 PRINT C$(I)
600 PRINT STRING$(LEN(C$(I)),"-")
610 PRINT
620 RETURN
625 REM HELP ROUTINE
630 GOSUB 580
640 PRINT
650 PRINT"VALID COMMANDS"
660 PRINT"
        HELP    PRINT   LOAD    SAVE    NAMES
        GRADES  NEW     QUIT    SORT"
670 RETURN
675 REM PRINT ROUTINE
680 GOSUB 580
690 IF TS<1 THEN PRINT"NO STUDENTS": GOTO 490
700 PRINT"VALID COMMANDS"
710 PRINT"
        REPORT          WORKSHEET"
720 GOSUB 4200
730 IF IN$="END" THEN 490
735 IF PEEK(16425)<>1 THEN POKE 16425,1
740 IF IN$="REPORT" THEN CLS: PRINT"REPORT": PRINT"------": GOTO 760
750 IF IN$="WORKSHEET" THEN CLS: PRINT"WORKSHEET": PRINT"---------": GOTO 1
410
755 REM PRINT REPORT ROUTINE
760 PRINT"TYPE IN DATE"
770 GOSUB 4200
780 CLS
```

Program continues

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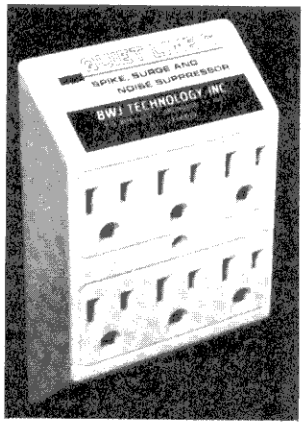

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Program continued

```
790 LPRINT IN$
800 LPRINT CL$;" FOR ";TA;" ASSIGNMENTS..AND ";TS;" STUDENTS....."
810 LPRINT"ASSIGNMENT NO.............";
820 FOR L=1 TO TA
830 LPRINT LEFT$(SP$, 5-LEN(STR$(L)))+STR$(L);
840 NEXT
850 LPRINT""
860 LPRINT"ASSIGNMENT TITLE..........";
870 FOR L=1 TO TA
880 LPRINT LEFT$(SP$, 5-LEN(A$(L)))+A$(L);
890 NEXT
900 IF T THEN LPRINT" TOTAL" ELSE LPRINT"  AVE.";"  TOTAL"
910 LPRINT
920 LPRINT"          ASSIGNMENT WEIGHT ";
930 FOR A=1 TO TA
940 LPRINT RIGHT$("  " +STR$(W(A)), 3)+"  ";
950 NEXT
960 LPRINT
970 FOR S=1 TO TS
980 N=0
990 D=0
1000 FOR A=1 TO TA
1010 G%=VAL(MID$(S$(S), 16+(A*5), 5))
1020 IF T THEN N=N+G%*W(A): GOTO 1050 'FOR TOTAL POINTS PROCESSING
1030 IF MID$(S$(S), 16+(A*5), 5)="    *" THEN G%=-1
1035 REM TO CALCUALTE WEIGHTED POINTS AND WEIGHTED VALUE
1040 IF G%>=0 THEN N=N+G%*W(A): D=D+W(A): AV(A)=AV(A)+G%
1050 NEXT A
1060 A=A-1
1070 IF T THEN G1$="     ": GOTO 1120
1080 IF G%=-1 THEN G1$=GR$: GOTO 1090
1085 REM TO CALCULATE STUDENT AVERAGE
1090  G%=N/D+.5
1100 G1$=STR$(G%)
1110 S$(S)=LEFT$(S$(S), 20+A*5)+LEFT$(SP$, 5-LEN(G1$))+G1$
1120 N$=STR$(N)
1130 IF S<10 LPRINT" ";
1135 REM TO REDUCE STRING LENGTH WHEN USING TOTAL POINTS
1140 IF T THEN S$(S)=LEFT$(S$(S), 20+5*A): GOTO 1200
```

Program continues

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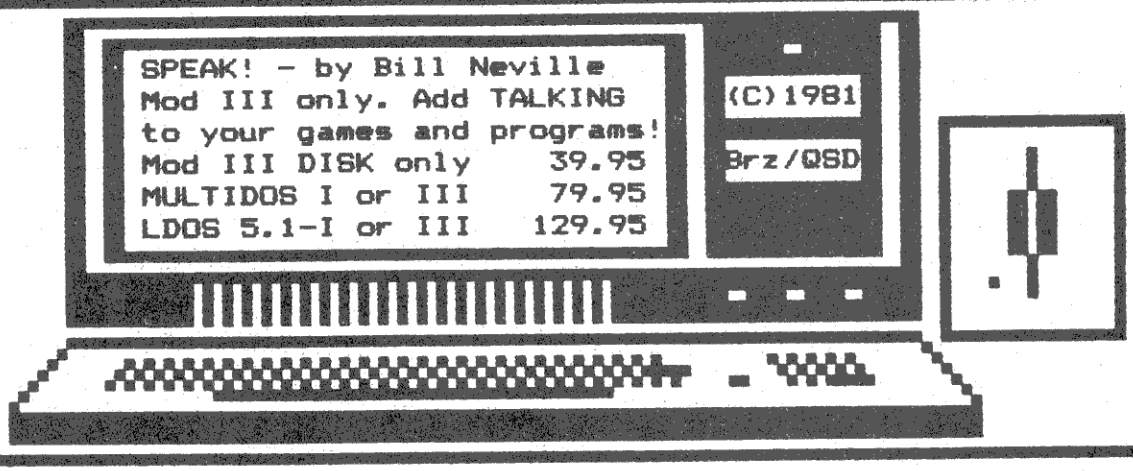

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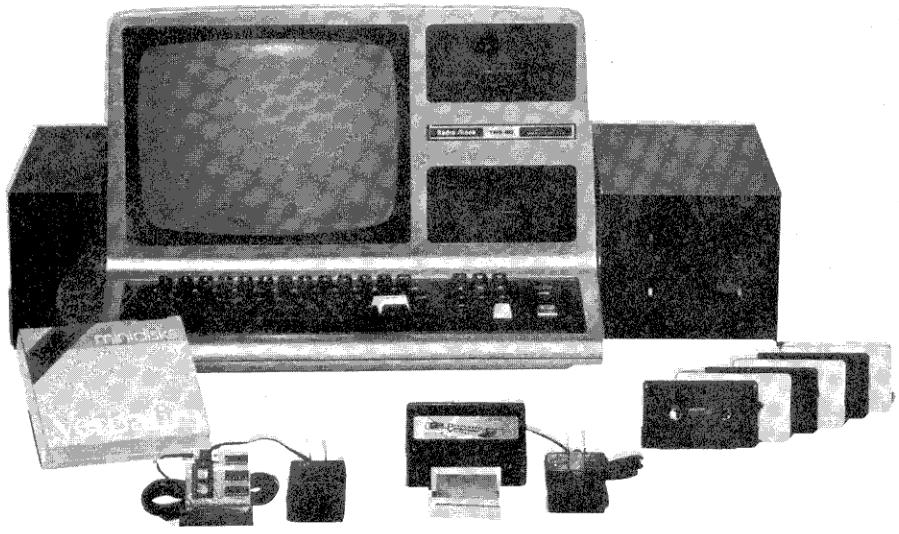
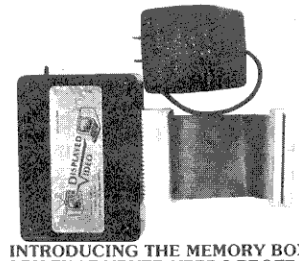
```
1150 N$=STR$(N)
1160 I=1
1170 IF G%<1 THEN G1$="     *": GOTO 1200
1175 REM TO FIND LETTER GRADE
1180 IF VAL(G1$)<VAL(B$(I)) THEN I=I+1: GOTO 1180
1190 G1$="     " +MID$("ABCDF&",I, 1)
1200 S$(S)=S$(S)+LEFT$(SP$, 6-LEN(N$))+N$+G1$
1210 PRINT".";
1220 IF T THEN 1240
1230 LPRINT S;" ";S$(S)
1240 NEXT S
1250 IF T THEN 1350
1260 LPRINT"AVE. ";SP$;
1270 FOR A=1 TO TA
1280 AV(A)=INT(AV(A)/TS+.5)
1290 G1$=STR$(AV(A))
1300 AV(A)=0
1310 LPRINT(LEFT$(SP$, 5-LEN(G1$))+G1$);
1320 NEXT A
1330 LPRINT
1340 A=A-1
1350 IF T THEN GOSUB 2880: LPRINT: FOR S=TS TO 1 STEP -1:IF (TS+1)-S<10 LPR
INT" ";
1360 IF T THEN LPRINT (TS+1)-S;" ";S$(S): NEXT S
1370 LPRINT CHR$(12): REMFOR S=1 TO 60-TS
1380 REM LPRINT CHR$(138)
1390 REM NEXT
1400 RETURN
1405 REM PRINT WORKSHEET
1410 LPRINT
1420 LPRINT"WORKSHEET FOR ";CL$
1430 PRINT"PLEASE TYPE IN DATE"
1440 GOSUB 4200
1450 LPRINT IN$
1460 FOR I=1 TO TS
1470 IF I<10 LPRINT" ";
1480 LPRINT I; LEFT$(S$(I), 20);"I.....I.....I.....I.....I.....I.....I.....
I.....I.....I.....I.....I.....I.....I"
1490 NEXT
1500 REM FOR I=1 TO 60-TS
1510 LPRINT CHR$(12): REM LPRINT CHR$(138)
1520 REM NEXT
1530 GOSUB 4220
1540 CLS
1550 PRINT"WORKSHEET FINISHED"
1560 PRINT"------------------"
1570 GOTO 490
1575 REM LOAD DATA
1580 CLS
1590 GOSUB 580
1600 INPUT"ENTER FILE NAME (NO EXTENSIONS)";DF$
1610 IF DF$="" THEN 1600
1620 IF DF$="END" THEN RETURN
1630 OPEN"I",1, DF$+"/DAT"
1640 INPUT#1, CL$, TS$, TA$
1650 TS=VAL(TS$)
1660 TA=VAL(TA$)
1665 PRINT CL$;" FOR ";TS;" STUDENTS AND ";TA;" ASSIGNMENTS"
1670 FOR S=1 TO TS
1680 INPUT#1, DR$
1690 S$(S)=DR$
1700 NEXT S
1705 IF TA=0 THEN GOTO 1790
1710 FOR A=1 TO TA
1720 INPUT#1, DR$
1730 A$(A)=DR$
1740 NEXT A
1750 FOR A=1 TO TA
1760 INPUT#1, DR$
1770 W(A)=VAL(DR$)
1780 NEXT A
1790 CLOSE
1800 RETURN
1805 REM SAVE DATA
1810 CLS
1820 GOSUB 580
1830 IF TS<1 THEN PRINT"NO STUDENTS": GOTO 490
1840 INPUT"
        WHICH DRIVE (0 OR 1)";DF
1850 INPUT"
        FILE NAME";DF$
1860 IF DF$="" THEN 1850
1870 IF DF$="END" THEN RETURN
1880 DF$=LEFT$(DF$, 8)+"/DAT" +":" +RIGHT$(STR$(DF), 1)
1890 OPEN"O",1, DF$
1900 DR$=CL$
```

Program continues





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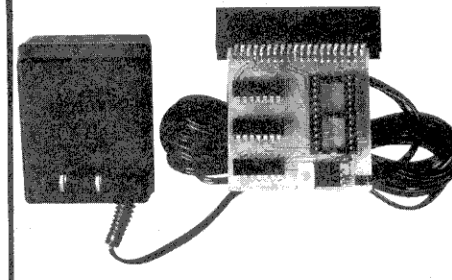

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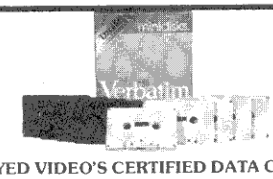

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```
1910 PRINT#1, DR$
1920 DR$=STR$(TS)
1930 PRINT#1, DR$
1940 DR$=STR$(TA)
1950 PRINT#1, DR$
1960 FOR S=1 TO TS
1970 DR$=S$(S)
1980 PRINT#1, CHR$(34); DR$; CHR$(34);
1990 NEXT S
2000 FOR A=1 TO TA
2010 DR$=A$(A)
2020 PRINT#1, DR$
2030 NEXT A
2040 FOR A=1 TO TA
2050 DR$=STR$(W(A))
2060 PRINT#1, DR$
2070 NEXT A
2080 CLOSE
2090 RETURN
2095 REM NEW
2100 RUN
2105 REM FOR 32K POKE 16561,190
          FOR 15K POKE 16562,127  TO RESTORE MEMORY
2110 POKE 16561, 255
2120 POKE 16562, 255
2130 END
2135 REM GRADES
2140 GOSUB 580
2150 IF TS<1 THEN PRINT"NO STUDENTS": GOTO 490
2160 PRINT
2170 PRINT"VALID COMMANDS:
        ENTER           END             CHANGE"
2180 PRINT
2190 C$=""
2200 INPUT"COMMAND OR HELP";C$
2210 IF C$="END" THEN 490
2220 IF C$="ENTER" THEN 2280
2230 IF C$="CHANGE" THEN 2640
2240 CLS
2250 PRINT"INVALID COMMAND"
2260 PRINT"---------------"
2270 GOTO 490
2275 REM ENTER GRADES
2280 IF TA=NA THEN CLS: PRINT"NO MORE ROOM": PRINT"------------": GOTO 490
2290 TA=TA+1
2300 A=TA
2310 INPUT"INPUT TOTAL POINTS POSSIBLE";T1
2320 PRINT"GRADE INPUTS FOR ASSIGNEMNT";" #  " TA
2330 PRINT"4-LETTER NAME OF ASSIGNEMNT"": ";
2340 GOSUB 4200
2350 G$=LEFT$(IN$, 4)
2360 IF G$="" THEN 2340
2370 A$(A)=G$
2380 PRINT"WEIGHT OF " A$": ";
2390 GOSUB 4200
2400 IN$=LEFT$(IN$, 4)
2410 W(A)=VAL(IN$)
2420 PRINT"ASSIGNMENT  # :" TA" " A$(A);" WEIGHT: " W(A)
2430 PRINT"(TYPE * FOR INCOMPLETES)":PRINT"  #     NAME           GRADE"
2440 FOR S=1 TO TS
2450 PRINT S; LEFT$(S$(S)+". ",20);
2455 X=USR(2345)
2460 GOSUB 4200
2470 IF IN$="" THEN 2450
2480 IF IN$="*" THEN 2530
2490 IF VAL(IN$)>T1 THEN PRINT"> ";T1;"??": GOTO 2450
2500 IF VAL(IN$)<0 THEN PRINT"<0 ??": GOTO 2460
2510 IF IN$="END" THEN CLS: TA=TA-1: PRINT"GRADES ENDED": GOTO 490
2520 IF T<>100 GOSUB 2590
2530 IN$=LEFT$(SP$, 5-LEN(IN$))+IN$
2540 S$(S)=LEFT$(S$(S), 20+((A-1)*5))+IN$
2550 NEXT
2560 I=1
2570 GOSUB 580
2580 GOTO 490
2585 REM FIND %
2590 G!=VAL(IN$)
2600 G!=((G!/T1)*100)
2610 G=G!
2620 IN$=STR$(G)
2630 RETURN
2635 REM CHANGE A GRADE
2640 PRINT"CHANGE GRADE FOR WHICH ASSIGNMENT #?"
2650 GOSUB 4200
2660 IF IN$="END" THEN CLS: PRINT"GRADE CHANGE ENDED": GOTO 490
2670 INPUT"HOW MANY POINTS MAXIMUM?";T1
2680 A=VAL(IN$)
```

Program continues

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```
2690 IF A<1 OR A>TA THEN PRINT"NO SUCH ASSIGNMENT!": GOTO 2640
2700 PRINT" ENTER STUDENT NUMBER ";
2710 GOSUB 4200
2720 IF IN$="END" THEN 2660
2730 S=VAL(IN$)
2740 IF S<1 OR S>TS THEN CLS: PRINT"NO SUCH STUDENT": GOTO 2640
2750 PRINT"STUDENT  ";S;"  ";LEFT$(S$(S), 20);
2760 PRINT MID$(S$(S), 16+(5*A), 5)
2770 PRINT"CHANGE GRADE TO: ";
2780 GOSUB 4200
2790 IF IN$="" THEN 2770
2800 IF IN$="*" THEN 2840
2810 IF VAL(IN$)>T1 THEN PRINT"> T1 ??": GOTO 2750
2820 IF VAL(IN$)<0 THEN PRINT"<0 ??": GOTO 2750
2830 GOSUB 2590
2835 REM FOR LEVEL II CHANGE 2840 TO:
          S$(S)=LEFT$(S$(S), 15+(A*5))+LEFT$(SP$, 5-LEN(IN$))+            I
N$+MID$(S$(S),16+5+(A*5), 5*(TA-A))
2840 MID$(S$(S), 16+(A*5), 5)=LEFT$(SP$, 5-LEN(IN$))+IN$
2850 I=1
2860 GOSUB 580
2870 GOTO 490
2875 REM SORT ROUTINE
2880 GOSUB 580
2890 PRINT
2900 INPUT"WHICH FIELD DO YOU WANT TO SORT ON, NAME, AVERAGE, OR POINTS   "
;IN$
2910 IF IN$="AVERAGE" THEN 2960
2920 IF IN$="POINTS" THEN 2960
2930 D1=0
2940 L1=LEN(S$(1))
2950 GOTO 2980
2960 D1=21+(5*A)
2970 L1=5
2980 IF TS=0 THEN PRINT"NO RECORDS IN FILE": RETURN
2990 X(0)=TS
3000 X(1)=VARPTR(S$(1)) 'ADDRESS OF RECORDS
3010 X(2)=D1            'DISPLACEMENT
3020 X(3)=L1            'LENGTH
3030 Z=USR 1(VARPTR(X(0)))
3040 FOR I=1 TO TS
3050 PRINT I;" ";S$(I)
3060 NEXT
3070 RETURN
3075 REM NAMES ROUTINE
3080 GOSUB 580
3090 PRINT
3100 PRINT"VALID COMMANDS:"
3110 PRINT"
        ADD              CHANGE           DELETE           NEW"
3120 PRINT
3130 C$=""
3140 INPUT"COMMAND OR HELP";C$
3150 IF C$="END" THEN CLS: I=1: GOSUB 580: GOTO 490
3160 IF C$="ADD" THEN 3790
3170 IF C$="DELETE" THEN 4030
3180 IF C$="CHANGE" THEN 3560
3190 IF C$="NEW" THEN 3200 ELSE 3080
3195 REM NEW CLASS
3200 CLS
3210 PRINT
3220 PRINT
3230 PRINT"NAME OF CLASS?  ";
3240 GOSUB 4200
3250 CL$=IN$
3260 TS=0
3270 TA=0
3280 PRINT"YOU MAY NOW TYPE IN NEW NAMES"
3290 PRINT"TYPE IN 'END' AFTER LAST NAME IS ENTERED."
3300 TS=TS+1
3310 IF TS>NS THEN PRINT"CAN'T TAKE ANY MORE STUDENTS": GOTO 3410
3320 PRINT TS":  ";
3330 GOSUB 4200
3340 IF IN$="END" THEN 3410
3350 IN$=LEFT$(IN$, 20)
3360 L=LEN(IN$)
3370 IF IN$="" THEN 3320
3380 IN$=IN$+LEFT$(L$, 20-L)
3390 S$(TS)=IN$
3400 GOTO 3300
3410 TS=TS-1
3420 GOSUB 2880
3430 FOR I=1 TO 600
3440 NEXT I
3450 RETURN
3460 CLS
```

Program continues

SMILE

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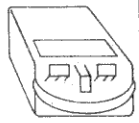

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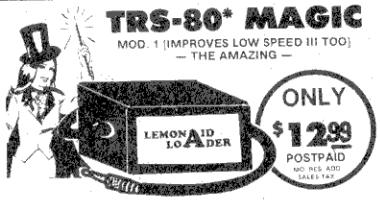

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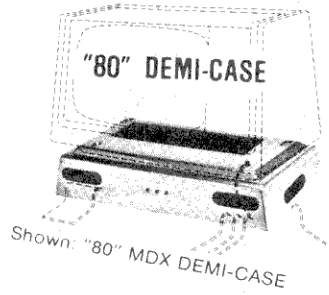

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```
3470 PRINT"" CL$""
3480 IF TS<0 THEN PRINT"NO STUDENTS": PRINT"-----------": GOTO 490
3490 FOR S=1 TO TS
3500 PRINT S; LEFT$(S$(S), 20)
3510 NEXT
3520 FOR I=1 TO 600
3530 I=1
3540 GOSUB 580
3550 GOTO 490
3555 REM CHANGE NAMES
3560 CLS
3570 PRINT"CHANGE"
3580 PRINT"------"
3590 PRINT"

TYPE IN STUDENT NUMBER:"
3600 GOSUB 4200
3610 IF IN$="END" THEN CLS: PRINT"DONE": PRINT"----": GOTO 490
3620 S=VAL(IN$)
3630 IF S<1 OR S>TS THEN PRINT"NO SUCH STUDENT NUMBER": GOSUB 4220: GOTO 30
80
3640 IF S<=TS THEN PRINT"OLD NAME*   ";LEFT$(S$(S), 20)
3650 PRINT"NEW NAME IS? ";
3660 GOSUB 4200
3670 IF IN$="" THEN 3650
3680 IN$=LEFT$(IN$, 20)
3690 L=LEN(IN$)
3700 IN$=IN$+LEFT$(L$, 20-L)
3710 S$(S)=IN$+MID$(S$(S), 21, LEN(S$(S)))
3720 GOSUB 2880
3730 FOR I=1 TO 600
3740 NEXT I
3750 CLS
3760 PRINT"NAME CHANGED"
3770 PRINT"-----------"
3780 GOTO 490
3785 REM ADD NAMES
3790 CLS
3800 PRINT"ADD"
3810 PRINT"---"
3820 TS=TS+1
3830 IF TS>NS THEN PRINT" TOO MANY STUDENTS": TS=TS-1: GOTO 3080
3840 PRINT"
ENTER NEW STUDENT NAME"
3850 GOSUB 4200
3860 IF IN$="" THEN 3840
3870 G$=""
3880 FOR I=1 TO TA
3890 G$=G$+GR$
3900 NEXT
3910 S$(TS)=STRING$(20, 32)+G$
3920 IN$=LEFT$(IN$, 20)
3930 L=LEN(IN$)
3940 IN$=IN$+LEFT$(L$, 20-L)
3950 S$(TS)=IN$+MID$(S$(TS), 21, LEN(S$(TS)))
3960 GOSUB 2880
3970 FOR I=1 TO 600
3980 NEXT I
3990 CLS
4000 PRINT"NAME ADDED"
4010 PRINT"----------"
4020 GOTO 490
4025 REM DELETE STUDENT
4030 CLS
4040 PRINT"DELETE"
4050 PRINT"------"
4060 PRINT
4070 PRINT"ENTER STUDENT NUMBER TO BE DELETED"
4080 GOSUB 4200
4090 S=VAL(IN$)
4100 IF S<1 OR S>TS THEN CLS: PRINT"NO SUCH STUDENT NUMBER": GOSUB 4220: GO
TO 3080
4110 PRINT"IS THIS THE NAME YOU WISH DELETED? (Y OR N) ";LEFT$(S$(S), 20);
4120 INPUT IN$
4130 IF IN$<>"Y" THEN 490
4140 S$(S)=S$(TS)
4150 TS=TS-1
4160 CLS
4170 PRINT"NAME DELETED"
4180 PRINT"------------"
4190 GOTO 490
4195 REM FOR LEVEL II INPUT IN$
4200 LINE INPUT IN$
4210 RETURN
4220 FOR II=1 TO 600
4230 NEXT II
4240 RETURN
```

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DDSD/CMD was designed by Allan J. Domuret, noted author for many popular computer magazines. DDSD is no more complicated than just executing it from DOS READY. No disk ZAPS of any kind are required. DDSD can even be an "AUTO" file. This program functions with all TRS-80 DOS systems and will not adversely affect fast CPU clock systems. DDSD will load itself at top of available memory, respecting any and all programs present. DDSD is compatible with both Mods I and III.

DDSD is available only on cassette, but will easily convert to a disk file by use of LMOFFSET, a utility available to any NEWDOS owner.

The general availability of this utility is exciting news for all N/80 V2 persons!! Even more exciting is the price: $19.95, less than half the price of similar utilities. And that's not all...

For a limited time, DDSD can be yours for just $10 -- if you subscribe to TAS at the same time. Twelve issues are $24, DDSD is $10. For maximum value, our special FLY offer is still available ($45 for 24 issues, FLY is free). There is no better time to check out this journal, so do it now! TAS focuses exclusively on the Mods I and III. DDSD/CMD, alone, is $19.95 plus shipping.

TASMON: History of a Powerful Monitor

About a year ago, Bruce Hansen, engineering student at MSU, found himself more and more involved with machine language programming. This involvement precipitated the need for a good monitor/debugger package. So he got one. Not satisfied, he bought another. Still not happy, he purchased a third. After the SEVENTH package, he gave up looking.

What Bruce wanted was ONE package that would fulfill all his needs. So what commands and features does the ideal monitor/debugger/disassembler pack have? He sat down, made a list, made a few inquiries, and set to work.

A couple of months later, he had what he wanted and needed. He was proud, but needed assurance. So he put it into the hands of several key people -- from experts at Z-80 programming to people who had never used a monitor before. In exchange he got feedback; he heard about errors, improvements were suggested, additional features were asked for, he found out which parts of the instructions weren't clear enough.

He appreciated all the comments, and stood up to all the criticisms. He acted on them all, until he was satisfied.

Today, the final version of TASMON has more than proven itself. Hundreds of people use it and love it, for 3 main reasons: it's very easy to use and understand, it's very powerful & versatile, and all the features are right there, in one neat, well-implemented package. TASMON has received thumbs-up approval from such people as Bill Barden, Jr of Assembly Line fame, Roger Fuller of Soft Bits fame and Roxton Baker of TRAKCESS fame.

So rather than buying a disassembler, a single-stepper, a monitor, and a file transfer utility, why not spend less and get it all in one package? TASMON, its 52 page User's Guide, a handy reference card, and tape or disk media, is just $29.95 plus shipping. Works on I or III. We guarantee: you will NOT find more powerful features for less money! A strong statement, but hard to prove wrong. Watch for reviews coming up in several major magazines for more detailed information.

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Attention wise shoppers! Looking for the most features and capabilities per dollar? Then add Modem 80 to your list for comparison. Dollar for dollar, byte for byte, Modem 80 will work its way to the top of your list!

The Modem 80 package contains seven programs to meet all of your needs. MODEM80/CMD is the main terminal and file transfer program. HOST1 permits remote control of the computer. A file transfer utility called XMODEM is included. SAVE permits off-line text preparation. TEXTFIX is a program to clean up text files so they'll load into a word processor; it removes extra linefeeds, control characters, etc. HEX is the program to convert binary files to ASCII hex characters, and the reverse.

These seven programs (collectively, "Modem 80 Communications Pack", feature all of the capabilities of programs currently costing up to $200. COMPARE: does the competitive program limit file-receiving and transmitting to the amount of available MEM? COMPARE: does the competitive program include a file to "clean up" messy transmissions? COMPARE: does the competitive program permit single line transmissions, for computers not able to accept full-speed data? COMPARE: are you able to execute, from within the program, DOS commands? Does the competitive program support ALL the popular DOSes (including CP/M)?? COMPARE!!

The Modem 80 Communications Pack contains all these features, and plenty more. It's wise to shop around before making a decision, especially when it's possible to save over $100! To make it easy for you, purchase the Modem 80 User's Guide for $5.00. Compare features and prices. When you've made a decision, the $5 will be applicable towards the purchase price. Modem 80 sells for $39.95. The User's Guide is in a sturdy notebook for easy storage and reference. Modem 80 is compatible on either I or III, and with your favorite OS. Requires 32K Disk System.

Can't afford that trip around the world the year? Not going to get to visit the Mayan ruins in Mexico? NASA rejected your application to take the Lunar Cruise Tour? Well, relax. Now you can have these and dozens more adventures in the comfort of your own home, compliments of your friendly TRS-80 and TAS.

The Adventure System is a new concept in adventuring. We supply the tools, you supply the imagination. Don't confuse The Adventure System with lesser quality products: The Adventure System allows you to create a data base containing your adventure instructions. This data base is then used by the machine language adventure driver to propel you into the worlds of your imagination!

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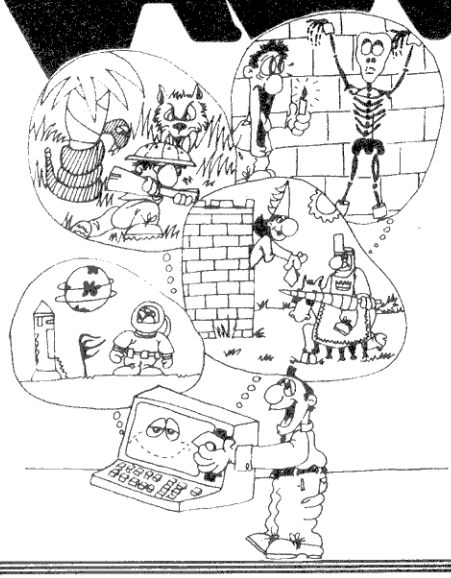

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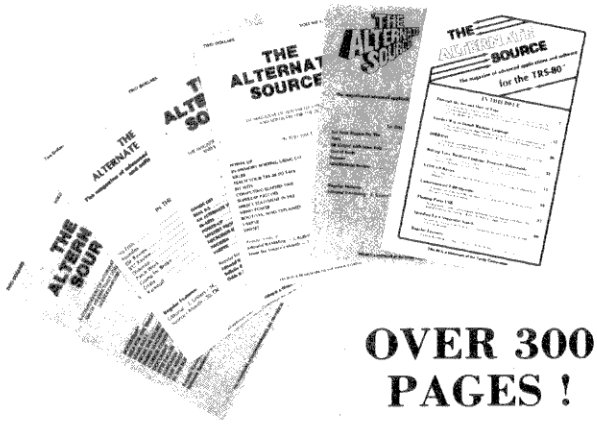

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The approach should work with the TRS-80 Model III and external Model I disk drive cable, but my experience is limited only to the Model I. This article desribes two methods of interfacing. The first interface is useful with one dual headed drive added to the initial 35 track system drive. For two or three dual headed drives the second method works in conjunction with the latest NEWDOS80.

The common 35 and 40 track drives are designated as 48 tpi (tracks per inch). Evidently, the head traverses less than one inch of disk surface. In high capacity drives there are two conventions: The 100 tpi format pioneered by Micropolis on their 77 track drives and 96 tpi format, standard on everyone else's 80 track drives. The 96 tpi format is twice the track density of 48 tpi. It is impossible to read a 100 tpi disk in a 96 tpi drive, and vice versa, although some manufacturers supply a drive in either format.

The innermost tracks of all drives are most prone to errors. To minimize problems, use good disks. Test questionable disks with programs such as The Floppy Doctor, Ver. 3.0. Cheaper single sided disks usually format fine on both sides, but are not burnished on the side with the more critical pivoting head. To minimize wear, the two heads are offset from one another by eight tracks. Double sided disks certified for large capacity drives are best: Verbatim MD 557-01 (double sided, 77 track certified, soft sectored) or Dysan No. 800438 (double sided, 96/100 tpi certified, and soft sectored). Verbatim has a hub reinforcing ring for better disk alignment. Large capacity drive track widths are only 6 mils, but manufacturers rate them equal in reliability to 8 inch floppy disks.

Disk Drive Cable

Figure 1 shows the pin designation and function of the Radio Shack disk drive cable for Model I. The socket at each drive position has certain pins missing. Radio Shack apparently removed them to make it unnecessary for the disk drive owner to open up the unit and cut appropriate DIP shunts.

Disk manufacturers use pin 32 as Head Select (side select) for dual headed drives. A high logic level selects the usual side (side 0), a low level on pin 32 selects the other side (side 1). Before dual headed drives the old Shugart standard permitted selecting one out of a maximum of three drives. To select a fourth drive, Radio Shack decided to use pin 32. Unfortunately, most of industry uses pin 6 for this purpose. But the Radio Shack assignment makes it easy to use Drive Position 2 for Side 0 of double headed disk and a single wire from pin 32 of Drive Position 3 to select Side 1 of the same drive.

Adding an extra insulation displacement socket between Drive Positions 2 and 3 with all pins present makes the interfacing job easier because you will not need the extra wire going to pin 32 of Drive Position 3. Either way, your dual headed drive will look to the expansion interface as two separate drives, Drive 2 and Drive 3.

Diode Interfacing

The hardware needed is a germanium diode, an 8, 14 or 16 pin DIP header, wire and (for the Radio Shack cable) a ribbon cable plug to mate with the cable socket in Drive Position 3. PC fingers from an old printed circuit board can be used instead

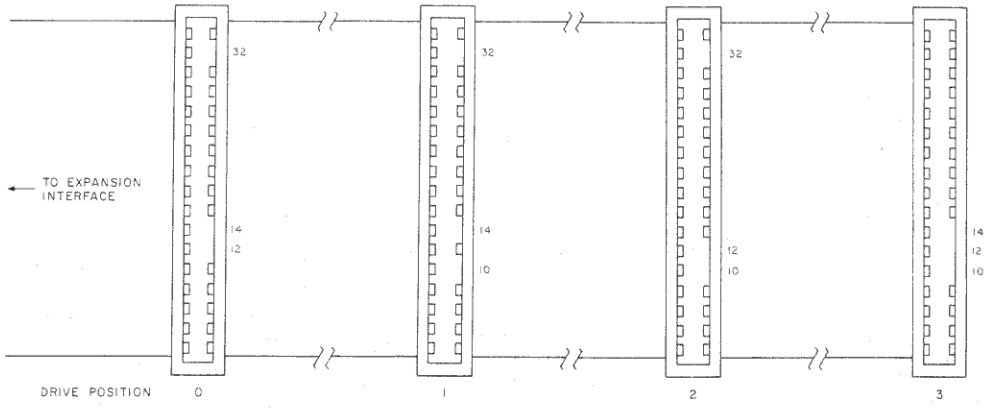

Fig. 1. Radio Shack four drive cable. Numbers on connectors indicate missing pins.

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- Each disk entry automatically "remembers" how many mailings have been made for that particular entry...Can be tied in with purge/select.
- Primarily written in BASIC for easy modification...embedded machine code for those speed sensitive areas.
- Editing is simple and fast...automatic search.
- Supports the 9 digit zip code.
- Deleted entries have "holes" on disk filled automatically ...and alph. order is still maintained!
- Test label printing lets you make horizontal and vertical adjustments with ease.
- Optional "one time" mailing for some selected entries.
- Extensive use of error traps (both operator and machine induced)...even recovers from a power failure during a printout!...recycling on disk errors.
- Patch program allows you to upgrade the system to any DOS.
- Documentation manual available alone for $4.95.
- Hardware requirements: 32K, printer, and 1 or 2 drives.

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Provide your customers with a printed calendar (along with standard banker's holidays) of any month of any year...Useful in motivating history students. Holds the same fascination for students as a game. Tape only for Model I or III.

SUPER CALENDAR (tape only) $19.95

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Sign (Tape only) $9.95

Produce large (reduced 50% here) attention getting signs with your printer...supports most keyboard characters...will print multiple lines...use alone or interface to your own BASIC program...requires just over 16K and a printer.

```
SSSSSSSSS  TTTTTTTTT  ØØØØØØØØ  PPPPPPPPP          LL        ØØØØØØØØ  ØØØØØØØØ  KK    KK
SS     SS  TTTTTTTTT  ØØ    ØØ  PP      PP          LL        ØØ    ØØ  ØØ    ØØ  KK   KK
SS         TTT        ØØ    ØØ  PP      PP          LL        ØØ    ØØ  ØØ    ØØ  KK  KK
SSSSSSSSS  TTT        ØØ    ØØ  PPPPPPPPP  ========  LL        ØØ    ØØ  ØØ    ØØ  KKKK
SSSSSSSSS  TTT        ØØ    ØØ  PPPPPPPPP          LL        ØØ    ØØ  ØØ    ØØ  KKKK
      SS   TTT        ØØ    ØØ  PP                 LL        ØØ    ØØ  ØØ    ØØ  KK  KK
SS    SS   TTT        ØØ    ØØ  PP                 LL        ØØ    ØØ  ØØ    ØØ  KK   KK
SSSSSSSSS  TTT        ØØØØØØØØ  PP                 LLLLLLLLL ØØØØØØØØ  ØØØØØØØØ  KK    KK
```

FAST SORT (handles multiple dim. arrays) and ALPHABETIZER (disk only) $29.95

Interfaces to your own basic programs...sort with the speed of machine code but with the convenience of basic. Just use your disk to merge our short basic programs (with embedded machine code) with your own basic program. Follow our simple instructions to poke several values before making the user call from basic. The pokes will set up a sort of string, integer, single, or double precision arrays (also ascending or descending order). Use one of two programs to sort arrays of the form A(1) or A(Q(1))...The disk includes 8 simple basic programs that are ready to merge with the main sort programs. Use them for learning and evaluation...Also included is a ready to use basic program (already merged with the ORDER program). Use it to obtain a printout of alphabetized names. This program alone is worth $19.95.

Sample Sort Times

8 sec. for 1000 dbl. prec. numbers...50 sec. for 5000 integers (Ours is one of the only alphabetizers that both ignores non alph. characters and treats upper and lower case alike.)

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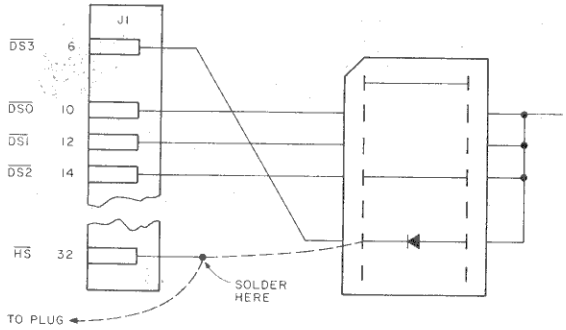

Fig. 2. Interfacing of Tandon TM 100-4 drives. Dotted lines indicate the two jumpers to be wired. One of these, an eight inch lead to the plug, connects to pin 32 of #3 cable socket. Pin 6 is not used by Radio Shack. Instead, pin 32 is Drive Select 3.

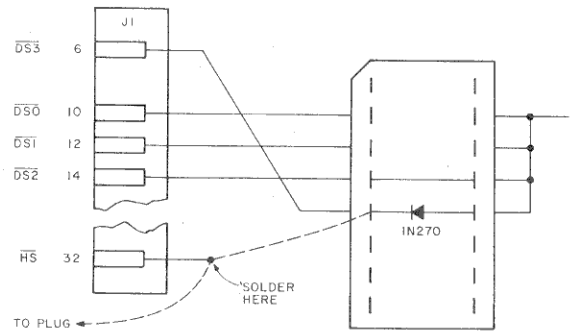

Fig. 3. Interfacing of MPI Model 92 drives.

of the plug. A mating plug will have a different pin out than the drive, so trace the wiring carefully making sure the single wire connects to pin 32 of the drive cable socket. Pin 31 accomplishes this on the Kel-Am (Eldon, MO) PF-17-2801-0 Ribbon Cable Plug.

The noise immunity in diode interfacing is not great. You may find improper drive selection if the extender incorporates a PC board. Disk drive extenders consisting of ribbon cable are better shielded because every other wire of the cable is ground. If you make your own disk drive extender, beware of the reversed pin designation. To compensate, do not connect wire no. 1 of the ribbon cable to the plug. Leave it hanging loose and let wire no. 2 be crimped to pin 1 of the plug. You will be shifting all wire designations by one, assuring a proper extender cable.

For interfacing Tandon TM 100-4 disk units, Fig. 2 shows the layout of the drive's PC board. Most of the wiring is done on the 16 pin header that fits in place of the DIP shunt. Remember to insert the header into an IC socket before soldering or the heat will distort the header. A germanium diode, 1N270, provides a true logic low level of about 0.25 V when the Head Select (side select) signal is at low level at pin 32 of the PC connector J1. This will select Side 1 of the drive. The shunt between pins 4 and 13 of the header assures the drive will also be selected as Drive 2 (side 0).

The MPI Model 92 requires a 14 pin header with different designation (see Fig. 3). Additionally, the shunt between pins 1 and 14 must be present for Head Load with Select operation.

The newly available Micropolis 1015 Mod VI (96 tpi) and Mod IV (100 tpi) need an eight-pin header. Only the four Drive Select lines are available at the header. Unlike other manufacturers, Micropolis uses pin 34 of the PCB drive connector to select Drive Position 3. Since Radio Shack does not use this pin, you will have to jumper it to pin 32. Follow the scheme shown for Tandon interfacing on Fig. 2.

Shugart recently introduced the SA460, a 96 tpi dual headed drive. Their pin assignment is similar to Tandon's, except a 14 pin header is needed. A shunt between pins 1 and 14 is also required.

Using Dual Headed Disk Drives

The advantage of the interface is you can read large capacity disks using TRSDOS or any other Model I DOS, providing you keep the directory on a single track. Unmodified TRSDOS has no trouble reading a 40, 77 or 80 track disk but will not write past track 35. To format 77 or 80 tracks per side and to write data to the disk, you have several options. Percom Data Company supplies Patchpak #4 for patching TRSDOS for a 77 track operation. You need two disk drives for this. If neither drive is a Micropolis 100 tpi (77 track) drive, be sure to order the Patchpak in 35 track format, otherwise you will not be able to access the Patchpak disk.

Once your TRSDOS is patched you will end up with a 35 track TRSDOS for Drive Position 0 that thinks all of the drives are 77 track. It will give incorrect FREE for Drive Position 0 and possibly Position 1 if you have a second 35 or 40 track drive in it. In all other respects it will be compatible. With Patchpak you can also obtain your patched TRSDOS in 77 track format.

NEWDOS80 lets you custom configure your disk system for, say, 35 track format in Drive Position 0, 40 track format for Drive Position 1 and 80 track format in Drive Positions 2 and 3. It correctly computes FREE and is easy to use with multi drive systems with a cue card such as that supplied for version 1.0 by MTC, Incorporated.

Apparat's Approach

Apparat recently introduced version 2.0 of NEWDOS80, with an option specifically for dual headed drives. If your NEWDOS-80 version 1.0 has all the zaps through number 53, you also have the option of having up to three double sided drives on line. Since I do not recommend eliminating a 35 track drive from your system this approach will allow you two additional dual headed drives. There is a penalty for this: You can only access those drives using NEWDOS80. The disks will be unreadable by any other DOS, including TRSDOS.

With the option activated, NEWDOS80 redefines a track to contain 20 rather than 10 sectors, with the first 10 sectors on Side 0 and the remaining 10 sectors on Side 1 of the disk. NEWDOS80 looks upon each dual headed 80 track drive as a single 80 track drive with each track split between the two sides. Pin 32 carries the multiplexing signal, while pins 10, 12 and 14 of the drive cable provide the actual Drive Select signal. Each dual-headed drive requires two simultaneous signals which explains why you are limited to three drives. Drive 3 is undefined.

Under NEWDOS80 the interfacing scheme in Figs. 2 and 3 will work only with one dual headed drive in drive position. If you need more than one dual headed drive, eliminate the diode and the wire between pin 32 of the drive and pin 5 (Fig. 2) or pin 6 (Fig. 3) of the header. You must also jumper the appropriate shunts on the DIP header for drive selection. With a Radio Shack cable with pins missing you can jumper all three drive select shunts. You will have to daisychain pin 32 of each dual headed drive PC board to pin 32 of Drive Position 3 socket.

Although Apparat advises buying their disk drive cable with pin 32 present in each of the sockets, this is not necessary if you are willing to run the single wire instead. With the Apparat cable you have to cut the trace to pin 32 on the PC board of any single sided drive, such as a 35 track system drive.

With the interfacing you will gain 314 grans (392.5K bytes) of user accessible storage in an 80 track dual-headed drive, or 4.7 times the capacity of a 35-track data disk. You will be up to date with today's technology—and ready for double density.■

Matt Robins is a scientist-turned-computer specialist. He gained experience with floppy disks in the R&D department of Compucorp in Los Angeles.

PROGRAMMING TOOLS FOR YOUR TRS-80™ MODEL I AND MODEL III

INSIDE LEVEL II

The Programmers Guide to the TRS-80 ROMS

INSIDE LEVEL II is a comprehensive reference guide to the Level II ROMs which allows the machine language or Basic programmer to easily utilize the sophisticated routines they contain. Concisely explains set-ups, calling sequences, and variable passage for number conversion, arithmetic operations, and mathematical functions, as well as keyboard, tape, and video routines. Part II presents an entirely new composite program structure which loads under the SYSTEM command and executes in both Basic and machine code with the speed and efficiency of a compiler. In addition, the 18 chapters include a large body of other information useful to the programmer including tape formats, RAM useage, relocation of Basic programs, USR call expansion, creating SYSTEM tapes of your own programs, interfacing of Basic variables directly with machine code, a method of greatly increasing the speed at which data elements are stored on tape, and special precautions for disk systems. INSIDE LEVEL II is a clearly organized reference manual. It is fully typeset and packed with nothing but useful information. It does not contain questions and answers, ROM dumps, or cartoons.
Includes updates for Model III. INSIDE LEVEL II.....$15.95

SINGLE STEP THROUGH RAM OR ROM

STEP80 allows you to step through any Basic or machine language program one instruction at a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so that the 'target program' may perform its display functions unobstructed. STEP80 will follow program flow right into the ROMs, and is an invaluable aid in learning how the ROM routines function. Commands include step (trace), disassemble, run in step mode at variable step rate, display or alter memory or CPU registers, jump to memory location, execute a CALL, set breakpoints in RAM or ROM, write SYSTEM tapes, and relocate to any page in RAM. The display may also be routed to your line printer through the device control block so custom print drivers are automatically supported.
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TELECOMMUNICATIONS PROGRAM

This machine language program may be used as a smart terminal with time share systems or for high speed file transfers between two disk-based micros over modems or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminal mode, save RAM buffer on disk, transmit disk file, receive binary files, examine and modify UART parameters, program 8 custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the transmission was accurate. This program comes on a formatted disk.
Specify Model I or Model III. TELCOM.....$39.95

PROGRAM INDEX VERSION 2.0

Assemble an alphabetized index of your entire program library from disk directories. Program names and free space are read automatically (need not be typed in) and may be alphabetized by disk or program. The list may also be searched for any disk, program, or extension; disks or programs added or deleted; and the whole list or any part sent to the printer. Printer output may be requested in three different formats including labels. The list itself may also be stored on disk for future access and update. It also includes a PURGE mode for quickly killing unwanted files. Directory reads and alphabetizing is done in machine code for speed. 1,000 programs may be sorted in less than 10 seconds. Works with TRSDOS, NEWDOS, and NEWDOS/80 single or double density. One drive and 32K required.
Specify Model I or Model III. INDEX.....$24.95

4 SPEED OPTIONS FOR YOUR TRS-80

The SK-2 clock modification allows CPU speeds to be switched between normal, an increase of 50%, or a 50% reduction; selectable at any time without interrupting execution or crashing the program. Instructions are also given for a 100% increase to 3.54 MHz. The SK-2 may be configured by the user to change speed with a toggle switch or on software command. It will automatically return to normal speed any time a disk is active, requires no change to the operating system, and has provisions for adding an LED to indicate when the computer is not at normal speed. It mounts inside the keyboard unit with only 4 necessary connections for the switch option (switch not included), and is easily removed if the computer ever needs service. The SK-2 comes fully assembled with socketed IC's and illustrated instructions.
Model I only. SK-2.....$24.95

INSTANT ASSEMBLER

The INSTANT ASSEMBLER is a new, powerful tape-based assembler and debugger for the TRS-80. Now you can assemble directly to memory and immediately debug your program with the built in single stepping debugger. Quickly switch from assembler to debugger and back again without losing the source code. This feature makes INSTANT ASSEMBLER an excellent learning tool for assembly language programming.
INSTANT ASSEMBLER is absolutely unique among tape based assemblers in that it produces relocatable code modules that can be linked with the separate LINKING LOADER, which is supplied in two versions for loading programs into either high or low RAM. This lets you build long programs with small modules. INSTANT ASSEMBLER also features immediate detection of errors as the source code is entered, a compactly coded source format that uses 1/3 as much memory as standard source, and many operational features including single stroke entry of DEFB and DEFW, pinpoint control of listings, alphabetic listing of symbol table, separate commands for listing error lines or the symbol table, block move function, and verification of source tapes.
INSTANT ASSEMBLER's debugger provides single stepping with full register displays, decimal or hex entry of addresses, forward or backward memory displays, disassembly of object code in memory, memory display in ASCII format, and hex-to-decimal or decimal-to-hex conversion. The single-stepper will step one instruction at a time or at a fast rate to any defined address.
INSTANT ASSEMBLER occupies less than 8400 bytes of memory. In a 16K machine this will leave you enough memory to write assembly language programs of around 2000 bytes. This and its module-linking feature make INSTANT ASSEMBLER ideal for users with only 16K machines. The instruction manual may be purchased separately for $3, which will apply towards the purchase of the INSTANT ASSEMBLER.
Specify Model I or Model III. INTASM.....$29.95

RAM SPOOLER AND PRINT FORMATTER

This program is a full feature print formatting package featuring user defineable line and page length (with line feeds inserted between words or after punctuation), screen dump, printer pause control, and baud rate selection. In addition, printing is done from a 4K expandable buffer area so that the LPRINT or LLIST command returns control to the user while printing is being done. Ideal for Selectric or other slow printers. Allows printing and processing to run concurrently. Output may be directed to either the parallel port, serial port, or the video screen.
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This complete package includes 3 versions of the machine language FFTASM routine assembled for 16, 32, and 48K machines, a short sample Basic program to access them, a 10K Basic program which includes sophisticated interactive graphing and data manipulation, and a manual of instructions and examples. The machine language subroutines use variables defined by a supporting Basic program to make data entry and retrieval extremely fast and easy for custom implementation. They perform 20 to 40 times faster than their Basic equivalent (256 points in 12.5 seconds), and require less than 1550 bytes of memory. The FFT is useful in analyzing stock market and comodity trends as well as for scientific information.
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DUPLICATE SYSTEM TAPES WITH CLONE

Make duplicate copies of any tape written for Level II. They may be SYSTEM tapes or data lists. The file name, load address, entry point, and every byte (in ASCII format) are displayed on the video screen. Model III version allows changing tape speed.
Specify Model I or Model III. CLONE.....$16.95

RAMTEST FOR LEVEL II

This machine language program is a very thorough test for several types of RAM errors. A complete test of each individual bit in a 48K machine takes just 14 seconds. Includes a separate test for power line glitches.
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EDIT BASIC PROGRAMS WITH ELECTRIC PENCIL

Load Basic programs or any other ASCII data file into the disk version of Electric Pencil for editting. One command from DOS quickly modifies existing files to Pencil format. One disk and 32K required.
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A versatile business computer.

CC—Color Computer or Chamber of Commerce?

Richard S. Adcock
141 NW Lorna
Burleson, TX 76028

A rumor is circulating that the Color Computer is not intended as a business machine and that Radio Shack envisions it will find only home applications. Is the rumor correct? The keyboard, for instance, does appear insubstantial—more like a calculator than a computer; and the low band width gives poor resolution to the typical color television. However, my clients continue to point out a rather ideal niche in the business world for the machine. Tandy may be overlooking some real business applications for the Color Computer.

The primary appeal of the Color Computer is low cost. To utilize fully the machine's capabilities, most home users connect the device to their somewhat expensive (though probably still fuzzy) color televisions; but the Color Computer works quite well with $80 black and white sets. This gives you a rather impressive amount of computing power in a fairly small package for well under $500 (or if you use mail order franchise dealers, very nearly under $400). Because of this and the fact that this machine has a built in RS-232 port, the Color Computer is an attractive alternative for a variety of applications which require smaller amounts of internal memory. (If you want more memory, devices such as Spectral Associates Ramcharger add substantial amounts of memory for very little extra cash.) With the RS-232 port, the computer transfers data utilizing an industry standard format. The following applications all owe their existence to the Color Computer's low cost. This low cost system performs well when you use a little ingenuity to help it along.

Employee Monitor

An architectural firm needed a way for the switchboard operator to monitor who was in the office and who was out. This was a serious problem because they used a multiplexed, single line phone system. The switchboard operator needed to keep the phone line free. In a firm of this one's size, fifty people or so are constantly in and out. Trying to locate one of these people could burden the phone line for several minutes. Their office layout placed the operator at the least used company exit.

Two Color Computers solved the problem. The program created a tv typewriter which formatted data and displayed it. When leaving, office personnel type in pertinent information, including their whereabouts and their expected return time. This exit procedure works at either end of the building. We put a signal splitter on the output of the Color Computer at the far end of the building from the operator (the other machine was on her desk). One output from the splitter feeds a monitor at the back computer allowing exiters to see what they are typing. The signal runs through 150 feet of coaxial cable and combines with the output from the second Color Computer in a 300 to 75 ohm transformer and is input into the second tv. Since the video output from a Color Computer switches to either tv channel three or four the television tuner separates the information. The operator can check both screens by changing channels on the tv set. Without this built-in feature, screen selection would have been more involved. After many months of operation, this system works well. This system fills a real need in a unique way that one could not consider without an inexpensive computer. If you do not believe this, consider using an IBM System 34 to perform the same task.

Job Monitoring

A local print shop, running roughly forty different jobs each day, needed to compile in-plant information about which jobs were running and how much time was spent on each until the data and a storage procedure could be transferred to a host computer for processing. The economically priced Color Computer was an ideal choice made even easier due to the built-in RS-232 port. Connecting a cassette with the computer allowed data to be stored, then fed to the host computer over an RS-232 line. With a Model III as the host, data transfer between the two machines was easy. The printer port (serial port) from the Color Computer outputs data at 600 baud, a figure easily matched in the Model III. Since we were using a hard wired connection rather than modem/phone lines, there were no line limitations on the baud rate.

The company starts the Color Computers in the morning, and runs them all day, accepting available job data from several locations, then writing this information out as a cassette data record. At the end of the day, all the cassettes are rewound and carried to the Color Computer which is wired into the Model III. A program reads the data files and prints them (using Color Basic's PRINT#-2 statement) to the serial port. The host Model III accepts and saves the data as a disk file thus transferring data on each cassette. Then the Model III processes the information as required by the application.

You can duplicate this arrangement in almost any situation where on-site data can be collected for later processing. Hardwiring the Model III or probably any other RS-232 port to the Color Computer is a matter of tying pin 1 of the printer port high, using pin 3 as ground and pin 2 as data out. You can change baud rates in the Color Computer by POKEing values into RAM as outlined in the operations manual.

In the preceding examples, the program resident in the Color Computer (which could be stored in a ROM pack) could prompt the user. However, the host computer can also prompt the user. This approach to remote data gathering is ideal for

the Color Computer especially since you can use a Videotex Terminal (a Color Computer with the Videotex terminal program in ROM) instead of the whole computer. Since a Videotex terminal costs about the same (or from some sources somewhat less) than the Color Computer, and since Radio Shack includes the terminal software and a built-in direct connect modem, this approach seems ideal for any situation where phone lines must transfer data.

Monitoring Sales Data

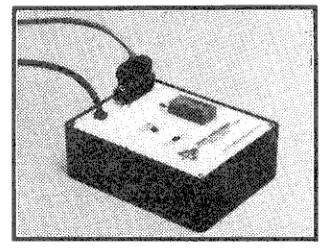
The owners of a chain of six convenience stores were interested in collecting sales data from each of the stores at certain times of the day. In this application the host computer prompts the sales clerk through the Videotex Terminal. It is an excellent solution because all it requires is that the person responsible for data entry turn on the machine and type.

A corollary application would allow salespeople at the end of a day on the road to call their home offices and place orders or transfer sales data. They could plug their computer or terminal into the phone jack, and send or receive data as required. In this instance, they might not need to carry a television with them since they could attach the computer to the one in their motel room.

The combination of small size, light weight and low cost makes the Color Computer an ideal on-the-spot data gathering/data communications device. The machine is also reliable. Add the new software for the machine, such as Scripsit and Spectaculator, a program similar to Visicalc, and this machine may prove to be one of the most widely and uniquely applied computers in the Radio Shack lineup. ■

Richard Adcock is president of Arkyler Computer Services Inc., a Fort Worth based company specializing in custom applications for microcomputers.

Model 953A EPROM PROGRAMMER



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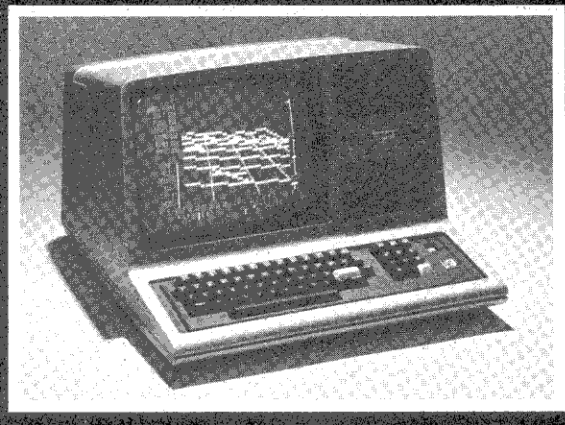
T80-FS1 Flight Simulator

Available for Model I or Model III. $25.00 on cassette or $33.50 on disk (with enhancements) All versions require 16K.



If you order direct, please specify whether you have Model I or Model III (the media *are* different) and whether you want disk or cassette. Include $1.50 and indicate UPS or first class mail. Illinois residents add 5% sales tax. Visa and Mastercard accepted.

If you don't yet own a disk, don't fret. You can upgrade anytime. Cassette users may send back their cassette (but *not* the manual) along with $10 (first class shipping included) and receive the disk version.

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A monitor for your Color Computer.

COLORMON

Douglas R. Cook
3895 West Wetland Drive
West Jordan, UT 84084

I wrote the program Colormon to answer the need for monitor systems and other programs for the TRS-80 Color Computer. It will aid programming and exploration of the Basic color computers. A small portion of it can run on an Atari. Colormon runs with Extended Color Basic and 16K of memory. Though it is too large for the 4K computer, sections can be removed and run on systems without Extended Color Basic, 4K of memory, or both.

You can PEEK and POKE all addresses with ease. I have run this monitor for several months with success. It is clean and there are no areas of memory locked out by this program or Basic. You may work any area of memory.

Machine-code programs and data may be placed into memory and changed. You can save to tape either data or programs. Later, you can load your saved data or program with the monitor. Colormon puts information into correct format to save to tape. The load command expects data or programs to be in uniform format when loading.

The PEEK and Print commands allow you to retrieve programs, data or Basic by densely filling the screen with characters. ■

The Key Box

Color Computer
Extended Color Basic
16K RAM

Color Monitor Instructions

CLOAD — Load this program from cassette. It occupies approximately 4K of memory and starts at Hex 1E00 with Extended Color Basic. Extended Color Basic is required to run parts of the program.

SELECTIONS: Dump, Enter, Save, Load, PEEK, Examine, Print and Instructions.

(IN) INSTRUCTIONS—Input decimal or hex numbers (decimal numbers directly, hex numbers preceded by &H, i.e. &H8000). Shift @ will stop execution of program and any key will resume. Enter key returns you to selections.

(DU) DUMP—a hex dump. It displays the first address in decimal and then eight bytes of data. For example:
Start address - &H8000
End address - &H8100
Start address - 32768
End address - 33024
Enter key returns you to selections.

(EN) ENTER—enters machine-language programs or data in hex or decimal. For example: Start address - &H1E00 Enter data, either hex or decimal, then hit Enter key again to continue or R (Enter key) to REDO. End (Enter key) returns you to selections.

(SA) SAVE—saves data or programs from memory to cassette. Enter start address and end address. When cursor returns, save is completed. Enter key returns you to selections.

(LO) LOAD—loads data or programs from cassette to the selected address. It expects data to be in the format used in the Save command. Enter key to return to selections.

(PE) PEEK—displays decimal address, hex address, decimal data and hex data, in that order. When cursor returns, Enter key returns you to selections.

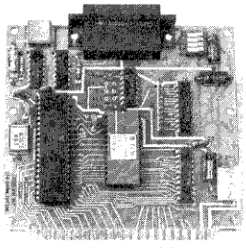
(EX) EXAMINE—displays decimal address, hex address, decimal data and hex data, in that order. You have the option to change data: Y (Enter key) to change data; Enter key to go to next address; End (Enter key) returns you to selections.

(PR) PRINT—displays hex address and print characters of data in memory between selected addresses. When cursor returns, Enter key returns you to selections.

```
10 ' TRS-80  COLOR COMPUTER
20 ' MONITOR PROGRAM (C) BY
30 ' DOUGLAS R COOK WB7SOW
40 ' 3895 WEST WESTLAND DR
50 ' WEST JORDAN, UTAH 84084
60 ' 801-561-4005
70 CLS:DIM A(16)
80 INPUT"SELECT- DUMP, ENTER, SAVE, LOAD,        PEEK, EXAMINE,
PRINT              OR INSTRUCTIONS";C$
90 IF LEFT$(C$,2)="DU" THEN 190
100 IF LEFT$(C$,2)="EN" THEN 310
110 IF LEFT$(C$,2)="SA" THEN 390
120 IF LEFT$(C$,2)="LO" THEN 480
130 IF LEFT$(C$,2)="PE" THEN 570
140 IF LEFT$(C$,2)="IN" THEN 620
150 IF LEFT$(C$,2)="PR" THEN 680
160 IF LEFT$(C$,2)="EX" THEN 790
170 GOTO 80
180 ' DUMP SUBROUTINE
190 INPUT"START ADDRESS";AD
200 INPUT"END ADDRESS";EN
210 FOR A=AD TO EN STEP 8
220 PRINT A;
230 FOR D=0 TO 7
240 F=PEEK(A+D)
250 PRINT HEX$(F);" ";
260 NEXT D
270 PRINT
280 NEXT A
290 INPUTQ:CLS:GOTO 80
300 REM ENTER SUBROUTINE
310 PRINT" Y=YES, ENTER KEY FOR NO, END    TO END":INPUT"START A
DDRESS";AD
320 FOR A=AD TO 32768:'32K
330 PRINT A;" ";:INPUT H
340 POKE A,H
350 PRINT A;H;:INPUT" ENTER KEY TO RESUME, Y TO REDU, END TO STO
P ";Q$:IF Q$="Y" THEN GOTO 330
360 IF Q$="END" THEN CLS: GOTO 80
370 NEXT A
380 REM SAVE SUBROUTINE
390 INPUT"START ADDRESS";AD
400 INPUT"END ADDRESS";EN
410 OPEN"O",-1,"DATA"
420 FOR B=AD TO EN STEP 16: FOR J=0 TO 15
430 A(J+1)=PEEK(B+J):NEXT J
440 PRINT#-1,A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9),A(10),
A(11),A(12),A(13),A(14),A(15),A(16):CLS:PRINT B;A(1):NEXT B
450 PRINT#-1,18,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
460 CLOSE-1:INPUTQ:GOTO 80
470 GOTO 80
480 INPUT"LOAD ADDRESS";AD
490 OPEN"I",-1,"DATA"
500 FOR C=AD TO 32767 STEP 16
510 INPUT#-1,A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9),A(10),
A(11),A(12),A(13),A(14),A(15),A(16)
520 FOR J=0 TO 15:POKE C+J,A(J+1):PRINT C+J;HEX$(C+J),A(J+1):NEX
T J
530 IF A(1)+A(2)+A(3)+A(4)+A(5)+A(6)+A(7)+A(8)+A(9)=18 THEN GOTO
 550
540 NEXT C
550 CLOSE-1:INPUTQ:GOTO 80
560 REM PEEK SUBROUTINE
570 INPUT"START ADDRESS";AD
580 INPUT"END ADDRESS";EN
590 FOR D=AD TO EN
600 S=PEEK(D):PRINT D;HEX$(D),S;HEX$(S);" ";CHR$(S):NEXT D
610 INPUT Q:GOTO 80
620 CLS:PRINT" INPUT DECIMAL OR HEXADECIMAL       NUMBERS THIS W
AY-"
630 PRINT" DECIMAL NUMBERS DIRECT"
640 PRINT" HEX NUMBERS PRECEEDED BY-  &H   LIKE THIS  &HA7A7
          SHIFT @  WILL STOP PROGRAM AND  ANY KEY WILL CONTINUE
 PROGRAM"
650 PRINT:PRINT" THIS PROGRAM WILL NOT RUN THE   PEEK,SAVE OR DU
MP  FUNCTION     WITHOUT EXTENDED  COLOR BASIC!"
660 PRINT:PRINT" ***ENTER KEY FOR SELECTIONS***"
670 INPUTQ:GOTO 80
680 INPUT"START ADDRESS";AS
690 INPUT"END ADDRESS";ES
700 FOR A=AS TO ES STEP 25
710 PRINT HEX$(A);"    ";
720 FOR D=0 TO 24
730 S=PEEK(A+D)
740 PRINT CHR$(S);
750 NEXT D
760 PRINT
770 NEXT A
780 INPUTQ$:CLS:IF Q$="END" THEN END ELSE GOTO 80
790 INPUT"START ADDRESS";AF
800 INPUT"END ADDRESS";EF
810 EF=32768
820 FOR A=AF TO EF
830 C=PEEK(A):PRINTA;HEX$(A),C;" ";HEX$(C);" ";CHR$(C):INPUT"CHA
NGE";QQ$:IF LEFT$(QQ$,1)="Y" THEN 850
840 IF LEFT$(QQ$,1)="E" THEN GOTO 870:
845 IF LEFT$(QQ$,1)="" THEN GOTO 860
850 INPUT"CHANGE TO ";D:POKE A,D:PRINT A;HEX$(A),D;" ";HEX$(D);"
 ";CHR$(D):INPUTQ$:IF Q$="END" GOTO 870
860 CLS:NEXT A
870 CLS:GOTO 80
880 END
```

Program Listing

Z8 BASIC COMPUTER/CONTROLLER



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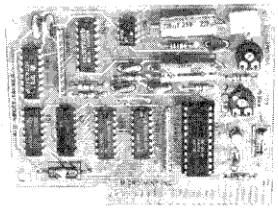

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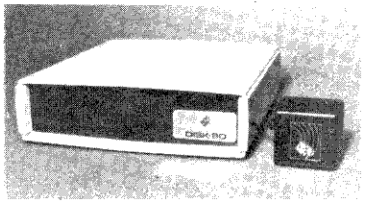

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LOAD 80

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Base 2 Screenprinter

William S. Kent
22315 6th Avenue, S.
#B-304
Des Moines, WA 98188

I have wanted a Screenprinter for my Base 2 lineprinter for some time; Ruth Lewart's article "Paper Tiger Screenprinter" (*80 Microcomputing*, February 1981) inspired the Program Listing.

I used a slightly different algorithm to generate the alphanumeric strings. Since the Base 2 uses 7-bit characters in the graphics mode, things were a little easier than for the 6-bit Paper Tiger. I used a 3-line rather than a 4-line format. ■

Mr. Kent is an engineering manager with The Boeing Company and works in Flight Simulation.

The Key Box

Basic Level II
Model I
48K RAM
NEWDOS
2 Disk Drives
Base2 Printer

```
10000 'SCREENPRINTER FOR BASE 2 MODEL 800 LINEPRINTER
10001 'WRITTEN BY W.S.KENT, DES MOINES, WA
10010 IFQ1=0GOSUB10190
10020 LPRINTQ6$;Q7$
10030 QV=15360  'START OF VIDEO MEMORY
10040 LPRINTQ1$;Q2$;Q4$;Q4$;Q2$  'DRAW UPPER CORNERS AND BORDER
10050 FORQI=0TO15
10060 FORQJ=0TO63:QN(QJ)=PEEK(QV+QJ):NEXT  'READ ONE LINE
10070 FORQK=0TO2
10080 IFINKEY$="B"THENLPRINTQ8$:RETURN  'LEAVE GRAPHICS
10090 LPRINTQ1$;Q2$;Q3$;  'ENTER GRAPHICS MODE AND DRAW LEFT BOR
DER
10100 FORQJ=0TO63
10110 IFQN(QJ)>127THENLPRINTQG$(QM(QN(QJ)AND21),QK);QG$(QM(QN(QJ
)AND42),QK);ELSELPRINTQZ$;QA$(QN(QJ)-32,QK);
10120 NEXTQJ
10130 LPRINTQ3$;Q2$  'DRAW RIGHT BORDER
10140 NEXTQK:QV=QV+Q8:NEXTQI
10150 LPRINTQ1$;Q2$;Q5$;Q5$;Q2$  'DRAW LOWER CORNERS AND BORDER
10160 LPRINTQ8$:RETURN  'RESET LINEPRINTER AND RETURN TO PROGRAM
10170 '
10180 '
10190 '   INITIALIZATION
10200 DEFINTQ:Q1=1:Q8=64:QZ$=CHR$(128):Q1$=CHR$(27)+CHR$(99)
10210 Q2$=STRING$(3,255):Q3$=STRING$(21,128)
10220 Q4$=STRING$(213,135):Q5$=STRING$(213,240)
10230 Q6$=CHR$(27)+CHR$(48):Q7$=CHR$(27)+CHR$(98)+CHR$(14)
10240 Q8$=CHR$(27)+CHR$(74)
10250 DIMQG$(7,3),QA$(90,3),QM(42),QN(90)
10260 '
10270 FORQJ=0TO7:FORQK=0TO2   'CREATE GRAPHIC STRINGS
10280 READQC:QG$(QJ,QK)=STRING$(3,QCOR128)
10290 NEXTQK,QJ
10300 '
10310 FORQJ=0TO90:FORQK=0TO4   'CREATE GRAPHICS STRINGS
10320 READQC:QW=(12*(QCAND1)+24*(QCAND2)+16*(QCAND4))OR128:QA$(Q
J,0)=QA$(QJ,0)+CHR$(QW)
10330 QW=(.25*(QCAND4)+.75*(QCAND8)+1.5*(QCAND16)+3*(QCAND32))OR
128:QA$(QJ,1)=QA$(QJ,1)+CHR$(QW)
10340 QW=((3*(QCAND64))/64)OR128:QA$(QJ,2)=QA$(QJ,2)+CHR$(QW)
10350 NEXTQK,QJ
10360 '
10370 QM(0)=0:QM(1)=1:QM(4)=2:QM(5)=3:QM(16)=4:QM(17)=5:QM(20)=6
:QM(21)=7
10380 QM(2)=1:QM(8)=2:QM(10)=3:QM(32)=4:QM(34)=5:QM(40)=6:QM(42)
=7
10390 RETURN
10400 '
10410 '
10420 DATA 0,0,0,127,0,0,0,127,0,127,127,0
10430 DATA 0,0,127,127,0,127,0,127,127,127,127,127
10440 DATA 0,0,0,0,0,0,0,95,0,0,0,7,0,7,0,20,127,20,127,20
10450 DATA 36,42,127,42,18,35,19,8,100,98,54,73,86,32,80,0,0,7,0
,0
10460 DATA 28,34,65,0,0,0,0,65,34,28,34,20,127,20,34,8,8,62,8,8
10470 DATA 0,64,48,0,0,8,8,8,8,8,0,0,64,0,0,32,16,8,4,2
10480 DATA 62,81,73,69,62,0,66,127,64,0,98,81,73,73,70,33,65,73,
77,51
10490 DATA 24,20,18,127,16,39,69,69,69,57,60,74,73,73,49,1,113,9
,5,3
10500 DATA 54,73,73,73,54,70,73,73,41,30,0,0,20,0,0,0,64,52,0,0
10510 DATA 8,20,34,65,0,20,20,20,20,20,0,65,34,20,8,2,1,89,5,2
10520 DATA 62,65,93,89,78,124,18,17,18,124,127,73,73,73,54,62,65
,65,65,34
10530 DATA 127,65,65,65,62,127,73,73,73,65,127,9,9,9,1,62,65,65,
81,113
10540 DATA 127,8,8,8,127,0,65,127,65,0,32,64,64,64,63,127,8,20,3
4,65
10550 DATA 127,64,64,64,64,127,2,12,2,127,127,4,8,16,127,62,65,6
5,65,62
10560 DATA 127,9,9,9,6,62,65,81,33,94,127,9,25,41,70,38,73,73,73
,50
10570 DATA 1,1,127,1,1,63,64,64,64,63,31,32,64,32,31,127,32,24,3
2,127
10580 DATA 99,20,8,20,99,3,4,120,4,3,97,81,73,69,67,4,2,127,2,4
10590 DATA 16,32,127,32,16,8,28,42,8,8,8,8,42,28,8,64,64,64,64,6
4
10600 DATA 62,65,93,89,78,32,84,84,84,120,127,40,68,68,56,56,68,
68,68,40
10610 DATA 56,68,68,40,127,56,84,84,84,24,0,8,126,9,2,76,82,82,8
2,60
10620 DATA 127,8,4,4,120,0,68,125,64,0,0,32,64,68,61,0,127,16,40
,68
10630 DATA 0,65,127,64,0,124,4,120,4,120,124,8,4,4,120,56,68,68,
68,56
10640 DATA 126,12,18,18,12,12,18,18,12,126,124,8,4,4,8,72,84,84,
84,40
10650 DATA 0,4,63,68,32,60,64,64,32,124,28,32,64,32,28,60,64,48,
64,60
10660 DATA 68,40,16,40,68,14,80,80,80,62,68,100,84,76,68
```

Program Listing

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LOAD 80

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Secrets

Stephen Mills, Ph.D.
611 Woodlawn Ave.
Springfield, OH 45504

Even users of microcomputers sometimes need a little privacy. You may have made your computer do some things you don't want just anyone to know about. In the case of a small business, the confidentiality of financial records or clients is essential, but even for the personal computerist and hobbyist, privacy might be valuable: perhaps in personal finance or your computerized "little black book." Perhaps you and your spouse have your own, no-holds-barred counterpart to *Interlude*, which you don't want the kiddies to run when they're tired of *Star Trek*. Perhaps you simply want to keep *everyone* from meddling with your Basic software when you're not supervising things.

But as computers go, the TRS-80 is not particularly good at keeping secrets. Of course any computer has some intrinsic inclination to keep a secret. For many people a computer is a mysterious and unapproachable keeper of information. Totally lacking in finesse, a computer is by nature unforgiving of syntactical errors; you cannot coax, persuade, flatter or seduce any computer into giving up secrets unless you speak the language fluently. Unfortunately, the TRS-80 has "been around." Its popularity, along with the general popularity of Basic, make this the least mysterious of all computers. All too many people know how to load and run a program. Fewer, but still many, can list and analyze a Basic program that is not working right, and defeat the computer's tendency to keep the secret.

One obvious and inelegant way of ensuring secrecy is simply to hide the software under lock and key. As the critical need for security—and the likelihood of deliberate meddling—grows, this technique may become more and more tempting. But it has two drawbacks. First, it may be inconvenient. It clearly breaks with the ritual of cassette-based software if you cannot quickly pull your program out of the rack or storage box beside the computer. A lockable storage compartment may not be conveniently nearby. Second, it is obvious. Anything that has to be hidden or secured behind lock and key automatically provokes interest and curiosity. What better way is there to advertise that something *is* secret, than to hide it physically? If the hidden software is found, whether by accident or by design, you can be pretty sure what the finder will do next.

How to Keep a Secret

This article presents a software alternative for keeping secrets. It is subtler, cleverer and (for the programmer) more interesting than physically hiding things. It avoids the two shortcomings of hiding: The secured software can be stored conveniently with non-secured programs and, even when loaded, it is not apparent that a security program is operating.

The alternative is Censor, a utility program which, when added to the resident Basic program, produces special format cassette recordings of your program. These programs can be reloaded by the TRS-80's normal input operations, but they will not run until a correct security code is entered. Incorrect responses or attempts to perform any operation before the code is given will cause program memory to be wiped out. Included are versions for Level I (any size RAM) and Level II 16K Basic; DOS is not covered, but such systems have far more elaborate security techniques available.

Although the Level I and Level II versions are quite different, they have several common characteristics. Both are machine language utilities which can be loaded while the Basic program to be secured is already in memory. Both will accept a security code up to 20 characters in length for that program. They will make as many cassette dumps as required, using a single keystroke command (Break will return to command mode). In addition, in both formats the output code includes a control program. When the secured tape is reloaded, the control program snatches control from the ROM-based command mode. However, the correct command mode prompt is displayed, to mislead the would-be tamperer; the only cue for the initiated is the absence of the underscore cursor. The control program tests for a correct security code, and returns control to command mode when it is received. Both versions feature checksum testing of the load (a feature not part of Level II CLOAD).

Both versions of Censor are relatively short and simple. Their brevity represents a compromise: convenience and versatility against complexity and

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Aspen Software programs are professional quality, reliable software tools developed for the TRS-80 and CP/M by a Ph.D. in Computer Science. All software is protected by Aspen Software's low cost upgrade privilege for new versions. Other tools include:

— SOFT-SCREEN™, a powerful, state of the art full screen text editor. Over a year in development, Soft-Screen is compatible with all TRS-80 programming languages, including BASIC, FORTRAN, MACRO, Ratfor, and COBOL. Commands are easy to learn, yet versatile and complete to satisfy the most experienced user. Soft-Screen is also available for P&T Model II CP/M.

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IMPORTANT: Specify computer model, operating system, memory size, and number of drives when ordering! For CP/M, currently only 8" single density CP/M versions available. Please inquire about other CP/M disk formats. All TRS-80 versions available. Manual only orders can be applied to final purchase. CP/M prices are introductory.

Orders sent postpaid by first class mail. Terms: Cash, check, money order, VISA, or Master Card. NM residents add 4% tax.

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tightness of security. Because of this, it can hardly be claimed that Censor has undefeatable security, but its features should make it an adequate resource for many personal computerists. It automatically usurps control from ROM, requiring immediate input of the correct security code (out of billions of possibilities); and it operates secretly.

Level I Censor

The Level I version of Censor is given in Program Listing 1. The Basic program to be censored is not at all modified (or encrypted); it is merely made inaccessible by the control program. Both Censor and the control program which it attaches to Basic are loaded in a protected area below the RAM dedicated to Basic programming. Thus Level I Censor has no special memory requirements.

Producing Censor requires the Radio Shack Editor/Assembler program, or T-Bug, or some equivalent. Whichever method is used, producing Censor is a two-step process. Censor cannot be directly transcribed by T-Bug because they both occupy the same region of memory, and T-Bug would destroy itself in the process. It cannot be loaded under System program control for the same reason. The first step, then, is to prepare a program which will produce a properly formatted version of Censor. When this program (Program Listing 1) is executed, Censor itself will be recorded on tape. This second-generation Censor may then be CLOADed with a Basic program already in memory; it is self-starting and does not conflict with any program RAM.

Listing 1 clearly shows the second-generation source file for Censor (lines 25–118). To produce the working version of Censor, this file is shifted to its proper location, 4107H–41FEH. The displacement for this move, 2304 bytes (or 900H bytes), is represented by the label DIS, which is used in assembly to

Program Listing 1.

```
                00000 ;         LISTING 1.  LEVEL I A. L. VERSION
                00001 ;*****************************************
*****
                00002 ;
                00003 ;
                00004 ;
                00005 ;         LEVEL I CENSOR PROGRAM
                00006 ;         (C) 1981 STEPHEN MILLS
                00007 ;
                00008           ;CENSOR SECURITY PROGRAM
                00009           ;PREVENTS UNAUTHORIZED LOADING OF
                00010           ;LEVEL I BASIC PROGRAMS.  CENSOR IS
                00011           ;LOADED OVER BASIC.  MACHINE LANGUAG
E
                00012           ;ROUTINE WRITES OUT SECURITY CODE AN
D
                00013           ;SAVES BASIC PLUS SECURITY BOOTSTRAP
.
                00014           ;WHEN PROGRAM IS LOADED A FAKE PROMP
T IS
                00015           ;DISPLAYED (THERE IS NO CURSOR).  AT
 THIS
                00016           ;POINT PROPER SECURITY CODE MUST BE
ENTERED
                00017           ;OR ENTIRE MEMORY CONTENTS DESTROYED
.
                00018           ;EDTASM VERSION PRODUCES A 250 BAUD
                00019           ;PROGRAM TO LOAD BELOW BASIC
                00020 ;
                00021 ;2 N D  G E N E R A T I O N  S O U R C E  F
I L E
                00022 ;         F O R  C E N S O R  B E G I N S  H E
 R E .
                00023 ;
4A07            00024           ORG     4A07H
4107            00025 ENTRY     DEFL    HEAD-DIS
4A07 310041     00026 HEAD      LD      SP,4100H ;MOVE STACK
4A0A 0605       00027           LD      B,5
4A0C 115B41     00028           LD      DE,DISPLA-DIS
4A0F CD5109     00029           CALL    0951H   ;LEVEL I DISPLAY LOO
P
4A12 10FB       00030           DJNZ    $-3     ;RETURNS EACH 13
4A14 2A6840     00031           LD      HL,(4068H)      ;GET CURSOR
LOC
                00032 ;NOTE     AFTER THE DISPLAY ROUTINE IS EXECUTE
D
                00033 ;         THE CURSOR LOCATION RESIDES IN THE
                00034 ;                 ALTERNATE HL REGISTER
```

Program continues

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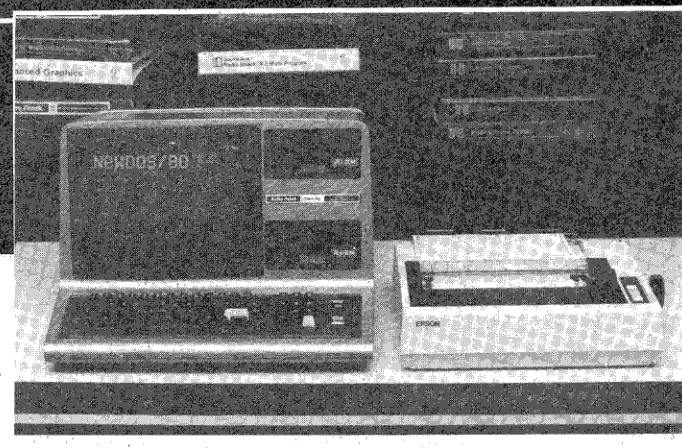

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Program continued

```
4A17 D9          00035 INPUT1  EXX     ;DO THIS TO GET CURSOR
4A18 362A        00036         LD      (HL),2AH        ;ASTERISK
4A1A D9          00037         EXX     ;BACK TO OTHER REGS
4A1B CD400B      00038 INPUT2  CALL    0B40H   ;INPUT LOOP
4A1E 28FB        00039         JR      Z,INPUT2
4A20 FE0D        00040         CP      13 ;INPUT RESETS ON <BREAK>
4A22 38E6        00041         JR      C,HEAD+3 ;OR <CLEAR> &
4A24 20F1        00042         JR      NZ,INPUT1 ;TERMINATES ON <EN
TER>
4A26 119E4A      00043         LD      DE,BUFFER
4A29 011400      00044         LD      BC,20
4A2C EDB0        00045         LDIR    ;MOVE THE INPUT TO BUFFER
4A2E 115441      00046 DUMP    LD      DE,CASMES-DIS
4A31 CD4F09      00047         CALL    094FH   ;DISPLAY LOOP
4A34 21BA41      00048         LD      HL,NEWADR-DIS
4A37 22FE41      00049         LD      (41FEH),HL      ;PUT IN NEW
START
4A3A 3A4038      00050 EDGE    LD      A,(3840H)
4A3D FE04        00051         CP      4       ;BREAK?
4A3F CAC901      00052         JP      Z,01C9H
4A42 1F          00053         RRA     ;TEST ENTER BIT
4A43 30F5        00054         JR      NC,EDGE
4A45 CDE90F      00055 DOWN    CALL    0FE9H   ;TURN ON CASSETTE
4A48 219E4A      00056         LD      HL,BUFFER
4A4B ED5B6C40    00057         LD      DE,(406CH)
4A4F CD4B0F      00058         CALL    0F4BH   ;DUMP BASIC & LEADER
4A52 18DA        00059         JR      DUMP
4A54 43          00060 CASMES  DEFM    'CSAVE?'
4A5A 0D          00061         DEFB    13
4A5B 0C          00062 DISPLA  DEFB    12      ;CLEAR SCREEN
4A5C 0D          00063         DEFB    13
4A5D 43          00064         DEFM    'CENSOR SECURITY CONTROL'
4A74 0D          00065         DEFB    13
4A75 46          00066         DEFM    'FOR LEVEL I BASIC PROGRAMS'

4A8F 0D          00067         DEFB    13
4A90 0D          00068         DEFB    13
4A91 45          00069         DEFM    'ENTER CODE (UP TO 20 CHARAC
TERS)'
4AB1 0D          00070         DEFB    13
                 00071 ;
                 00072 ;THE CENSOR CONTROL PROGRAM WHICH IS SAVED
                 00073 ;       ALONG WITH BASIC BEGINS HERE
                 00074 ;
419E             00075 BUFFER  DEFL    $-DIS-20        ;OVERWRITES
DISPLA
4AB2 52          00076 READYM  DEFM    'READY'
4AB7 0D          00077         DEFB    13
4AB8 3E          00078         DEFM    '>'     ;FAKE PROMPT
4AB9 00          00079         DEFB    0       ;END OF MESSAGE
4ABA E5          00080 NEWADR  PUSH    HL      ;START OF BOOTSTRAP
4ABB F5          00081         PUSH    AF
4ABC 2027        00082         JR      NZ,CANCEL
4ABE 21B241      00083         LD      HL,READYM-DIS ;FAKE PROMPT
4AC1 3E0D        00084         LD      A,13 ;LOAD CARRIAGE RETURN C
ODE
4AC3 D7          00085 FAKEIT  RST     10H
4AC4 7E          00086         LD      A,(HL)
4AC5 23          00087         INC     HL
4AC6 B7          00088         OR      A
4AC7 20FA        00089         JR      NZ,FAKEIT
4AC9 D9          00090         EXX     ;GET CURSOR POSITION
4ACA 3620        00091         LD      (HL),20H ;KILL CURSOR
4ACC CD400B      00092 WTZ     CALL    0B40H
4ACF FE0D        00093         CP      13      ;DO KEYBOARD INPUT
4AD1 20F9        00094         JR      NZ,WTZ ;TIL <ENTER>
4AD3 0614        00095         LD      B,20    ;COUNT FOR TEST
4AD5 119E41      00096         LD      DE,BUFFER
4AD8 1A          00097 COMPAR  LD      A,(DE) ;FETCH CODE
4AD9 BE          00098         CP      (HL) ;COMPARE TO WHAT'S ON S
CREEN
4ADA 2009        00099         JR      NZ,CANCEL
4ADC 23          00100         INC     HL
4ADD 13          00101         INC     DE
4ADE 10F8        00102         DJNZ    COMPAR
4AE0 F1          00103         POP     AF ;RESTORE FLAGS FROM LOAD
4AE1 E1          00104         POP     HL ;RESTORE END OF PROG ADDR

4AE2 CAEC0E      00105         JP      Z,0EECH
4AE5 219140      00106 CANCEL  LD      HL,4091H
4AE8 119240      00107         LD      DE,4092H
4AEB 016F3F      00108         LD      BC,8000H-4091H
4AEE EDB0        00109         LDIR
4AF0 0000        00110 CKSUM   DEFW    0
4AF2 0000        00111         DEFW    0
4AF4 0000        00112         DEFW    0
4AF6 0000        00113         DEFW    0
4AF8 0000        00114         DEFW    0
4AFA 0000        00115         DEFW    0
4AFC 0000        00116         DEFW    0
4AFE 07          00117 TAIL    DEFB    ENTRY&0FFH
0900             00118 DIS     DEFL    $-41FFH
                 00119 ;
                 00120 ;T H E  F I R S T  G E N E R A T I O N  P R
O G R A M
                 00121 ;
                 00122 ;THE FOLLOWING SECTION TRANSFORMS THE ABOVE
SOURCE
                 00123 ;       CODE INTO A LEVEL I READABLE PROGRAM
 TAPE
                 00124 ;
                 00125 ;               **** IMPORTANT ****
                 00126 ;
                 00127 ;USER MUST PREPARE BLANK TAPE FOR OUTPUT  B
E F O R E
                 00128 ;       RUNNING THIS PROGRAM!
                 00129 ;
4AFF 31FF4A      00130 ADJ     LD      SP,$
4B02 11FE41      00131         LD      DE,41FEH
4B05 21FE4A      00132         LD      HL,TAIL
4B08 01F800      00133         LD      BC,TAIL-HEAD+1
4B0B AF          00134         XOR     A
                 00135 ;
                 00136 ;MOVE CENSOR INTO PLACE & CALC ITS CHECKSUM
                 00137 ;
4B0C 96          00138 LOOP    SUB     (HL)
4B0D EDA8        00139         LDD
4B0F EA0C4B      00140         JP      PE,LOOP
4B12 D641        00141         SUB     41H ;CORRECT FOR MSB OF STAR
T ADDR
4B14 32F041      00142         LD      (CKSUM-DIS),A ;ADJUST ITS CK
SUM
                 00143 ;
                 00144 ;       PREPARE TO MAKE MULTIPLE
                 00145 ;       250-BAUD DUMPS OF CENSOR
                 00146 ;
4B17 11544A      00147 LP2     LD      DE,CASMES
4B1A CD4F09      00148         CALL    094FH
                 00149 ;
                 00150 ; TURNING ON CASSETTE BEFORE KEYSCAN LOOP
                 00151 ;       WRITES EXTRA LEADER BETWEEN DUMPS
                 00152 ;
4B1D CDE90F      00153         CALL    0FE9H
4B20 0600        00154         LD      B,0
4B22 CD400B      00155 LP3     CALL    0B40H
4B25 FE03        00156         CP      3 ;TERMINATE ON <BREAK>
4B27 CAC901      00157         JP      Z,01C9H
4B2A 10F6        00158         DJNZ    LP3
4B2C 21074F      00159         LD      HL,ENTRY
4B2F 11FF41      00160         LD      DE,41FFH
4B32 CD4B0F      00161         CALL    0F4BH
4B35 18E0        00162         JR      LP2
4AFF             00163         END     ADJ
```

correct all direct addresses (cf. lines 25, 28, 46, etc.) in the file. The first-generation program (beginning at line 120) will perform the block move, and calculate and adjust the checksum of the file. Level I's CLOAD function will be storing the checksum in the stack area (at 41FFH); this value must be 41H if Censor is to be self-starting.

Once the program is transcribed and checked, it should be saved to ensure against untrapped errors (EDTASM users use the W command; T-Bug users execute P 4A07 4B37). Now you are ready to prepare Censor. Load the first-generation program but, before executing it, put a blank tape in the recorder and press the record and play keys. Once prepared, execute the program by entering / for the System version, or J 4AFF for the T-Bug version. The recorder will start up right away, recording the final version of Censor. Note that, as written, the first-generation program will record Censor over and over again. Output for each complete recording will only take about seven seconds (and about half that is leader!). You will be prompted for each recording with the appearance of the message CSAVE? which will help you count the recordings, but the program does not wait for your response. When you have as many dumps as you want, press and hold down the Break key. When the current output is completed, control will be passed back to the Basic command mode.

When you are ready to save a program that is to be Censor-protected, CLOAD the Censor tape. The process will not affect the resident program in any way, as loading another Basic program would do. The program will start itself, clearing the screen and displaying:

CENSOR SECURITY CONTROL FOR LEVEL I BASIC PROGRAMS

ENTER CODE (UP TO 20 CHARACTERS)

The asterisk which appears here is your cursor, which will move along the screen as you type in the code. If you press Break or Clear, the coding routine will start anew. When the code is entered, the program will ask if you wish to save the coded version. When you are ready, press Enter and the program will be CSAVEd. When that is completed, another Enter will cause another recording to be made, while Break will return to the command mode with the Basic program undisturbed.

To run the Censored program, CLOAD it. When the recorder stops, the screen will show the usual Ready prompt. The only clue that things are not as they seem is that there is no cursor ('_') after the prompt. At this point, enter your security code. Do not type List, Run or even press Break before you have done so. If this is done correctly, command mode will be returned with the Basic program ready to run. If there has been a CLOAD checksum error, the user will not

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Program Listing 2.

```
                00000 ;LISTING 2      ASSEMBLY VERSION OF LEVEL II
CENSOR
                00010 ;
                00020 ;LEVEL II CENSOR        VERS.2
                00030 ;SECURED ACCESS PROGRAM FOR LEVEL II BASIC
                00040 ;(C) 1981 STEPHEN MILLS
                00050 ;
                00060 ;CENSOR CONVERTS BASIC PROGRAMMING INTO
                00070 ;A SECURITY CODED SYSTEM TAPE, WHICH CAN
                00080 ;BE LOADED UNDER SYSTEM AND DECODED BY
                00090 ;PROPER <=20 CHARACTER CODE.
                00100 ;
                00110 ;       WITH BASIC IN MEM, SYSTEM LOAD CENSO
R,
                00120 ;ENTER TAPE FILENAME & SECURITY ACCESS CODE
                00130 ;CENSOR WILL SAVE CODED BASIC AS SYSTEM TAPE
.
                00140 ;TO RECOVER BASIC, LOAD <FILENM> UNDER SYSTE
M,
                00150 ;AND RESPOND TO '*' PROMPT WITH SECURITY COD
E.
                00160 ;
002E            00170 KEY     EQU     2EH
41E3            00180         ORG     41E3H   ;PUT ADDRESS IN PLAC
E TO MAKE
41E3 BF7E       00190         DEFW    ENTRY2  ;OUTPUT CODE SELF-ST
ARTING
4016            00200         ORG     4016H   ;RE-INITIALIZE KEYBO
ARD DCB (TO
4016 E303       00210         DEFW    3E3H    ;AVOID CRASHES W/ HI
-MEM KB ROUTINES
40A4            00220 BASBEG  EQU     40A4H   ;START OF CODE
40F9            00230 BASEND  EQU     40F9H   ;END+3 OF BASIC HERE

7E12            00240         ORG     7E12H
7E12 C7         00250 INIT    RST     0
7E13 0000       00260 PROLEN  DEFW    0 ;PROGRAM LENGTH BUFFER
                00270 ;
                00280 ;       SUBROUTINES USED BY CENSOR OUTPUT WH
ICH
                00290 ;       WILL INITIALLY BE SCRAMBLED ARE STAC
KED
                00300 ;               HERE
                00310 ;
7E15 E5         00320 INPUT   PUSH    HL      ;HL HAS BUFFER ADDR
7E16 C5         00330         PUSH    BC
7E17 CD2B00     00340 INL1    CALL    2BH     ;KEYSCAN
7E1B            00350 DSABL   EQU     $+1     ;DISABLE BREAK HERE
7E1A FE01       00360         CP      1       ;TEST FOR BREAK
7E1C CA191A     00370         JP      Z,1A19H
7E1F FE0D       00380         CP      13      ;CAR RET?
7E21 282A       00390         JR      Z,INDONE
7E23 FE20       00400         CP      ' '     ;LOWEST ALLOWED
7E25 38F0       00410         JR      C,INL1  ;AS INPUT
7E27 77         00420         LD      (HL),A  ;PUT IN BUFFER
7E28 23         00430         INC     HL
7E29 CD3300     00440 IN2     CALL    33H     ;DISPLAY IT
7E2C 10E9       00450         DJNZ    INL1
7E2E C1         00460         POP     BC
7E2F E1         00470         POP     HL
7E30 C9         00480         RET
7E31 CDD67E     00490 ACCODE  CALL    PRINT   ;SCRAMBLED KEYWORD W
ILL BE HERE
7E34 42         00500         DEFM    'BASIC SPOILED'
7E41 0D         00510         DEFB    13
7E42 C37200     00520         JP      72H
0014            00530 ACLEN   EQU     $-ACCODE
7E45 0B         00540 CTDONE  DEC     BC      ;THIS ROUTINE PERFOR
MS THE
7E46 23         00550         INC     HL      ;COUNTING FOR 'DIVID
E' AND
7E47 78         00560         LD      A,B     ;PROVIDES EXIT FROM
THAT
7E48 B1         00570         OR      C       ;SUBROUTINE
7E49 C0         00580         RET     NZ      ;RETURN TO 'DIVIDE'
IF NO CHANGE
7E4A E1         00590         POP     HL      ;UNSTACK RET ADDR
7E4B E1         00600         POP     HL      ;RESTORE POINTER
7E4C C9         00610         RET     ;EXITS FROM 'DIVIDE' SUBROUT
INE
7E4D 3620       00620 INDONE  LD      (HL),' ' ;FILL BUFFER
7E4F 23         00630         INC     HL      ;WITH SPACES
7E50 10FB       00640         DJNZ    INDONE
7E52 04         00650         INC     B       ;ADJ FOR INL1
7E53 18D4       00660         JR      IN2
                00670 ;
                00680 ;       FOLLOWING CALCULATES A ONE BYTE
                00690 ;       NUMERICAL KEY TO START ENCODING
                00700 ;               OR DECODING
                00710 ;
7E55 AF         00720 CODEWD  XOR     A       ;MAKE CODE FROM BUFF
ER
7E56 C5         00730         PUSH    BC      ;SAVE WHAT'S THERE
7E57 E5         00740         PUSH    HL      ;SAVE BUFFER ADDR
7E58 0613       00750         LD      B,ACLEN-1
7E5A 86         00760         ADD     A,(HL)  ;ACCUMULATE CODE
7E5B 23         00770         INC     HL
7E5C 10FC       00780         DJNZ    $-2
7E5E E1         00790         POP     HL
7E5F C1         00800         POP     BC
7E60 0F         00810         RRCA    ;ADDTL CHANGE
7E61 C9         00820         RET
7E62 AF         00830 KILL    XOR     A       ;GENERATES CRASH ON
BAD INPUT
7E63 67         00840         LD      H,A
7E64 4C         00850         LD      C,H     ;SET UP FOR
7E65 69         00860         LD      L,C     ;BLOCK MOVE OF
7E66 5C         00870         LD      E,H     ;RAM
7E67 163C       00880         LD      D,3CH
7E69 45         00890         LD      B,L
7E6A EDB0       00900         LDIR
                00910 ;
                00920 ;       NEXT SUBROUTINE MODIFIES FILE.  ON E
NTRY:
                00930 ;               (HL) = START ADDR OF CODE
                00940 ;               (BC) = NUMBER BYTES TO CODE
                00950 ;               (D) = A KEYWORD
                00960 ;       SINCE THESE OPERATIONS ARE SYMMETRIC
AL, SAME
                00970 ;       ROUTINE WILL SCRAMBLE OR UNSCRAMBLE
SOURCE.
                00980 ;
7E6C ED4B137E   00990 DIVIDE  LD      BC,(PROLEN)     ;GET LENGTH
7E70 E5         01000         PUSH    HL      ;SAVE START OF PROG
7E71 7E         01010 ENCDL   LD      A,(HL)  ;FIRST BYTE
7E72 AA         01020         XOR     D       ;D HAS CODE WORD!
7E73 77         01030         LD      (HL),A
7E74 CD457E     01040         CALL    CTDONE
7E77 7E         01050         LD      A,(HL)  ;GET IT
7E78 ED67       01060         RRD     ;JUMBLE BITS
7E7A CD457E     01070         CALL    CTDONE
7E7D 7E         01080         LD      A,(HL)  ;BYTE 3
7E7E 2F         01090         CPL     ;INVERT IT
7E7F 77         01100         LD      (HL),A
7E80 CD457E     01110         CALL    CTDONE
7E83 18EC       01120         JR      ENCDL
                01130 ;
                01140 ;       MAIN OPERATION OF OBJECT PROGRAM BEG
INS HERE
                01150 ;       NOTE: THIS SECTION OF CODE IS ALSO S
CRAMBLED
                01160 ;         ON TAPE.  IT IS DECODED BEFORE EXE
CUTION.
                01170 ;
7E85 CDD67E     01180 CONT2   CALL    PRINT
7E88 0A         01190         DEFB    10      ;LINE FEED
7E89 2A         01200         DEFM    '*?'
7E8B 0D         01210         DEFB    13
7E8C 21E27E     01220         LD      HL,HIGH ;LOAD ACCESS
7E8F 0614       01230         LD      B,ACLEN
7E91 CD157E     01240         CALL    INPUT
7E94 CD557E     01250         CALL    CODEWD  ;DECODE INPUT
7E97 11317E     01260         LD      DE,ACCODE
7E9A 4F         01270         LD      C,A
7E9B 1A         01280 CLP     LD      A,(DE)
7E9C 13         01290         INC     DE
7E9D A9         01300         XOR     C       ;CORRECT IT
7E9E AE         01310         XOR     (HL)
7E9F 20C1       01320         JR      NZ,KILL
7EA1 23         01330         INC     HL      ;BUMP BUFFER
7EA2 10F7       01340         DJNZ    CLP
7EA4 51         01350         LD      D,C
7EA5 2ABD7E     01360 FOLLOW  LD      HL,(LOWPT)
7EA8 CD6C7E     01370         CALL    DIVIDE
7EAB ED4B137E   01380         LD      BC,(PROLEN) ;COUNTER
7EAF ED5BA440   01390         LD      DE,(BASBEG) ;STORAGE PLACE
7EB3 EDB0       01400         LDIR    ;MOVE IT BACK
7EB5 ED53F940   01410         LD      (BASEND),DE
7EB9 C37200     01420         JP      72H
00A6            01430 FIRST   EQU     $-INPUT-1       ;LENGTH OF S
CRAMBLED FILE
7EBC 78         01440 TERM    DEFB    78H
7EBD 0000       01450 LOWPT   DEFW    0       ;LOW ADDR HERE
                01460 ;
                01470 ;       INITIAL DECODING OF OBJECT FILE DONE
HERE
                01480 ;
7EBF 3EC9       01490 ENTRY2  LD      A,201   ;RETURN OPCODE
7EC1 32E241     01500         LD      (41E2H),A ;CORRECT AUTOSTART

7EC4 06A6       01510         LD      B,FIRST ;COUNT
7EC6 21147E     01520         LD      HL,INPUT-1 ;LESS FOR INC
7EC9 0E2E       01530         LD      C,KEY   ;GET UNSCRAMBLER
7ECB 23         01540 UNSCR   INC     HL      ;BUMP PTR
7ECC 7E         01550         LD      A,(HL)  ;GET MODIFIED BYTE
7ECD F5         01560         PUSH    AF      ;SAVE IT
7ECE 91         01570         SUB     C       ;SUBTRACT OLD BYTE
7ECF 77         01580         LD      (HL),A  ;RESTORE LOCATION
7ED0 F1         01590         POP     AF
7ED1 4F         01600         LD      C,A
7ED2 10F7       01610         DJNZ    UNSCR
7ED4 18AF       01620 CONVRT  JR      CONT2   ;CONTINUE EXECUTION
OF DECODE
7ED6 E3         01630 PRINT   EX      (SP),HL ;GET BUFFER ADDR
7ED7 7E         01640 PL1     LD      A,(HL)
7ED8 23         01650         INC     HL
7ED9 CD3300     01660         CALL    33H
7EDC FE0D       01670         CP      13
7EDE 20F7       01680         JR      NZ,PL1
7EE0 E3         01690         EX      (SP),HL
7EE1 C9         01700         RET
7EE2 00         01710 HIGH    NOP
                01720 ;
                01730 ;       CASSETTE OUTPUT CONTROL OF INITIALIZ
ING
                01740 ;       PROGRAM UTILIZES THE FOLLOWING SUBRO
UTINES
                01750 ;
                01760 ;       'BLOCK' DOES MEMORY OUTPUT.  ON ENTR
Y:
                01770 ;               (HL) = START ADDRESS OF MEM
                01780 ;                (B) = COUNT FOR OUTPUT
                01790 ;       RUNNING SUM KEPT IN (C)
                01800 ;
7EE3 7E         01810 BLOCK   LD      A,(HL)  ;GET NEXT
7EE4 F5         01820         PUSH    AF
7EE5 81         01830         ADD     A,C     ;CALC CKSUM
7EE6 4F         01840         LD      C,A     ;STORE IT
7EE7 F1         01850         POP     AF
7EE8 CD6402     01860         CALL    264H    ;SAVE IT
7EEB 23         01870         INC     HL
7EEC 10F5       01880         DJNZ    BLOCK
7EEE C9         01890         RET
                01900 ;
                01910 ;       'CSAVE' CONTROLS 'SYSTEM'-FORMAT
                01920 ;       OUTPUT.  USES 'BLOCK'
                01930 ;       WRITES LINK CODE, STARTING ADDRESS
                01940 ;               AND CHECKSUM
                01950 ;
7EEF 3E3C       01960 CSAVE   LD      A,3CH   ;LINK CODE
```

Program continues

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Program continued

```
7EF1 CD6402    01970          CALL    264H
7EF4 78        01980          LD      A,B      ;RECORD COUNT
7EF5 CD6402    01990          CALL    264H
7EF8 7D        02000          LD      A,L ;STARTING ADDR
7EF9 4F        02010          LD      C,A      ;START CHECKSUM
7EFA CD6402    02020          CALL    264H
7EFD 7C        02030          LD      A,H
7EFE CD6402    02040          CALL    264H
7F01 81        02050          ADD     A,C
7F02 4F        02060          LD      C,A
7F03 CDE37E    02070          CALL    BLOCK
7F06 79        02080          LD      A,C      ;GET CKSUM
7F07 C36402    02090          JP      264H     ;WRITE & RET
7F0A 55        02100 FILNAM   DEFB    55H      ;SYSTEM TAPE INDICAT
OR
7F0B 11127E    02110 RUN      LD      DE,INIT
7F0E 2AF940    02120          LD      HL,(BASEND)      ;CONFLICT
7F11 E5        02130          PUSH    HL       ;SAVE IT A WHILE!
7F12 ED52      02140          SBC     HL,DE
7F14 E1        02150          POP     HL
7F15 D2317E    02160          JP      NC,ACCODE ;AT 1ST HAS CODE
7F18 ED4BA440  02170          LD      BC,(BASBEG)      ;GET START
7F1C 3F        02180          CCF     ;CLEAR CARRY
7F1D E5        02190          PUSH    HL       ;SAVE FOR BLOCK MOVE

7F1E ED42      02200          SBC     HL,BC    ;CALC PROG LENGTH
7F20 22137E    02210          LD      (PROLEN),HL
7F23 3E02      02220          LD      A,2      ;RESULT IF
7F25 84        02230          ADD     A,H      ;NO PROGRAM
7F26 AD        02240          XOR     L        ;IN MEM
7F27 CA7200    02250          JP      Z,72H
7F2A CDD67E    02260          CALL    PRINT
7F2D 46        02270          DEFM    'FILENAME?'
7F36 0D        02280          DEFB    13
7F37 0606      02290          LD      B,6
7F39 210B7F    02300          LD      HL,FILNAM+1
7F3C CD157E    02310          CALL    INPUT    ;PUT FILENAME
7F3F CDD67E    02320          CALL    PRINT
7F42 0A        02330          DEFB    10
7F43 41        02340          DEFM    'ACCESS CODE?'
7F4F 0D        02350          DEFB    13
7F50 21317E    02360          LD      HL,ACCODE
7F53 0614      02370          LD      B,ACLEN
7F55 CD157E    02380          CALL    INPUT
7F58 CD557E    02390          CALL    CODEWD   ;GET CODE VALUE
7F5B 327B7F    02400          LD      (SPOT1),A
7F5E 32FC7F    02410          LD      (SPOT2),A
7F61 57        02420          LD      D,A      ;PUT IT IN D
FIELD OVERFLOW
7F62 3EFF      02430          LD      A,-1 ;DISABLE BREAK
7F64 321B7E    02440          LD      (DSABL),A ;IN INPUT
7F67 7E        02450 ENCL     LD      A,(HL)   ;GET BYTE
7F68 AA        02460          XOR     D        ;MODIFY IT
7F69 77        02470          LD      (HL),A   ;1ST CHANGE FOR
7F6A 23        02480          INC     HL
7F6B 10FA      02490          DJNZ    ENCL ;TRANSMITTED CODE
7F6D ED4B137E  02500          LD      BC,(PROLEN)      ;MOVE LENGTH

7F71 11117E    02510          LD      DE,INIT-1
7F74 E1        02520          POP     HL
7F75 2B        02530          DEC     HL       ;BACK UP ONE TO PROG
RAM
7F76 EDB8      02540          LDDR    ;BLOCK MOVE IT
7F78 13        02550          INC     DE       ;BUMP UP
7F79 EB        02560          EX      DE,HL    ;GET LOW IN HL
7F7B           02570 SPOT1    EQU     $+1
7F7A 1600      02580          LD      D,0      ;CODE WORD IS HERE
7F7C 22BD7E    02590          LD      (LOWPT),HL
7F7F CD6C7E    02600          CALL    DIVIDE   ;ENCODE
7F82 06A6      02610          LD      B,FIRST
7F84 21157E    02620          LD      HL,INPUT
7F87 3E2E      02630          LD      A,KEY ;SCRAMBLER
7F89 86        02640 LOOP     ADD     A,(HL) ;MIX IT
7F8A 77        02650          LD      (HL),A
7F8B 23        02660          INC     HL
7F8C 10FB      02670          DJNZ    LOOP
7F8E CDD67E    02680 DUMP     CALL    PRINT
7F91 0A        02690          DEFB    10       ;LINE FEED
7F92 4C        02700          DEFM    'LOAD CASSETTE'
7F9F 0D        02710          DEFB    13
7FA0 CD2B00    02720 WAIT     CALL    2BH
7FA3 FE01      02730          CP      1 ;BREAK?
7FA5 284C      02740          JR      Z,FINAL
7FA7 B7        02750          OR      A ;ANYTHING?
7FA8 28F6      02760          JR      Z,WAIT
7FAA 3EC3      02770          LD      A,0C3H ;JP OPCODE
7FAC 32E241    02780          LD      (41E2H),A
7FAF AF        02790          XOR     A
7FB0 CD1202    02800          CALL    212H     ;DEFINE DRIVE
7FB3 CD8702    02810          CALL    287H     ;WRITE LEADER
7FB6 210A7F    02820          LD      HL,FILNAM
7FB9 0607      02830          LD      B,7      ;WRITE HEADER
7FBB CDE37E    02840          CALL    BLOCK    ;W/O CHECKSUM
7FBE 21127E    02850          LD      HL,INIT
7FC1 06D1      02860          LD      B,HIGH-INIT+1    ;COUNTER
7FC3 CDEF7E    02870          CALL    CSAVE
7FC6 0603      02880          LD      B,3
7FC8 21E241    02890          LD      HL,41E2H
7FCB CDEF7E    02900          CALL    CSAVE
7FCE 2ABD7E    02910          LD      HL,(LOWPT)
7FD1 ED5B137E  02920          LD      DE,(PROLEN)
7FD5 14        02930          INC     D
7FD6 15        02940 OUTLP    DEC     D ;DECREMENT MSB OF CT
7FD7 2807      02950          JR      Z,FINISH
7FD9 0600      02960          LD      B,0 ;0 FOR MAXIMUM DUMP
7FDB CDEF7E    02970          CALL    CSAVE ;SAVE A BLOCK
7FDE 18F6      02980          JR      OUTLP
7FE0 7B        02990 FINISH   LD      A,E ;GET REMNANT
7FE1 43        03000          LD      B,E
7FE2 B7        03010          OR      A ;TEST FOR 0
7FE3 C4EF7E    03020          CALL    NZ,CSAVE ;SAVE ODD BYTES
7FE6 21BC7E    03030          LD      HL,TERM
7FE9 0603      03040          LD      B,3
7FEB CDE37E    03050          CALL    BLOCK    ;WRITE AUTO START
7FEE CDF801    03060          CALL    1F8H     ;TURN OFF CASSETTE
7FF1 189B      03070          JR      DUMP
               03080 ;
               03090 ;        FOLLOWING CONVERTS DECODING PROGRAM
INTO
               03100 ;        A SUBROUTINE IN ORDER TO RESTORE BAS
IC
               03110 ;        PROGRAM IN MEMORY.  IT CALLS THE DEC
ODE
               03120 ;        SEGMENT, SUPPLIES THE KEYCODE IN (D)
 AND
               03130 ;        JUMPS INTO THE UNSCRAMBLED DECODING
SECTION
               03140 ;        RETURN TO BASIC IS AUTOMATIC
               03150 ;
7FF3 3EC9      03160 FINAL    LD      A,0C9H   ;RETURN OPCODE
7FF5 32D47E    03170          LD      (CONVRT),A
7FF8 CDBF7E    03180          CALL    ENTRY2
7FFC           03190 SPOT2    EQU     $+1
7FFB 1600      03200          LD      D,0 ;CODE WORD IS RECOVERED
7FFD C3A57E    03210          JP      POLLOW
3C00           03220          ORG     3C00H    ;VIDEO MESSAGE
3C00 20        03230          DEFM    '
                                       '
3C40 20        03240          DEFM    '                * * * LEVEL I
I BASIC  CENSOR * * *                  '
3C80 20        03250          DEFM    '                  VERS. 2  (C)
 1981  STEPHEN MILLS                   '
3CC0 20        03260          DEFM    '    CONVERTS RESIDENT BASIC
 PROGRAM TO LIMITED ACCESS SYSTEM      '
3D00 20        03270          DEFM    '    FORMAT OUTPUT.   USER M
UST SUPPLY SYSTEM FILENAME (UP TO      '
3D40 20        03280          DEFM    '    6 CHAR) AND SECURITY CO
DE (UP TO 20 CHARACTERS).              '
3D80 20        03290          DEFM    '    *  AFTER ENCODED TAPE I
S RELOADED, SECURITY CODE MUST BE      '
3DC0 20        03300          DEFM    '    TYPED IN IMMEDIATELY &
CORRECTLY WHEN  *? PROMPT APPEARS      '
4020           03310          ORG     4020H    ;CURSOR STORAGE
4020 C03D      03320          DEFW    3DC0H    ;SET CURSOR BELOW ME
SSAGE
7F0B           09999          END     RUN
00001 TOTAL ERRORS
```

be informed until after the security check. At this point the Basic program is in accessible memory and everything is normal. If the security code is not correctly entered, all memory (up to 16K) will be erased.

Level II Censor

The Level II version of Censor (see Program Listing 2) is longer and more complex than that for Level I, mainly because of the greater flexibility of Level II. Without software control, the Level I user is tightly bound to ROM, while the knowledgeable Level II user can move about freely in the system. I have therefore gone to somewhat greater lengths to defeat the meddler. In the Level II version, the secured program code is scrambled. The control program, as it is recorded, is mostly encrypted, and the security code itself is doubly encrypted and never decoded. The Level II version has memory requirements: Although it is not necessary to reserve memory, there must be 500 bytes of memory left above the Basic program for Censor to occupy. Censor does perform a test to determine if there is a conflict.

Censor can be transcribed through an editor/assembler or a monitor program, or it can be produced directly from Basic by means of POKEs. The first method is most convenient; however, because Censor contains discontinuous sections of code, which T-Bug is incapable of outputting. Also, the assembler technique makes it easy to revise Censor for different memory configurations (simply change the ORG address in line 240).

If you are a 16K user, who cannot use this method, you have an alternative in Program Listing 3. This Basic program provides a way of producing Censor as a second-generation program. Censor is contained in the data statements of Listing 3, along with a USR function program that does the output (T-Bug users who have already put the program in memory need only transcribe the first two lines of data, if they change the value of S in line 140 to 32273). With memory size set to 32160, run the program in Listing 3. It will POKE the Censor program into place, performing a checksum test of the data as it does so. If all is well, the program will allow you to make multiple recordings of Censor. During recording, the video message for Censor appears on the screen; it should not be omitted because

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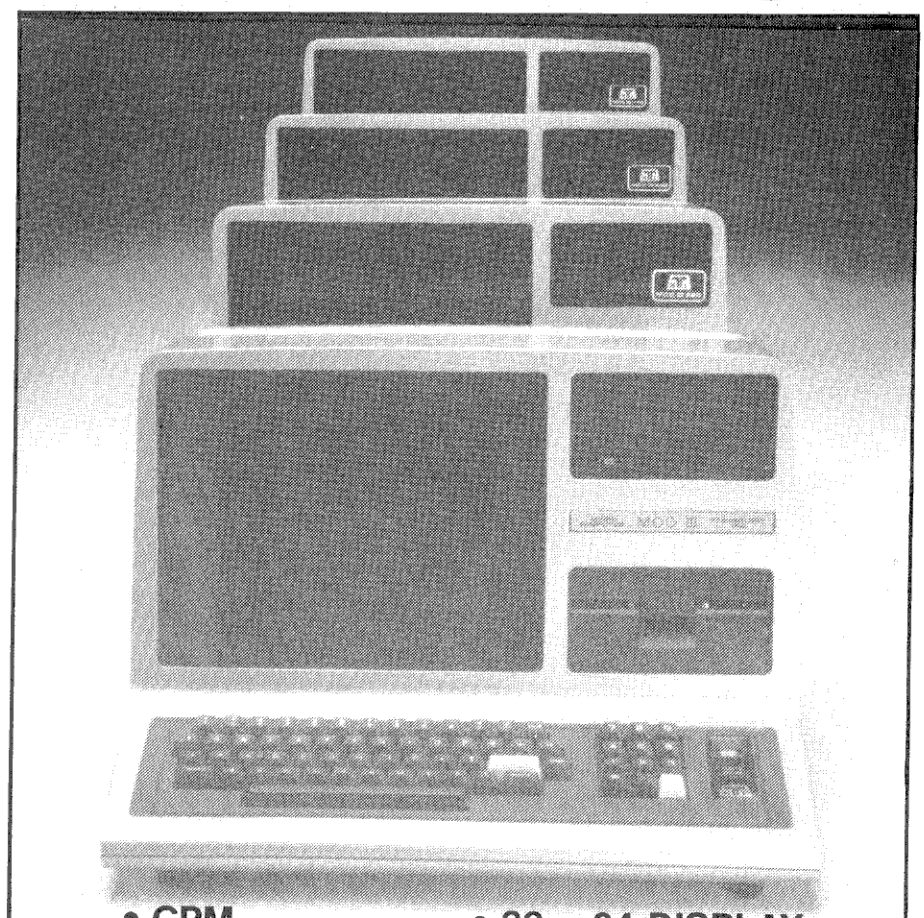

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the lower portion of video memory is being dumped onto tape.

When you are ready to use Censor to protect a resident Basic program, enter the system mode and load Censor from cassette. During the load, information about the use of Censor will be written directly onto the screen, cutting down the memory requirements for the program itself. Also during the load, keyboard control (in the keyboard Device Control Block) is restored to ROM. This last feature is important if you are using keyboard utilities which reside in high memory (like a debounce routine or an encoding utility like UNIKEY). Without this correction, a system crash would probably result.

When the cassette has stopped, enter "/" to start the program. Because the output of Censor is a system tape, it is necessary to assign a file name for the recording. This six-character label is not part of the security code, and need have no connection at all with the code. When that has been entered, the program requests an access code. Here type in your security code (up to 20 characters). Now Censor is ready to dump your program in encrypted form. It will permit multiple dumps, stopping and returning to the command mode when you press the Break key.

To reload the protected program, you must get into the System mode and enter the filename you have assigned to the program. Censor converted your Basic program to this format because, unlike Level I, the Level II CLOAD function does not derive program addresses from the cassette itself. Instead, Level II simply buffers the program wherever its pointers dictate. This makes it very easy to merge programs in Level II Basic, but it also makes it impossible to usurp control from ROM during the load. In the System format, on the other hand, the loaded program is stored according to information read from the cassette. Therefore, the tape can insert an address which redirects the program counter to Censor's control program. In this case, we do not write directly into the stack (as in Level I), but change the System vector address 41E2H to 41E4H.

When the load is completed, a bogus System prompt sans cursor will appear. At this point type in the correct security code for your program. You will note that the control program executes an automatic carriage return after the prompt, a clear reminder to the user that a control program is operating. This input process is very stringent: No breaks, clears or backspacing will be permitted, so be careful what you type.

If the entered security code is correct, the Basic program will be decoded and transferred to its normal location (beginning at 42E9H), at which point it is ready to run. If the control program is not satisfied, a system crash will result, erasing the program, filling the screen with vibrant garbage and causing an unresettable lock-up. This dramatic touch is intended to frighten off the more naive meddlers ("Oh-oh! I've broken it now!"). If the user finds this annoying, a slight modification of the Kill routine in Listing 2 should take care of it.

After all, it seems that the popular TRS-80 *can* be trained to keep secrets. If only it were so easy with all our friends . . . ■

```
0 '     LISTING 3       LEVEL II CENSOR BASIC VERSION

10 CLS:PRINT"

        LEVEL II CENSOR (C) 1981 STEPHEN MILLS
"
20 PRINT"
        Basic-based first generation program
         Requires MEMORY SIZE? set to 32160
"
30 REM          T-BUG USERS WHO HAVE ENTERED MAIN
                PROGRAM INTO 7E12H TO 7FFFH ONLY
                NEED DATA LINES 50-60   *  MUST
                CHANGE VALUE OF S TO 32273 (LINE 140)
40 FORX=13TO94:SET(X,4):SET(X,10):NEXT:FORX=5TO9:SET(13,X):SET(9
4,X):NEXT
50 DATA33,191,126,34,227,65,33,227,3,34,22,64,33,192,61,34,32,64
,175,205,18,2,205,135,2,33,246,125,6,7,205,227,126,33,32,64,6,2,
205,239,126,33,22,64,6,2,205,239,126,33,227,65,6,2,205,239,126,3
3,18,126,17,238,1,205,253,125,33,0,60,17
60 DATA0,2,205,253,125,6,3,33,15,126,205,227,126,195,248,1,85,67
,69,78,83,79,82,20,21,40,7,6,0,205,239,126,24,246,123,183,200,67
,195,239,126
70 DATA120,11,127,199,0,0,229,197,205,43,0,254,1,202,25,26,254,1
3,40,42,254,32,56,240,119,35,205,51,0,16,233,193,225,201,205,214
,126,66,65,83,73,67,32,83,80,79,73,76
80 DATA69,68,13,195,114,0,11,35,120,177,192,225,225,201,54,32,35
,16,251,4,24,212,175,197,229,6,19,134,35,16,252,225,193,15,201,1
75,103,76,105,92,22,60,69,237,176,237,75,19,126,229,126,170,119,
205,69,126,126,237,103,205,69,126,126,47,119
90 DATA205,69,126,24,236,205,214,126,10,42,63,13,33,226,126,6,20
,205,21,126,205,85,126,17,49,126,79,26,19,169,174,32,193,35,16,2
47,81,42,189,126,205,108,126,237,75,19,126,237,91,164,64,237,176
,237,83,249,64,195,114,0,120,0,0,62,201,50,226,65,6,166,33
100 DATA20,126,14,46,35,126,245,145,119,241,79,16,247,24,175,227
,126,35,205,51,0,254,13,32,247,227,201,0,126,245,129,79,241,205,
100,2,35,16,245,201,62,60,205,100,2,120,205,100,2,125,79,205,100
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110 DATA42,249,64,229,237,82,225,210,49,126,237,75,164,64,63,229
,237,66,34,19,126,62,2,132,173,202,114,0,205,214,126,70,73,76,69
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,67,69,83,83,32,67,79,68,69,63,13,33,49,126,6,20,205,21,126
120 DATA205,85,126,50,123,127,50,252,127,87,62,255,50,27,126,126
,170,119,35,16,250,237,75,19,126,17,17,126,225,43,237,184,19,235
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130 DATA13,205,43,0,254,1,40,76,183,40,246,62,195,50,226,65,175,
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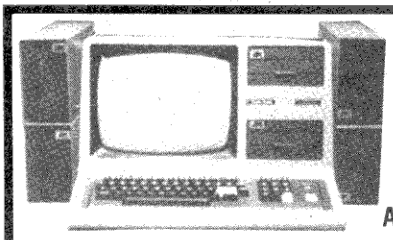
1,40,7,6,0,205,239,126,24,246,123,67,183,196,239
140 DATA126,33,188,126,6,3,205,227,126,205,248,1,24,155,62,201,5
0,212,126,205,191,126,22,0,195,165,126
150 POKE16562,125:POKE16527,125:POKE16526,158:POKE16561,158:CLEA
R50:DEFINTN-S:S=32767:FORL=32160TOS:READN:C=C+N:POKEL,N:NEXTL
160 IFS=32767ANDC=65431THEN180
170 IFS<>32273ORC<>11263THENPRINT"BAD DATA":END
180 PRINT"
        *** PREPARE FOR CASSETTE OUTPUT ***"
190 A$=INKEY$:IFA$<>CHR$(13)THEN190
200 CLS:PRINT@79,"* * * LEVEL II BASIC CENSOR * * *",@143,"Vers.
 2.2  (c) 1981 Stephen Mills"
210 PRINT@196,"CONVERTS RESIDENT BASIC PROGRAM TO LIMITED ACCESS
 SYSTEM",@260,"FORMAT OUTPUT.   USER MUST SUPPLY SYSTEM FILENAME
 (UP TO",@324,"6 CHAR) & SECURITY CODE (UP TO 20 CHARACTERS)."
220 PRINT@388,"*  AFTER ENCODED TAPE IS RELOADED, SECURITY CODE
MUST BE";@452,"TYPED IN IMMEDIATELY & CORRECTLY WHEN  *? PROMPT
APPEARS"
230 PRINT@652,"CENSOR SYSTEM TAPE IS NOW BEING RECORDED":PRINT"T
HE ABOVE INFORMATION WILL LOADED DIRECTLY ONTO TAPE WHEN CENSORI
S USED."
240 N=USR(0):M=M+1:CLS:PRINT@192,"Copy";M;"of CENSOR <filename>
has been recorded.":INPUT"Do you want another copy";A$:IFLEFT$(A
$,1)<>"Y"THENEND
250 PRINT"PRESS <ENTER> WHEN CASSETTE IS READY":GOTO190
```

Program Listing 3.



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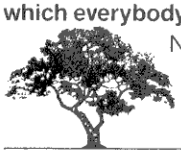

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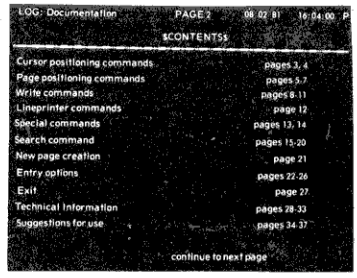

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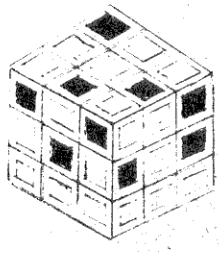

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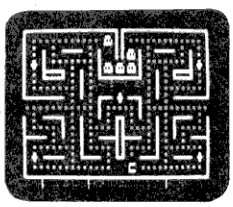

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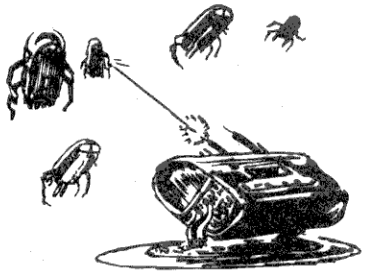

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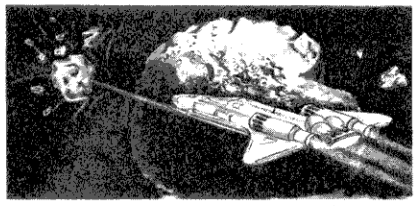

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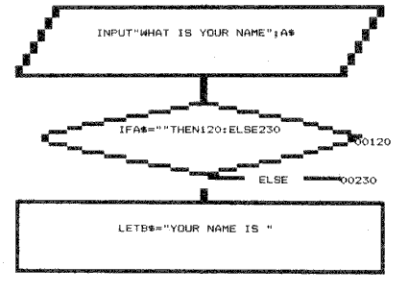

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Use Basic's ON ERROR–GOTO function to get out of trouble!

To Err Is. . .Okay

Richard S. Adcock
141 NW Lorna
Burleson, TX 76028

It's 3:10 AM and dark outside. It is probably Thursday though you're no longer certain. You accidentally enter a 0 instead of $522.36. Your TRS-80 might return a "/0" error message. Even late at night this may not present a severe problem. All you may have to do is restart the program and be more cautious the next time. On the other hand, $522.36 may have been number 72 of 75 data entries, 71 of which you have just entered for the fourth time in your diligent effort to balance your checkbook. You again type in "RUN", realizing that all your variables will be reduced to a pile of useless zeros.

All is not lost. The Basic interpreter inside your TRS-80 allows you to bypass its built-in error handling routines. You can take those errors, slap them around a bit and create something which, though not always useful, is at least somewhat less destructive. You will write your own error handling routines, in Basic.

A user written error handling routine contains two parts. The first part inserts a statement early in the program which functions as the door to an error trap. In a TRS-80 this statement takes the form of: "On Error GOTO nnnn." Most people wish it had more teeth. (The device is less humane than it appears. I once returned to an error trap several days after it was sprung to find that the error had gnawed off its number to escape. All my usually verbose Model III could say when I asked, "CMD E?" was, "NO ERROR FOUND!".) The "nnnn" refers to a line number which contains the error handling routine. It tells the computer what to do if any errors are caught. Basically, there are four options to an error handling routine: Print a number related to the error which just occured using "Print Err." Print the line number in which the error occurred using "Print Erl." Take some action based on the nature of the error. Reset your computer's built-in error handling routines. You will often use several of these options simultaneously.

Rules

Building an error trap is not difficult, but as with most programming you must follow definite rules.

First rule: isolate the error handling routine from your program. If you neglect to isolate the error handling routine off in some corner, you will probably generate an RW error. This means Resume without Error and only including an error handling routine in your program can cause it.

Second rule: the error handling routine must terminate with "Resume." Your "Resume" statements may assume several forms. "Resume" prompts the computer to pick up where the error occurred. The "Resume 0" does the same thing as the unadorned "Resume." "Resume nnnn" tells the computer to try another part of your program where there should be fewer bugs. Finally, "Resume Next" sends the computer to the statement following the one where the error occurred.

If you fail to include a "Resume" statement of some sort, you will have committed "NR", no resume, which is an error that can only happen when handling errors.

The following program incorporates an error routine:

```
   5  ON ERROR GOTO 1000
  10  INPUT "INPUT A NUMBER";A
  20  INPUT "INPUT ANOTHER
      NUMBER";B
  30  X=X+1
  40  B=B+A
  50  PRINT "AVERAGE= ";B/X
  60  GOTO 10
1000  IF ERR/2+1=11 THEN PRINT
      "YOUR FIRST NUMBER WAS A
      ZERO. TRY AGAIN.":RESUME 10
1010  ON ERROR GOTO 0
```

Line 5 tells the computer to handle errors your way. No more vague messages and zeroed variables. The program uses two "On Error GOTO nnnn" statements. This is legal, and quite useful. If you have been having syntax troubles in a subroutine, before you can check that part of the program, you must enter tedious data. You can use an error handling routine which simply points out the syntax error and then performs a "Resume nnnn" at the first line of the subroutine. If another error occurs you will still resume at the first line of the subroutine. By setting several different error traps each with its own "nnnn," you can utilize a different error handling routine for each part of the program. This enhances the usefulness of an error handling routine immensely. In the example, if the If ... Then statement in line 1000 fails, the statement in line 1010 will restore the computer's built-in error handling routines. The now enabled built-in routines will display both the error and its line number. This forces a restart which zaps the data, but we need to know what the error is and often the built-in routines are the easiest way to get that information.

The error we are trying to trap in the example is division by zero. The key to trapping a particular error is the "ERR/2+1=nn" statement. By replacing "nn" with one of the numbers in

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the appendix of your reference manual under error codes you can set the number for any specific error. If you check the appendix, 11 corresponds to a "/0" error. A lot of other numbers and error codes are also back there. They are why it is often easier to resort to the "On Error GOTO 0" statement rather than trying to cover all possibilities yourself. If you don't expect any particular error and use a simple "Resume", you could put the computer into the endless loop of error, resume, commit error. . . . You might as well let the computer handle the problem. The results will be about the same.

The formula "ERR/2 + 1" identifies which error has occurred. If you include a "Print Erl" statement in your error handling routine it will tell you the line where the error occurred. This can be useful information especially in the event that your expected error occurred but not where you think it did. It is easy to spend a lot of time looking for a bug at one point which is really somewhere else. The "Print Erl" statement can help you avoid trying to fix something that's not broken.

One final trick is available to you when you're setting up an error handling routine. The "Error nn" statement makes the computer think a specific error has occurred. By inserting the "Error nn" statement in your program and replacing "nn" with the numeric code for the error your routine is handling (11 in my example), you can check the routine long before you need it. This gives the computer a chance to practice, and helps you avoid another source of infinite frustration, the error trap that won't.

Error trapping is a useful addition to any program and can save time and frustration when you debug or run the thing that you have newly created. ■

Richard Adcock is president of a Fort Worth-based company specializing in custom applications for microcomputers.

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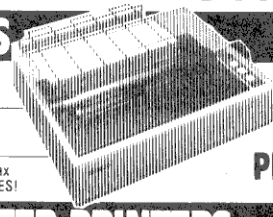

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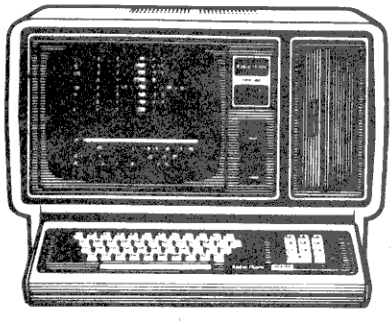

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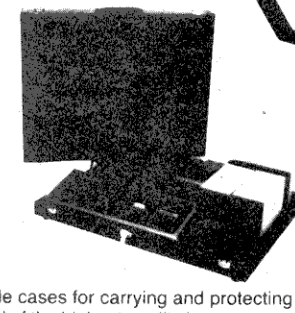

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When one-way is the wrong way.

Two-Way ANOVA

Richard C. McGarvey
221 Hirschfield Drive
Williamsville, NY 14221

I bought my first computer in order to speed up my study time while taking some required courses in Statistical Analysis. When I bought the computer I expected to be able to find the necessary statistical programs, but I was wrong. I did find many programs but I was unable to find some of the more important ones.

One example of a program I needed was Analysis of Variance, called ANOVA in statistical circles. I found one-way ANOVA all over the place but I couldn't find two-way ANOVA. I tried to get by with the programs I could find but I really wasn't getting much done. I decided to take matters into my own hands.

Since one-way ANOVA was pretty much out of date (statistical procedures change often) I was forced to write my own program. I got the necessary formulae from my statistics book and wrote my first important Basic program. This was not hard to do since ANOVA handles data in several different ways. After many hours of work I finally developed a workable two-way ANOVA program which I used a lot for one semester.

The next semester I found that my two-way ANOVA was fine for school book problems but fell short for more complex problems, such as problems involving differential attrition. When differential attrition occurs (usually in human subject experiments), it is necessary to make adjustments in the handling of the data. The adjustments are the inclusion of grand mean and harmonic mean in the calculations.

It was time to get back to work and adjust my program to properly compensate for differential attrition. Several more hours of work were required to make those adjustments. Finally, after a few 'false starts' and a few 'almost quits', I managed to get a workable program. I will now make this program, with a minimum of instructions, available to anyone who is interested (see Program Listing 1).

Harmonic Mean

p = # of Factors (cells) Level A
q = # of Factors (cells) Level B
N sub n = number of scores in cell n

$$\bar{n}_n = \frac{p \cdot q}{\frac{1}{N_1} + \frac{1}{N_2} \cdots \frac{1}{N_n}}$$

Sum of Squares

$$SS_A = \bar{n}_n\left[\frac{(\Sigma\bar{A}_i^2)}{q} - \left(\frac{G^2}{p \cdot q}\right)\right] \quad SS_B = \bar{n}_n\left[\frac{(\Sigma\bar{B}_j^2)}{p} - \left(\frac{G^2}{p \cdot q}\right)\right]$$

$$SS_{AB} = \bar{n}_n\left[\Sigma\left(\bar{AB}_{ij}^2\right) + \left(\frac{G^2}{pq}\right) - \left(\frac{\Sigma\bar{A}_i^2}{q}\right) - \left(\frac{\Sigma\bar{B}_j^2}{p}\right)\right]$$

$$SS_W = \Sigma x^2 - \frac{(\Sigma x)^2}{N}$$

Degrees of Freedom

$df_A = p - 1$

$df_B = q - 1$

$df_{AB} = df_A \cdot df_B$

$df_W = N - pq$ (Error)

df total $= N - 1$

MS of Cells

$MS_A = \frac{SS_A}{df_A}$

$MS_W = \frac{SS_W}{df_W}$

$MS_B = \frac{SS_B}{df_B}$

$MS_{AB} = \frac{SS_{AB}}{df_{AB}}$

Calculated 'F'

$F_A = \frac{MS_A}{MS_W}$

$F_{AB} = \frac{MS_{AB}}{MS_W}$

$F_B = \frac{MS_B}{MS_W}$

Table 1. Formulae

The Formulae

I wish I could give credit to the source of the formulae I used for this program but I don't know what publication they came from. I was given the formulae on a handout sheet by Dr. Joel Raynor, State University of New York at Buffalo who I credit as their source. See Table 1 for the exact formulae.

If an equal number of scores

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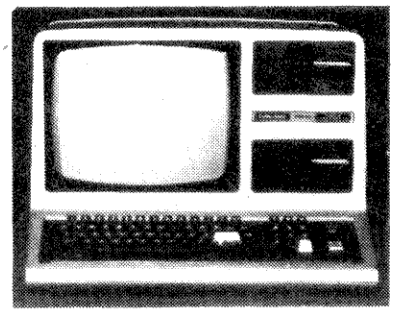

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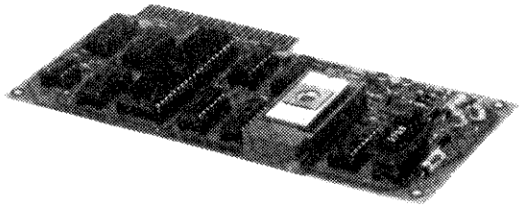

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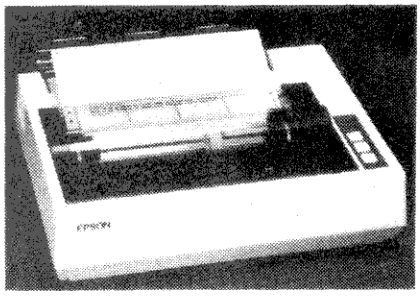

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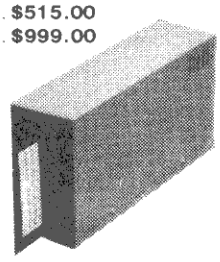

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are assigned to each group, the results will be exactly the same as in an uncorrected two-way ANOVA. When differential attrition occurs in the data the results are textbook accurate. I hand-calculated many examples of ANOVA to compare to the computer results and the only differences I have found were in the 1/10,000 range. This probably results from the way rounding is handled by the computer (or me!).

Data Input

Table 3 is an example of test data for the program. Data is entered in groups (called cells). The data is entered starting with group one, which is the upper left cell. The next cell to be entered is the cell to the right. This continues to the end of the row. After a row is completed, the first cell in the next row is entered. It does not matter in what order the individual scores are entered, but cell order is important because each cell position represents a level of a particular experimental factor.

When the program is started you will be asked to input the number of rows and columns. In the example data (Table 3) there are three columns and four rows. After that entry, you will be asked to input the scores for group (cell) one. To end the input of each group enter the @ symbol. The next cell input will then be prompted.

When all scores are entered, the program will give you the opportunity to edit them. If selected, this option will display the scores for each cell. If you want to change a score, you must redo the entire cell. This routine is long and not really necessary, so drop it if you want. To drop the edit routine, simply delete the GOSUB that calls it and do not enter the routine when you key in the program.

Data Output

After the edit routine is done, the computer will begin to compute the data for output. Each computation will be prompted so that you will know that the computer is working. This will also make editing the program easier, since each formula computation is headed by its identifier.

When computation is done the data table will be displayed on the CRT. Also the printout option will be prompted. Table 2 is the data output as it appears on Radio Shack's Line Printer VI. Program Listing 2 gives the subroutines that produce the lines in the data output. They will have to be changed to match your printer codes. In order to drop them all together, drop the GOSUBs that appear in lines 14, 15 and 16 and delete lines 31-33. This will produce the data table without the dividing lines.

The last prompt is the option to have the scores printed. They will be printed by cell and score number. This is a checking procedure and, like the edit routine, it can be dropped from the program to conserve time and memory.

Table 2 is an accurate output of the data that is shown in Table 3 once computation is complete. You can use this to check whether you have correctly entered the program code. Your results on this data should be the same. There should be no significant differences between the example output and your result. If there are, you can find an error by going to the section which is headed with the title of the result in which your error appears and work backward.

A Final Note

I have many statistical analysis programs. Some are original and others are adapted from different Basic programs. Anyone who wants these programs can send me a disk and a postage paid return envelope and I will be glad to send the programs I wrote, and those that I translated to TRS-80 Basic, free of charge. ■

Richard McGarvey is a professional police officer with the Amherst, NY Police Department. He owns two TRS-80 Model Is.

Data Table (ANOVA Test)

Source	DF	SS	MS	CAL. F
Column	2	177.226	88.6131	6.77543
Row	3	92.5463	30.8488	2.35872
C X R	6	289.345	48.2241	3.68725
W / C	64	837.03	13.0786	
Total	75	1396.15		

For DF to F Table Use:
Column = 2 / 64
Row = 3 / 64
CXR = 6 / 64

Table 2. ANOVA Result Printout

Columns (Factor B)

Rows (Factor A)			
	8 10 16 5 4 10	10 11 15 9 6 8 4	17 19 18 15 12
	15 9 11 14 6 8	12 8 5 6 3	14 13 16 11 7 8
	11 15 16 9 11 13 17 16	17 11 15 6 9 4	12 15 9 11 13 16 17
	17 15 19 18 17 11 15	10 15 5 6 12 17	8 10 17 11 8 6 10

Table 3. Score Groups (Cells)

Program Listing 1

```
1 CLEAR(10000):DEFINTR,S,Y,I,X,Z,T,N,O:CLS:PRINTCHR$(23)"TWO - W
AY  ANOVA":PRINT:PRINT"UPDATE 07/24/80":PRINT"THIS PROGRAM WILL
USE UNEQUAL":PRINT"SCORES PER CELL":FORX=1TO1000:NEXT:GOSUB19:GO
SUB25:CLS:NC=CR:FORX=1TOCR:T1=T1+N(X):NEXT:T=T1
2 GOSUB3:GOSUB11:GOSUB24
3 CLS:PRINT@384,"NOW COMPUTING COLUMN AND ROW 'N' VALUES":FORX=1
TOC:FORI=XTONCSTEPC:S(X)=S(X)+N(I):NEXTI,X:Y=1:FORX=1TOR:FORI=YT
O(Y+(C-1)):R(X)=R(X)+N(I):NEXTI:Y=Y+C:NEXTX:CLS:PRINT@384,"NOW C
ALCULATING CELL MEANS":FORX=1TOCR:FORI=1TON(X)
4 L=L+(A(X,I)):NEXTI:L=L/N(X):M(X)=L:L=0:NEXTX:CLS:PRINT@384,"NO
W CALCULATING HARMONIC MEAN":FORX=1TOCR:H=H+(1/N(X)):NEXTX:H=CR/
H:CLS:PRINT@384,"NOW CALCULATING THE GRAND MEAN":G=0:FORX=1TOCR:
G=G+M(X):NEXTX:CLS
5 PRINT@384,"NOW CALCULATING THE USABLE GRAND MEAN":G=((G[2)/CR)
:CLS:PRINT@384,"NOW CALCULATING CELL SCORE SQUARES":FORX=1TOCR:F
ORI=1TON(X):B(X,I)=(A(X,I)[2):NEXTI:NEXTX:CLS:PRINT@384,"NOW CAL
CULATING SQUARES WITHIN CELLS":FORX=1TOCR
6 FORI=1TON(X):K1=K1+(A(X,I)[2):NEXTI:NEXTX:FORX=1TONC:FORI=1TON
(X):K2=K2+A(X,I):NEXTI:K2=K2[2:K2=K2/N(X):K3=K3+K2:K2=0:NEXTX:E3
=K1-K3:CLS:PRINT@384,"NOW CALCULATING SQUARE OF ROWS":L6=0:L7=0:
FORX=1TOCRSTEPC:FORI=XTOX+(C-1):L6=L6+M(I):NEXTI
7 L7=L7+L6[2:L6=0:NEXTX:L7=L7/C:CLS:PRINT@384,"NOW CALCULATING C
OLUMNS SQUARED":L6=0:L8=0:FORX=1TOC:FORI=XTOCRSTEPC:L6=L6+M(I):N
EXTI:L8=L8+L6[2:L6=0:NEXTX:L8=L8/R:CLS:PRINT@384,"NOW CALCULATIN
G SQUARES OF ROW*COL MEANS":L9=0:FORX=1TOCR
8 L9=L9+(M(X)[2):NEXTX:CLS:PRINT@384,"NOW CALCULATING SSR":E2=(L
7-G)*H:CLS:PRINT@384,"NOW CALCULATING SSC":E1=(L8-G)*H:CLS:PRINT
@384,"NOW CALCULATING SSR*C":E5=((L9+G)-(L7+L8))*H:CLS:PRINT@384
,"NOW CALCULATING SST":E4=(E1+E2+E3+E5):CLS
9 PRINT@384,"DEGREES OF FREEDOM NOW!!!":DC=C-1:DR=R-1:DX=((R-1)*
(C-1)):FORX=1TOCR:DW=DW+(N(X)-1):NEXT:DT=DC+DR+DX+DW:CLS:PRINT@3
84,"NOW I'M DOING MS":Q1=E1/DC:Q2=E2/DR:Q3=E5/DX:Q4=E3/DW:CLS:PR
INT@384,"NOW i'M ON CALCULATED 'F'.":FC=Q1/Q4
10 FR=Q2/Q4:FX=Q3/Q4:CLS:RETURN
11 PRINT"                    DATA TABLE":PRINT"SOURCE";TAB(12)"DF
";TAB(24)"SS";TAB(36)"MS";TAB(48)"CAL. F":PRINT"COL";TAB(12)DC;T
AB(24)E1;TAB(36)Q1;TAB(48)FC:PRINT"ROW";TAB(12)DR;TAB(24)E2;TAB(
36)Q2;TAB(48)FR
12 PRINT"C X R";TAB(12)DX;TAB(24)E5;TAB(36)Q3;TAB(48)FX:PRINT"W
/ C";TAB(12)DW;TAB(24)E3;TAB(36)Q4:PRINT"TOTAL";TAB(12)DT;TAB(24
)E4:PRINT:PRINT"FOR DF TO F TABLE USE:":PRINT"COL  =";DC;"/";DW:
PRINT"ROW  =";DR;"/";DW:PRINT"CXR  =";DX;"/";DW
13 RETURN
14 A$="":LPRINTSTRING$(3,CHR$(138)):INPUT"ENTER THE TABLE NAME";
QR$:LPRINTTAB(20)"DATA TABLE  ";CHR$(123);" ";QR$;" ";CHR$(125);
CHR$(138):GOSUB31:LPRINT"SOURCE";TAB(12)"DF";TAB(24)"SS";TAB(36)
"MS";TAB(48)"CAL. F":GOSUB32
```

Program continues

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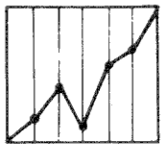

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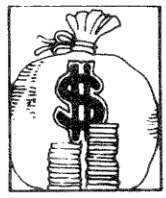

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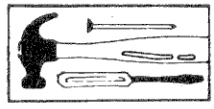

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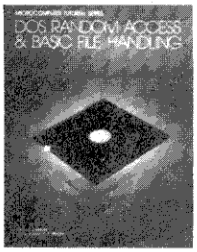

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Program continued

```
15 LPRINT"COL";TAB(12)DC;TAB(24)E1;TAB(36)Q1;TAB(48)FC:GOSUB32:L
PRINT"ROW";TAB(12)DR;TAB(24)E2;TAB(36)Q2;TAB(48)FR:GOSUB32:LPRIN
T"C X R";TAB(12)DX;TAB(24)E5;TAB(36)Q3;TAB(48)FX:GOSUB32:LPRINT"
W / C";TAB(12)DW;TAB(24)E3;TAB(36)Q4:GOSUB33
16 LPRINT"TOTAL";TAB(12)DT;TAB(24)E4:GOSUB33:LPRINT:LPRINT"FOR D
F TO F TABLE USE:":LPRINT"COL  =";DC;"/";DW:LPRINT"ROW  =";DR;"/
";DW:LPRINT"CXR  =";DX;"/";DW
17 PRINT:PRINT"ENTER 1 TO GET HARD COPY OF SCORES":INPUTA$:IFA$=
"1"THEN23ELSE18
18 INPUT"ENTER TO END";A$:END
19 DIMB(50,50),A(50,50),T(50),M(50),N(50),C(50):CLS:PRINT@384,"E
NTER THE NUMBER OF COLUMNS AND ROWS (C,R)":INPUTC,R:CR=C*R:CLS:C
LS:FORX=1TOCR:NN=1:CLS:PRINT@384,"ENTER SCORES FOR CELL ";X;:PRI
NT"   ( END WITH ' @ ' SYMBOL )"
20 INPUTA$:IFA$="@"THEN21ELSEA(X,NN)=VAL(A$):A$="":NN=NN+1:GOTO2
0
21 A$="":N(X)=NN-1:NEXTX:FORX=1TOCR:S=S+N(X):NEXT:RETURN
22 CLS:PRINTCHR$(23)"YOU HAVE MADE":PRINT:PRINT"AN ENTRY ERROR !
!":PRINT:PRINT"ENTER AGAIN PLEASE":FORX=1TO2000:NEXT:GOTO1
23 FORX=1TOCR:FORZ=1TON(X):LPRINT"CELL #";X;"SCORE#";Z;"=";A(X,Z
):NEXTZ,X:GOTO18
24 PRINT"FOR PRINT OUT ENTER 1 .....";:INPUTA$:IFA$="1"THEN14ELS
E17
25 CLS:PRINT@384,"ENTER 1 TO EDIT SCORES":INPUTA$:IFA$<>"1"THEN3
0ELSEFORX=1TOCR:PRINT"FOLLOWING ARE THE SCORES FOR CELL # ";X:FO
RY=1TON(X):PRINT"SCORE ";Y;" IS ";(A(X,Y)):NEXTY:PRINT"DO YOU WI
SH TO CHANGE ANY SCORES IN CELL ";X
26 INPUT"ENTER Y OR N ";A$:IFA$="N"THEN29ELSEN=1
27 PRINT"END SCORE ENTRY WITH ' @ ' --- ALL SCORES MUST BE RE-EN
TERED.":PRINT"SCORE ";N;" FOR CELL ";X;" SHOULD BE ???":INPUTA$:
IFA$="@"THEN28ELSEA(X,N)=VAL(A$):N=N+1:GOTO27
28 N=N-1:N(X)=N
29 NEXTX
```

```
30 RETURN
31 LPRINTSTRING$(6,CHR$(241));CHR$(243);STRING$(14,CHR$(241));CH
R$(243);STRING$(12,CHR$(241));CHR$(243);STRING$(12,CHR$(241));CH
R$(243);STRING$(10,CHR$(241));CHR$(242):RETURN
32 LPRINTSTRING$(6,CHR$(241));CHR$(250);STRING$(14,CHR$(241));CH
R$(250);STRING$(12,CHR$(241));CHR$(250);STRING$(12,CHR$(241));CH
R$(250);STRING$(10,CHR$(241));CHR$(249):RETURN
33 LPRINTSTRING$(6,CHR$(241));CHR$(248);STRING$(14,CHR$(241));CH
R$(248);STRING$(12,CHR$(241));CHR$(248);STRING$(12,CHR$(241));CH
R$(247):RETURN
```

Program Listing 2

SOME STRAIGHT TALK ABOUT DISK DRIVES

- DON'T BE CONFUSED BY ALL THE BRAND NAMES YOU SEE IN THE MARKET PLACE, THERE ARE VERY FEW MANUFACTURERS OF THE BASIC DRIVE CHASSIS, ALL THE OTHER NAMES ARE THOSE OF THE ASSEMBLERS OR THE RETAILERS.
- AS MANUFACTURED, THE DRIVE WILL NOT RUN ON A TRS-80‡, IT MUST BE MODIFIED BY THE ASSEMBLER.
- THE QUALITY OF THE DRIVE DELIVERED TO YOU IS DEPENDENT ON BOTH THE MANUFACTURER AND THE ASSEMBLER, THE BEST CAN TURN TO JUNK IF THE ASSEMBLY IS IMPROPERLY DONE.
- THE POWER SUPPLY AND CASE ARE VERY IMPORTANT COMPONENTS OF THE COMPLETE DRIVE, THE CASE MUST ALLOW PROPER COOLING AIR FLOW, AND THE POWER SUPPLY MUST MAINTAIN TWO CONSTANT VOLTAGES.
- YOU MUST DEPEND ON THE COMPANY SELLING YOU THE DRIVE TO SERVICE IT AT REASONABLE COST WHEN IT FAILS YOU, THE MANUFACTURER IS NOT EQUIPPED TO DO THIS!
- THE BEST MEASURE OF QUALITY IN A DRIVE IS IT'S SPECIFICATIONS, WILL IT HANDLE DOUBLE DENSITY, WHAT IS THE TRACK TO TRACK ACCESS TIME, THE ANSWERS TO THESE TWO QUESTIONS INDICATE THE PRECISION OF IT'S COMPONENTS.
- WHAT KIND OF DRIVE SHOULD YOU BUY ? LEVEL IV HAS CHOSEN TO DISTRIBUTE EXCLUSIVELY, THE MPI LINE, ALL MODELS OF MPI ARE DOUBLE DENSITY RATED AND REQUIRE ONLY A FIVE MILLI-SECOND TRACK TO TRACK ACCESS TIME.
- WHAT DO ALL THE MODEL NUMBERS MEAN?
  B-51= 40 TRACKS SINGLE HEAD SINGLE SIDE B-52= 40/40 TRACKS DOUBLE HEAD DOUBLE SIDE
  B-91= 80 TRACKS SINGLE HEAD SINGLE SIDE B-92= 80/80 TRACKS DOUBLE HEAD DOUBLE SIDE
  (DOUBLE HEADS)-READ BOTH SIDES OF DISK (DUALS)-TWO DRIVES IN ONE CASE (RAW)-NO POWER SUPPLY OR CASE
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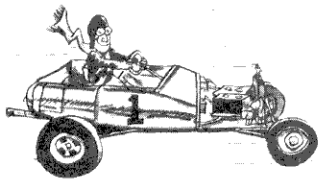

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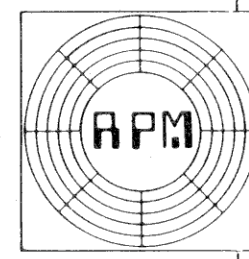

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Color from a Model II?

Paul T. Ward
Rolf A. Deininger
School of Public Health
University of Michigan
Ann Arbor, MI 48109

The TRS-80 Model II is a useful microcomputer, by itself and as a terminal for a central host computer. However, its graphics capabilities are not exciting and the lack of color is disappointing. To add color plotting capabilities, we interfaced the TRS-80 to a Houston Instruments DMP-3 digital plotter (HIPLOT), which uses 8½ by 11 inch paper and has a maximum plotting area of 7 by 10 inches.

The Key Box

Model II
64K RAM
TRSDOS
2 Disk Drives
Daisy Wheel Printer

Hardware

Interfacing the TRS-80 to the HIPLOT is very simple. Serial port B on the back of the TRS-80 connects to the serial port of the plotter. The cabling provides an Xon-Xoff handshake and requires the pin connections shown in Fig. 1 to run at a 2400 baud rate.

HIPLOT jumper 6-16 sets the baud rate at 2400. Before running any Basic program, you must issue the system commands:

```
SETCOM B = (2400,8,N,2)
FORMS {S}
```

Software

Existing software, such as the Model I HIGRAPH, is restricted to plotting a bar chart, line graph, or pie chart. We developed our own software. Since our numbers span large ranges, the program must be able to produce logarithmic graphs. Fig. 2 is an example of such a graph.

Program Listing 1 produces the box and lettering "TRS-80 Model II and HIPLOT" (see Photo 1).

Line 260, the first command to the plotter, draws a box around the text. The string instructs the plotter to move the pen home (the lower left corner), to go into absolute plotting mode, to set the origin at −100,0 and then to draw with the pen down to the specified coordinate pairs. The coordinates are expressed in units, where each unit is .005 inches. This string produces a box 10 inches in the X and 7 inches in the Y direction.

The program requests the user to change the pen to a new color and, after pressing any key, line 300 sends a string which will write the text "TRS-80 Model II" to the plotter. U means pen up, A means absolute coordinates, and 300,1100 means go 300 units in the X direction and 1100 units in the Y direction for symbol plotting (S). The numbers associated with S (14) mean vertical orientation (1) and size of the letters (4). Ninety-three plotable ASCII characters may be oriented in four directions and drawn in five sizes. The 4 indicates a letter height of .56 inches. Line 310 redraws the same text displaced by .02 inches to create a thicker line. The last character of each string is an underline indicating the end of the symbol plotting mode. Line 350 draws the text "and", and lines 390 and 410 draw the text "HIPLOT" twice. Line 410 sends the pen home (H) and deselects the plotter (@).

By the time this short article reaches print, Radio Shack will be advertising their TRS-80 Plotter ($1995). This plotter is the HIPLOT DMP-3 with an automat-

Model II		HIPLOT
pin 2	to	pin 3
pin 3	to	pin 2
pin 7	to	pin 7
jumper 4-5		
jumper 6-8-20		jumper 6-16

Fig. 1. TRS-80 Model II and HIPLOT pin connections.

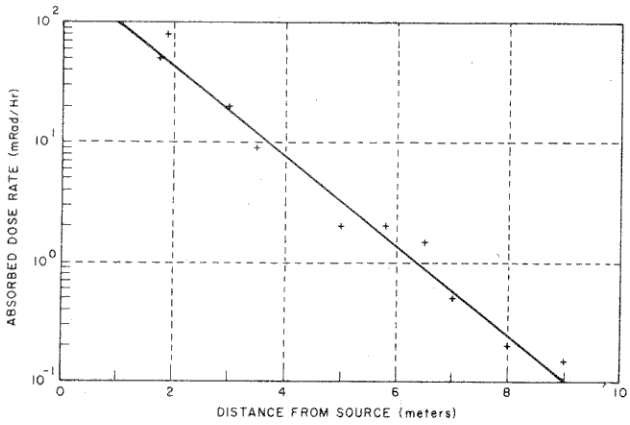


Fig. 2. Logarithmic Graph.

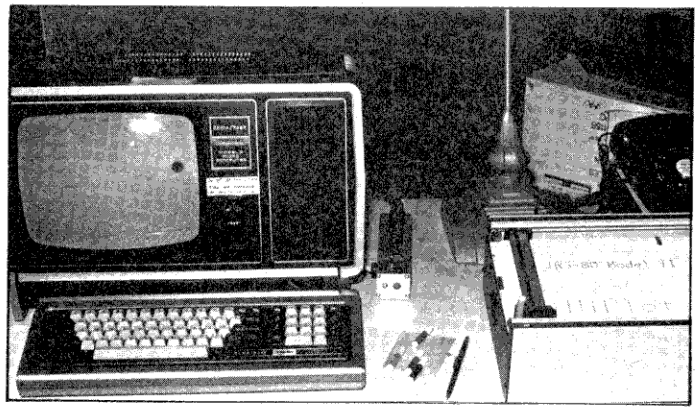


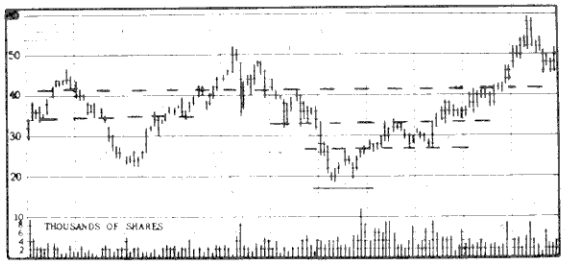
Photo 1.

ic color pen changer and a manual capability to direct the pen to a certain location. Depending on the plotting load you have, you may save yourself $800 and get a HIPLOT DMP-3 or, for about the same amount of money, a DMP-6 or 7 with a plot area of 10 by 15 inches. ■

Paul Ward is a graduate student in radiological health, and Rolf Deninger is a professor of environmental health at the School of Public Health of the University of Michigan.

```
100 REM ******************************************************
110 REM *                TRS-80 MODEL II                     *
120 REM *                      AND                           *
130 REM *                HI-PLOT PLOTTER                     *
140 REM *                 TITLE PAGE                         *
150 REM *                  PROGRAM                           *
160 REM *                                                    *
170 REM *     WRITTEN BY PAUL T. WARD SEPT. 1981             *
180 REM *                                                    *
190 REM ******************************************************
200 REM
210 REM DRAW BORDER AT MAXIMUM PLOTTING SIZE
220 REM
230 CLS:PRINT"PUT PAPER AND BLACK PEN IN PLOTTER"
240 PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
250 I$=INKEY$: IF I$="" THEN GOTO 250
260 LPRINT";: H U A -100,0 O D 0,1400 2000,1400 2000,0 0,0 "
270 PRINT: PRINT"INSERT RED PEN WHEN PLOTTER STOPS"
280 PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
290 I$=INKEY$: IF I$="" THEN GOTO 290
300 LPRINT" U A 300,1100 S14 TRS-80 Model II_ "
310 LPRINT" U A 304,1104 S14 TRS-80 Model II_ "
320 PRINT:PRINT"RE-INSERT BLACK PEN WHEN PLOTTER STOPS"
330 PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
340 I$=INKEY$: IF I$="" THEN GOTO 340
350 LPRINT" U A 850,760 S14 and_ "
360  PRINT:PRINT"INSERT BLUE PEN WHEN PLOTTER STOPS"
370 PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
380 I$=INKEY$: IF I$="" THEN GOTO 380
390 LPRINT" U A 450,300 S15 HIPLOT_ "
400 LPRINT" U A 454,304 S15 HIPLOT_ "
410 LPRINT" H @ "
```

Program Listing.



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A joystick interface for your Model I.

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Howard Batie
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With this inexpensive dual joystick interface you get two-player action and real-time input. And as an added bonus, two addressable output ports are provided to control external circuitry under computer control. The design can be constructed in an evening for under $20, exclusive of cabinet and joysticks.

There are two basic types of joysticks—switches on each of five data lines (such as used by Atari) and twin potentiometers (such as sold by Jameco). Either kind may be used with this interface, although a few extra parts are required for the potentiometer version. The interface is designed to be plugged directly onto the PCB extension on the rear of the TRS-80, but can also be used by most other home computers.

Description

The full schematic of the switch-type dual joystick interface is shown in Fig. 1. If you

The Key Box

Model I
Joystick Interface

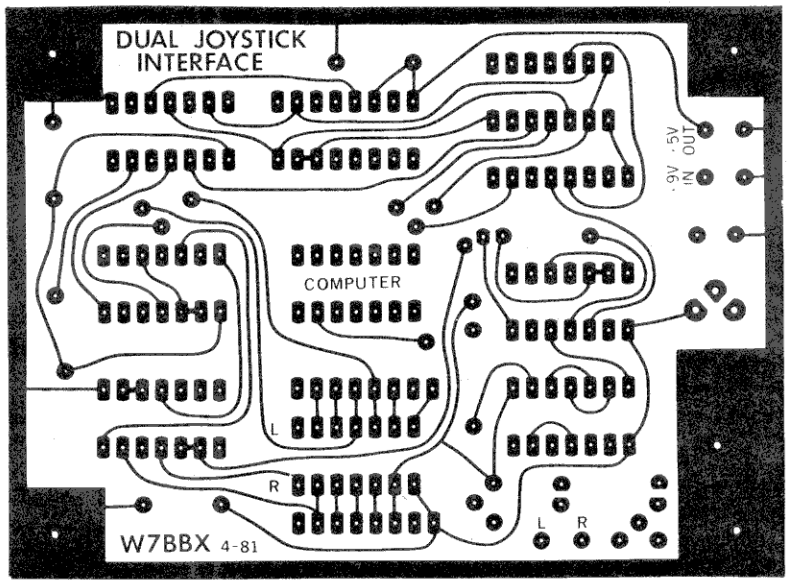

Fig. 1a. Component side of PC board.

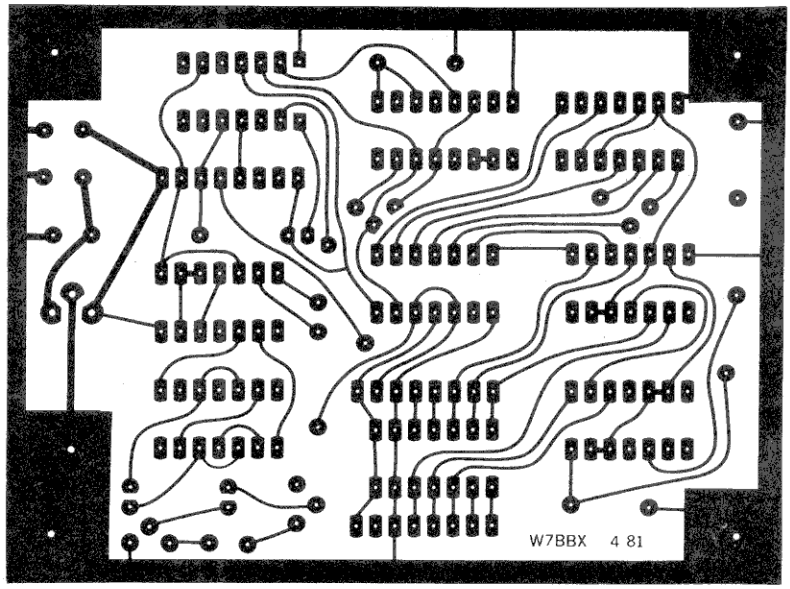

Fig. 1b. Reverse side of PC board.

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take a good look at it, you'll see that I cheated a bit by not decoding all the available address lines, not using all the data lines, and I used CMOS switches instead of the standard 74LS367 tri-state buffers. These departures from the normal procedures are worthwhile in this case because cost, parts and voltage drain are drastically reduced if we use only those signal lines we really need.

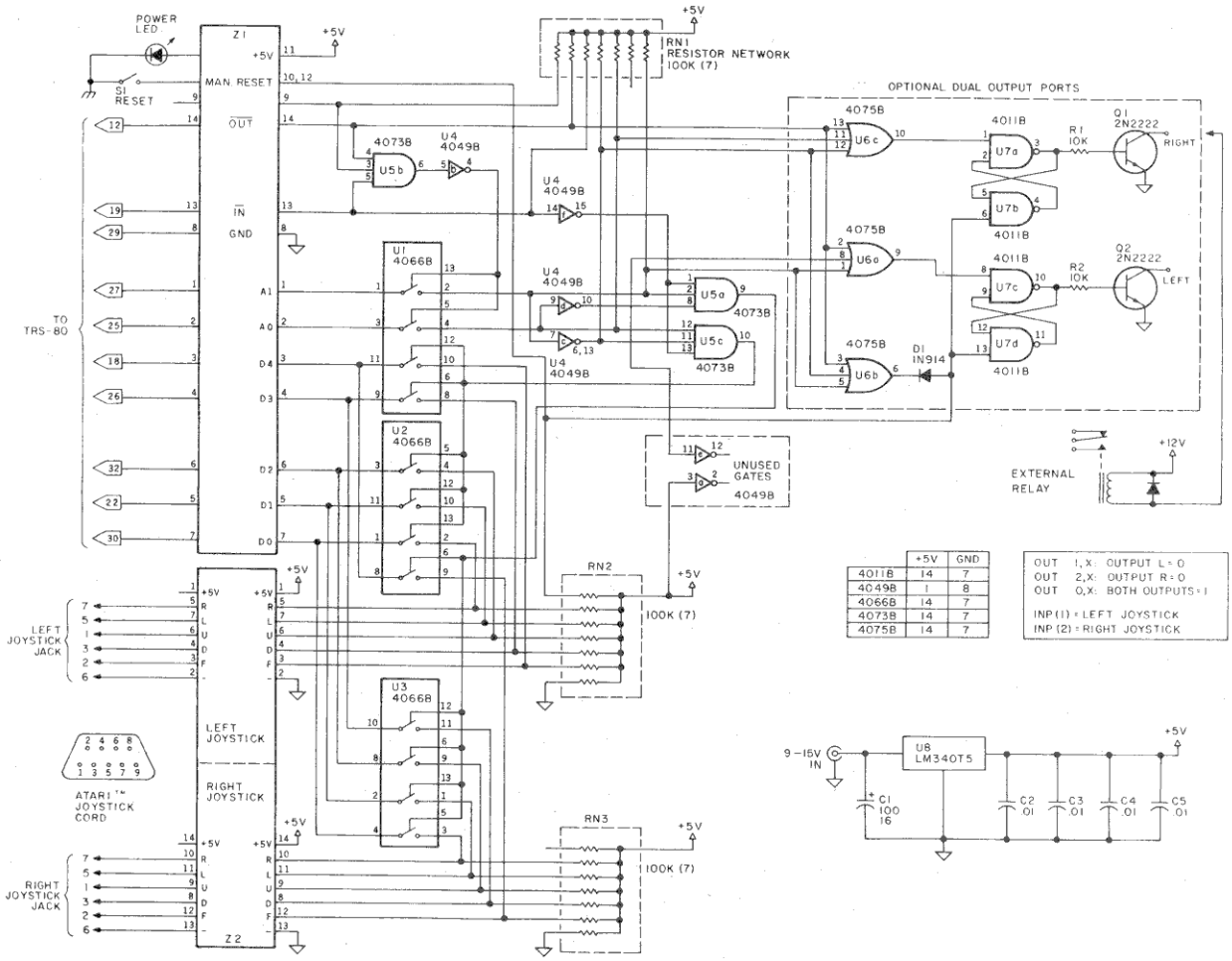
The circuit was designed around the requirement to keep program statements simple. For example, I wanted to call the input data from the left joystick with INP(1) and the right joystick with INP(2). I also wanted the output ports to provide a latched change of logic level with unambiguous statements. OUT 1,X (X is an integer from 0 to 255) sends a logic change output signal for the left player, and OUT (2,X) does the same for the right player. OUT 0,0 resets the output signal latches for both players to their normal logic state. These commands were purposely chosen so that the programmer could easily remember what commands affect which port while avoiding any possible interaction with the TRS-80 cassette input and output port (#255).

Also, note that the five data lines D0–D4 are used only with the INP statement; they are, in effect, tri-stated at all other times. This is done because we really don't need to output any specific data, but just need an indication that an OUT command has been issued to one of the two output ports. Thus, the two address lines during the OUT statement provide all the output data that is necessary; i.e., they identify which output port is to be activated. During an INP statement, however, we want to monitor the logic level at each of five separate switches (right, left, up, down and fire) and pass this data to the CPU. Without going into the complexity of data multiplexers, this will require five separate data lines, one for each switch.

How is all of this done? Pins 12 and 19 of the TRS-80 expansion edge connector provide the OUT* and IN* signals respectively. Each is a negative-going strobe pulse of about 1.3 microseconds which occurs during the execution of the OUT or IN statement. The OUT* or IN* signal line may be low in any instant, but not simultaneously. These strobes are used in conjunction with the two address lines A0 and A1 to determine which other parts of the circuit are activated.

All the address and data lines used are gated through U1–U3. These devices are solid-state switches and, in the circuit shown, take the place of the usual tri-state buffers found in most other computer interface designs. Looking at the top switch of U1, the input pin 1 is connected to the output pin 2 only if the control line pin 13 is high. The resistance between pins 1 and 2 is then about 300 ohms. But when pin 13 is low, the resistance between the same two pins is on the order of several hundred megaohms (open-circuited). Further, the switch is bidirectional, so that pin 1 can be used as the input and pin 2 as the output, or pin 2 can be the input and pin 1 the output. This allows great flexibility when laying out a printed circuit board.

The OUT* and IN* signal lines are fed to U5b and the U5b output is inverted by U4b. The output of U4b is normally logic 0, but when either the OUT* or IN* line is strobed low, the U4b output rises to logic 1, which turns on the top two switches of U1. This allows the two address lines to be decoded at the U5a and U5c inputs. However, U4f keeps these gates OFF unless the IN* signal has strobed low and activated the address line switches (OUT* has no effect here). When INP (1) is executed,



	+5V	GND
4011B	14	7
4049B	1	8
4066B	14	7
4073B	14	7
4075B	14	7

Fig. 1. Schematic diagram.

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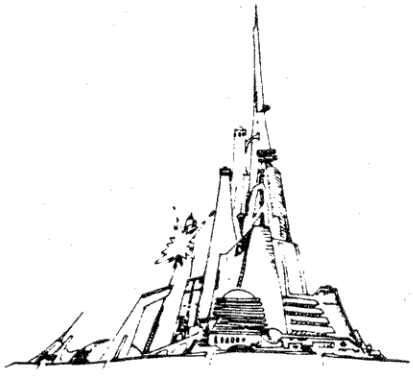

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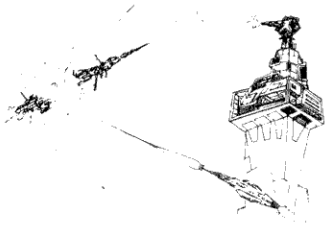

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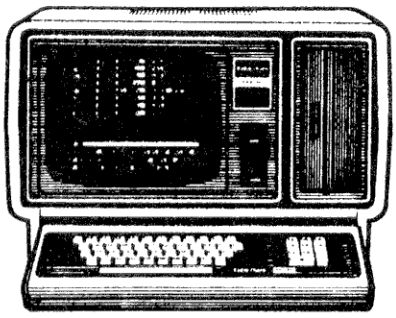

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IN* is strobed low, address line A0 is high and A1 is low, so all inputs at U5c are high; U5c pin 10 goes high, which turns on the bottom two switches of U1 and the top three switches of U2. The computer data lines D0-D4 are now looking for input data from the left joystick. Since no input connection is made to data lines D5-D7, the CPU sees these as logic 1 signals. Therefore, if no switch is depressed when INP(1) is executed, the CPU gets the value 255 as the input data from the left joystick.

Now if IN* is strobed low in response to an INP(2) statement, A0 is low and A1 is high. Again, U4b pin 4 closes the top two switches in U1, the A0 and A1 address lines are applied to U5b and U5c, and U5a pin goes high. This turns on the bottom switch in U2 and all switches in U3, and the CPU is now looking for input data from the right joystick. Moving the joystick to the right position takes D0 low (inputted data is 254); the left position inputs 253. The UP position inputs 251, and 247 is inputted if the joystick down switch is closed. If the fire button is pressed, D4 goes low and inputted data is 239 (see Table 1). These input values are then used by the program to determine the proper action to be taken.

A similar process is used to decode either of the two output ports, except decoding is done by U6c and U6a. When A0 is high, A1 is low, and OUT* is strobed low in response to OUT 1,X all inputs of U6a are then low, allowing pin nine to go low. This toggles the cross-connected flip-flop U7c-U7d. This toggled state will be maintained until reset by an OUT 0,X statement, or until manually reset by depressing S1. OUT O,X is decoded by U6b, which is really a third output port, but is used only to reset the first two. U6b pin 6 goes low, and both flip-flops are reset through D1. One thing to keep in mind: It's a good idea to include the statement OUT 0,0 near the beginning of any program, just to make sure the output ports are properly initialized.

Provisions are made at the output of each flip-flop to activate a relay for external control of bells, whistles, etc. When U7a pin 3 goes high, Q1 is saturated and the relay closes. A typical low-current relay is sold by Radio Shack and requires only 12 ma. A spike-limiting diode rectifier (1N4001, etc.) may be placed in parallel with the relay coil as shown in Fig. 1.

Since the circuit is all CMOS, power drain is virtually negligible, and the circuit could be

Joystick Position	Logic Output R	L	U	D	Input Data
UP	1	1	0	1	251
UP-RIGHT	0	1	0	1	250
RIGHT	0	1	1	1	254
DOWN-RIGHT	0	1	1	0	246
DOWN	1	1	1	0	247
DOWN-LEFT	1	0	1	0	245
LEFT	1	0	1	1	253
UP-LEFT	1	0	0	1	249
CENTER	1	1	1	1	255

Table 1.

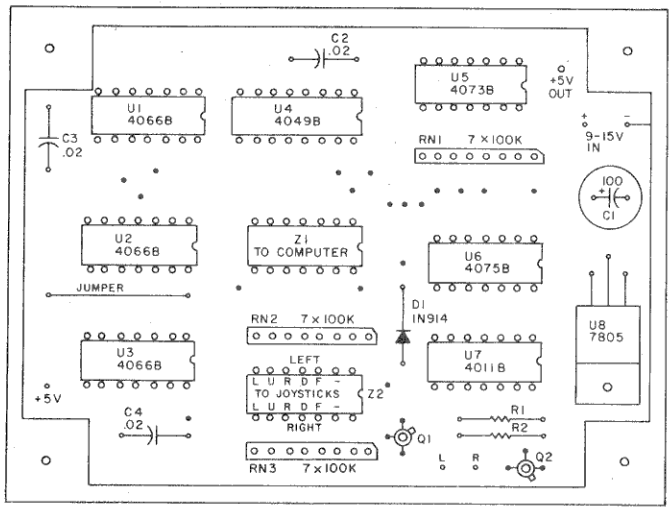

Fig. 2. Parts placement diagram.

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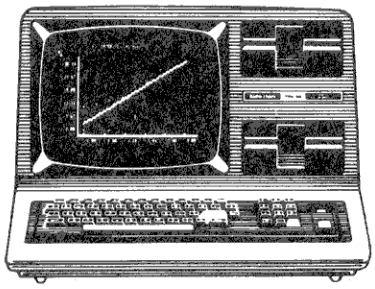

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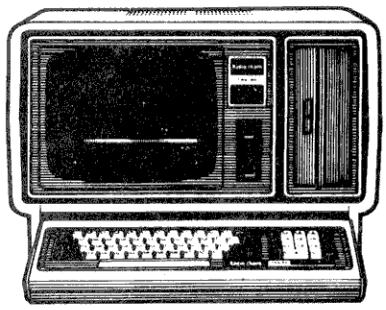

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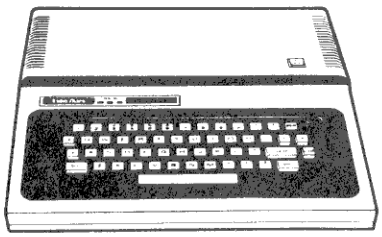

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powered with four internal NiCad cells (1.25v per cell). However, to ensure proper and constant TTL-compatible logic levels to and from the computer, the PC board accomodates U8, a standard 5-volt regulator in a TO-220 case, which can be powered by any AC adaptor for games or calculators which has an output voltage between 8 and 15 volts.

Construction

Parts layout is not critical, and is greatly simplified by using three resistor networks, each with seven 100K ohm pull-up resistors. The entire circuit of Fig. 1, including the voltage regulator, is built on a 3″ by 4″ double-sided PC board and housed in an 8″ by 3″ by 5″ LMB ME-583 cabinet, which is in strict conformance with my shrink postulate. My shrink postulate states that the physical size of any completed project is determined not by the complexity of the circuit, but only by the number and size of input and output panel controls and connectors. Anyway, I believe that a couple of extra dollars invested in a good-looking cabinet is well worth it. Inside, the electron doesn't care.

The two joystick input sockets, the on-off switch and the reset button are placed on the front panel, and the computer connector socket, right and left output jacks, and the AC adaptor input jack are on the rear panel. Standard 9-pin D-connector sockets are used on the front panel (Atari joysticks can be plugged in directly), and, since ten signal lines are required to the computer, a 15-pin D-connector is used on the rear panel.

Connections to the joysticks and computer panel connectors are simplified by using standard 14-pin headers at the IC sockets labeled Z1 and Z2. This also minimizes the time and effort needed to remove the PC board from the cabinet once it's wired in. Simply removing the headers from the two IC sockets disconnects 22 of the 27 required interconnecting wires. Provisions have also been made on the PC board to tap off the +5 volt regulator output to drive other circuitry you may want to include inside the cabinet. About 200 ma is available, assuming that the AC adaptor you use can supply that current continuously. Also, if you do want to tap into the computer address and/or data lines, the header plugs make it extremely convenient to do so. If desired, the ME583 cabinet is sufficiently large to permanently install the AC adaptor inside and eliminate the AC adaptor input jack. This would also provide a little more "ballast weight" for the cabinet.

Software

Inputting data and activating the output ports can be done at any appropriate step in the program logic flow. For example, the input data lines can be continually scanned for closure of any switch inside a Basic loop (or Assembly program counterpart) with an elementary routine such as:

```
300 A = INP (1): B = INP(2)
310 IF A = 255 AND B = 255 THEN 300
320 IF B<255 THEN 340
330 IF A = 254 THEN (R) ELSE IF
A = 253 THEN (L) ELSE IF A = 251
THEN (U) ELSE IF A = 247 THEN (D)
ELSE IF A = 239 THEN (F)
340 IF B = 254 THEN (R) ELSE IF
B = 253 THEN (L) ELSE IF B = 251
THEN (U) ELSE IF B = 247 THEN (D)
ELSE IF B = 239 THEN (F)
```

This example shows switch closures in only one of the four cardinal directions, plus fire. Additional data values can also be tested for combinations of directions: 250 = UP and RIGHT; 246 = DOWN and RIGHT; 249 = UP and LEFT; and 245 = DOWN and LEFT. Additionally, the fire data line can be tested independently of the states of the direction data lines if the last statement on line 330 is changed to: 330 ..... ELSE IF A <239 THEN (F). Alternatively, if you want to input data when a certain set of conditions are met, one possibility is: 300 IF G = 10 AND H = 3 THEN A = INP(1): B = INP(2).

These software aids are directly usable on the Model I Level II with either switch-type or potentiometer joysticks using the interfaces shown in Figs. 1 and 3. Minor changes to the logical operation statements may be required for use on other computers; however, the joystick hardware can be used by most any eight-bit Basic computer which has negative-going strobe signals during execution of OUT and INP statements, or their equivalents. If your computer has positive-going strobes, the OUT and IN signal lines can be inverted externally.

Potentiometer Joysticks

To use potentiometer-type joysticks with the interface shown in Fig. 1, we need a method of converting the continuously varying resistance to discrete logic levels which are

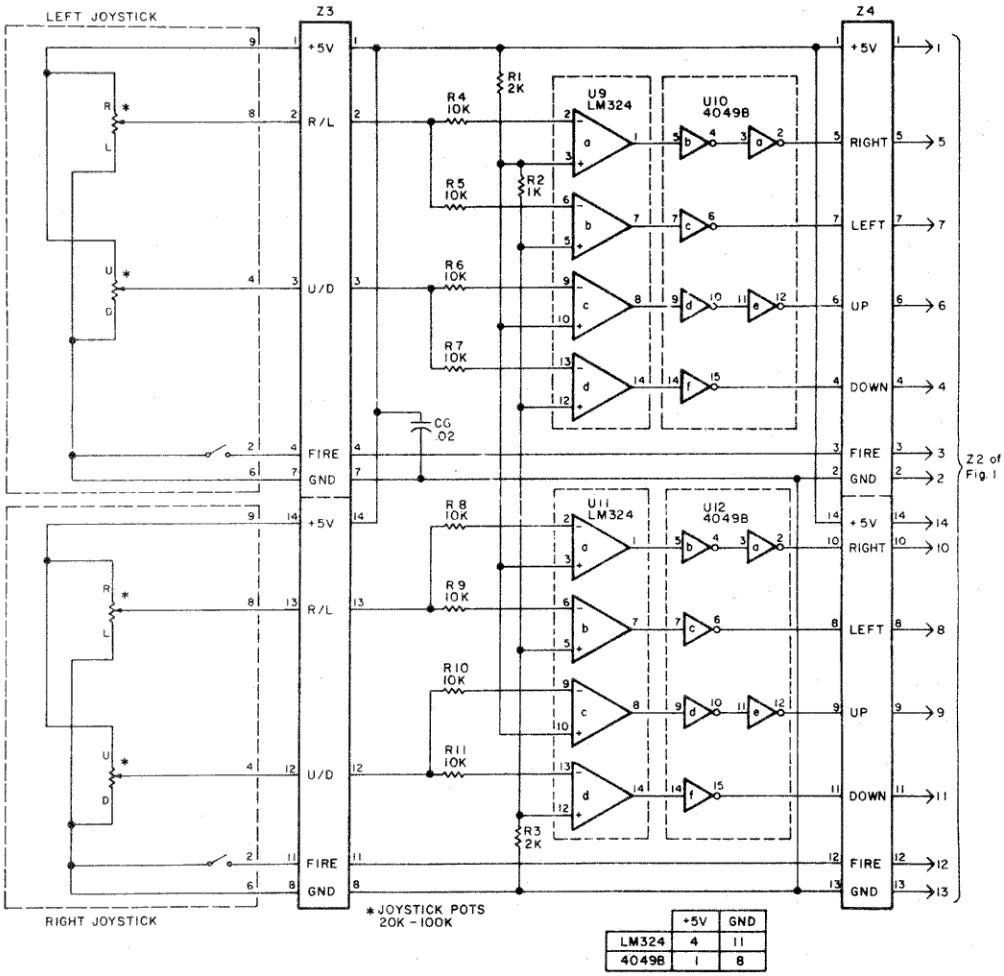

Fig. 3. Interface for potentiometer joysticks.

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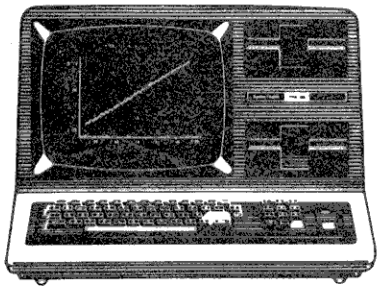

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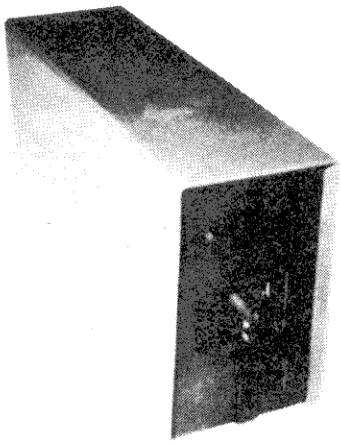

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recognizable and usable by the CPU. The additional circuitry of Fig. 3 performs that conversion. The five output data lines can be connected directly to the joystick inputs of Fig. 1, and the joysticks themselves now go to the inputs of Fig. 3.

What we have in Fig. 3 is really four two-bit analog-to-digital converters. But this is all we need here since we're only interested in three different positions of the joystick lever: right, center and left or up, center and down.

Looking at U9a and U9b, we see that these two op-amps are configured for maximum open-loop gain (no feedback resistor), and will act as voltage threshhold detectors, or voltage comparators. If the voltage into the inverting input is below that of the reference voltage on the non-inverting input, the op-amp output will be high. But when the inverting input reaches the threshhold reference voltage at the non-inverting input, the op-amp output toggles sharply to logic zero. The reference voltage at the U9a and U9b non-inverting inputs is determined by the R1-R2-R3 voltage divider, with a higher reference voltage at the non-inverting input of the top op-amp. The difference in reference voltages between the two non-inverting inputs (voltage drop across R2) will determine the amount of joystick travel around its center position, which is normally the "off" area. I've arbitrarily selected the center 20 percent of the lever motion to be the "off" area. The voltage on U9b pin 5 is 2.0 volts, and 3.0 volts on U9a pin 3, a difference of one volt, or 20 percent of the total joystick wiper travel from zero to five volts.

Now remember that to work properly with the switch-type joystick interface of Fig. 1, the right output line of Fig. 3 must go to logic zero when we move the joystick handle right (out of the center OFF area) and the left output line must be low only when the joystick handle is to the left of the center off area. When in the center off area, both right and left output lines must be high. This decoding is done by U10c and U10f. U10a, b, d and e are used only to provide buffered non-inverted output data to the inputs of Fig. 1. The process is repeated with U9c and U9d for the Up-pot, and with U11 and U12 for the second joystick.

The choice of the LM-324 as the quad op-amp for this application was made quite deliberately. Its particular advantages are that it works well as a voltage comparator from a single ended 5V supply, uses a minimum of external components, and the voltage transition threshhold can be set anywhere between a few millivolts above ground and a few millivolts below Vcc and still give good switching performance. Additionally, it's widely available, quite inexpensive and draws only about three to four milliamperes.

The entire circuit of Fig. 3 can be constructed on a small PC board or perfboard and mounted above the PC board of Fig. 1. Stacking the two PC boards in this way saves both space inside the cabinet and additional mounting bolts. Connecting the PC board of Fig. 3 to the joysticks and to the Fig. 1 PC board can again be simplified by using 14-pin IC sockets and DIP headers, if desired.

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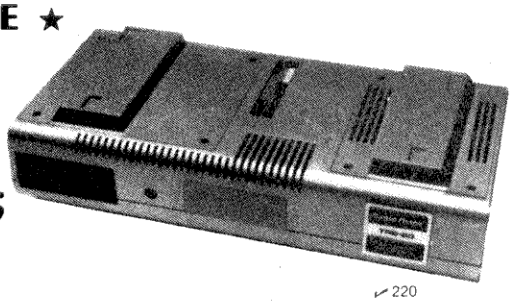

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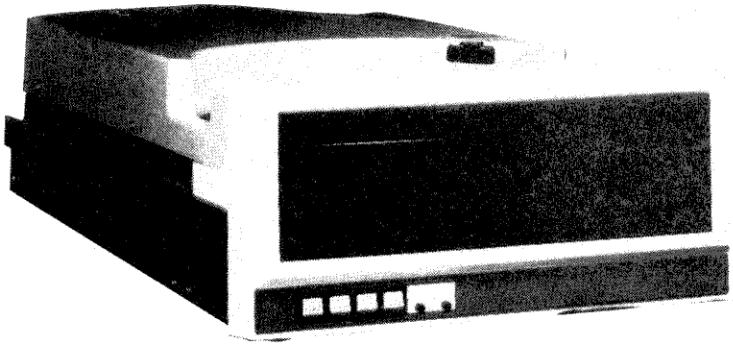

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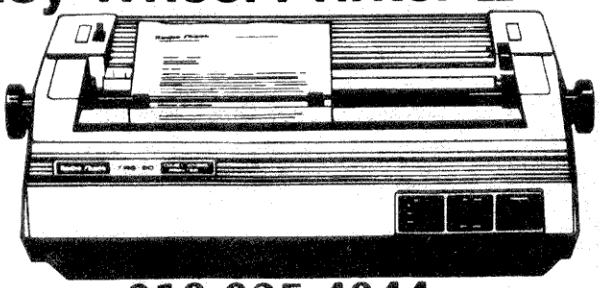

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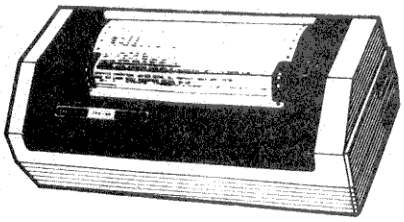

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Satellite Beach, FL 32937

This program will match you against the computer in a game similar to Othello. My major objective in writing this program was to learn how to write a playing algorithm and apply it in a game.

To play, you start with a board divided into 64 squares, eight rows by eight columns. The playing pieces are small round disks with one black side and one white side. To start, two white and two black pieces are placed in the four center squares adjacent to each other. The object is to get more pieces on the board than your opponent. In this game the computer is black and you are white. Each player tries to flip the opponent's pieces. A legal move flips at least one of the other player's pieces. To flip, place your piece so your opponents' are between two of your pieces. The move in Fig. 1 square 1 is legal since a black piece is between two white pieces. Pieces are also flipped diagonally. Square 3 will flip five pieces: four up and down and one diagonally to the right. Square 2 is an illegal move; at least one black piece is not between two white pieces. The game ends when the board is full or no player has a legal move. If a player cannot move, the opponent takes another turn.

Enter the program and run it. There will be a pause before the board is drawn. The message WHERE TO ('99' IF NO POSSIBLE MOVE) -->? will appear. You have several options: enter your move, change the board, or save or load a game from cassette. To change the board type Change. To save a game type Save. You can save the game at any point during play. To load an old game type Load. To enter a move locate the column (10–80) and row (1–8). Add the two numbers for the square. The upper right square is number 88, column 80 row 8. The lower left square is 11, column 10 row 1. Place pieces in the corners whenever possible; there they cannot be flipped. After any move the board is updated. The previous move is displayed at the bottom of the screen along with how many pieces were flipped. When the game is over the program displays how many pieces each player has flipped and the winner's name.

The Key Box

Basic Level II
Model III
at least 16K RAM

The Program

The program sets up various

	W						
2	B	B					
	B		1				
	B		W				
	B	B					
	3						

Fig. 1

80	1	49	5	17	18	6	50	2
70	51	57	41	33	34	42	58	52
60	7	43	13	25	26	14	44	8
50	19	35	27			28	36	20
40	21	37	29			30	38	22
30	9	45	15	31	32	16	46	10
20	53	59	47	39	40	48	60	54
10	3	55	11	23	24	12	56	4
	1	2	3	4	5	6	7	8

Fig. 2. Move preference for each square.

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*TM Microsoft Corp.
*TM Tandy Corp

DEALER INQUIRIES INVITED

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arrays; the B array contains the board. In the B array, one represents a black piece, two a white piece, zero an empty square, and nine a square off the playing board. The D array contains all the squares where a piece can be put. The first four values in D are 81, 88, 11 and 18. The first square the computer evaluates is 81, a corner.

The next one it checks is 88, the next corner and so on. The D array contains the squares according to where a piece should be placed. Fig. 2 shows the move preference for each square on the board.

The additional arrays are for temporary storage during play. After the arrays are loaded and the board is drawn you are prompted to enter your move.

Lines 190–300 check for legality. Each square has eight adjacent directions, any one of which could flip pieces. A For... Next routine loops eight times (once for each direction). The variable A contains your move and the C array contains eight values (−11, −10, −9, −1,1,1,9,10, 11). When your move in A is added to a value in C(x) it points to the direction to be checked for legality. If you move to square 64 and add −11, C(1) points to square 53. The variable K points to the square being checked. Square 53 is checked for a black piece. If there is none a new direction is checked (lines 280, 190 and 200). If there is a black piece K continues to check for more black pieces (lines 220 and 230). If a white piece is not found at the end (line 240) it loops again to check another direction. If a white piece is found at the end, it backs up (line 250) and flips all the pieces in the row to white (line 270). The variable N keeps track of how many pieces are flipped. After flipping all the pieces the loop is incremented and the next direction is checked. This is done for each of the eight possible directions. If, after all directions are checked, no piece was flipped the move is declared illegal (line 310).

"If... no piece was flipped the move is declared illegal."

It is now the computer's turn. First it determines all legal moves. Lines 350–380 and 470–610 do this. Line 350 puts the number of a square to be checked into the variable A. Line 360 checks if the square is occupied. If it is, the next square for evaluation is put in A. If the square is empty the subroutine starting at line 470 checks the move's legality. A legal move is put in the G array and how many pieces the move flips is put in the B2 array. Then the computer evaluates each move individually. The variable N1 is the total number of legal moves possible for the computer. Line 400 forms a loop to load A with the values stored in G(x). The variable A now contains one of the computer's legal moves. Line 470 puts that move in the B array. A subroutine restores the board to its original state (line 780) when the computer has finished evaluating a particular move. Lines 140–180 determine what damage the human can do to the computer if it makes the move it is working on. The maximum number of flips by the human is stored in the B1 array. When the maximum number of flips has been determined for each legal move the program goes to line 420.

Lines 420–430 determine the computer's best move based on

Program Listing 1

```
10 CLS:DEFINTC-S,U-Z
20 '***** OTHELLO
30 '***** BY: JOHN COMINIO
40 '***** 04-SEPT-1981
50 DIMB(102),C(8),D(64),G(40),H(40),B1(40),B2(40),B3(40)
60 DATA9,9,9,9,9,9,9,9,9,9,0,0,0,0,0,0,0,0,9,9,0,0,0,0,0,0,0,0,9,9,0,0,0,0,
0,0,0,0,9,9,0,0,0,2,1,0,0,0,0,9,9,0,0,0,1,2,0,0,0,9,9,0,0,0,0,0,0,0,0,9,9,0,0
,0,0,0,0,0,0,9,9,0,0,0,0,0,0,0,0,0,9,9,9,9,9,9,9,9,9,9,-11,-10,-9,-1,1,9,10
,11
70 DATA81,88,11,18,83,86,61,68,31,38,13,16,63,66,33,36,84,85,51,58,41,48,14
,15,64,65,53,56,43,46,34,35,74,75,52,57,42,47,24,25,73,76,62,67,32,37,23,26
,82,87,71,78,21,28,12,17,72,77,22,27
80 FORR=1TO99:READX:B(R)=X:NEXTR:FORR=1TO8:READX:C(R)=X:NEXTR:FORR=1TO60:RE
ADX:D(R)=X:NEXTR:X=0:N=99
90 GOSUB640
100 PRINT@768,"";CHR$(30);:N=0:INPUT"WHERE TO ('99' IF NO POSSIBLE MOVE) --
>";A$:PRINT@768,CHR$(30);:IFA$="CHANGE"THEN900ELSEIFA$="SAVE"THEN980ELSEIFA
$="LOAD"THEN1010ELSEA=VAL(A$)
110 IFA=99THENX1=1:IFX=1ANDX1=1THEN680ELSEGOTO350
120 IFA<11ORA>88THEN100
130 IFB(A)<>0THENPRINT@832,"SQUARE OCCUPIED":FORR=1TO750:NEXTR:PRINT@832,CH
R$(30);:GOTO100ELSER5=1:GOSUB190:R5=0:GOTO310
140 R5=0:B1=0:FORR1=1TO60:A=D(R1)
150 IFB(A)<>0THEN170
160 GOSUB190
170 NEXTR1
180 B1(Z)=B1:GOTO410
190 N=0:FORJ=1TO8
200 K=A+C(J)
210 IFB(K)<>1THEN280
220 K=K+C(J)
230 IFB(K)=1THEN220
240 IFB(K)<>2THEN280
250 K=K-C(J)
260 IFK=ATHEN280
270 N=N+1:IFR5=1THENB(K)=2:GOTO250ELSE250
280 NEXTJ
290 IFN>0THENIFN<B1THEN300ELSEB1=N
300 RETURN
310 IFN>0THEN330
320 PRINT@832,"ILLEGAL MOVE":FORR=1TO750:NEXTR:PRINT@832,CHR$(30);:GOTO100
330 IFN>1THENA$="S"ELSEA$=""
340 B(A)=2:PRINT"LEGAL MOVE.  FLIPS";N;"PIECE";A$;".":FORR=1TO1000:NEXTR:GO
SUB640
350 N1=0:G(1)=0:R4=0:FORR=1TO60:A=D(R)
360 IFB(A)<>0THEN380
370 GOSUB470
380 NEXTR
390 IFG(1)=0THEN450
400 FORZ=1TON1:R4=2:A=G(Z):B(A)=1:S1=A:GOSUB470:GOTO140
410 GOSUB780:V=0:NEXTZ
420 FORZ=1TON1:IFB1(Z)=0THENB1(Z)=.1
430 B3(Z)=B2(Z)/B1(Z):NEXTZ
440 GOSUB790:R4=1:GOSUB470:GOTO620
450 PRINT@896,CHR$(30);:PRINT"NO MOVE FOR ME":FORR=1TO750:NEXTR:X=1:IFX=1AN
DX1=1THEN680ELSEGOTO100
460 END
470 N=0:FORJ=1TO8:K=A+C(J)
480 PRINT@768,CHR$(30);:PRINT"THINKING. . .";
490 IFB(K)<>2THEN580
500 K=K+C(J)
510 IFB(K)=2THEN500
520 IFB(K)<>1THEN580
530 K=K-C(J)
540 IFK=ATHEN580
550 N=N+1:IFR4=1THENB(K)=1
560 IFR4=2THENB(K)=1:V=V+1:H(V)=K
570 GOTO530
580 NEXTJ
590 IFR4=2THEN610
600 IFN>0THENN1=N1+1:G(N1)=A:B2(N1)=N
610 RETURN
620 IFN=1THENA$=""ELSEA$="S"
630 V=0:B(A)=1:PRINT@768,"";:PRINTCHR$(30);:PRINT"MY MOVE -->";A;"FLIPS";N;
"PIECE";A$;".":PRINT:FORR=1TO1000:NEXTR:FORR=1TON1:H(R)=0:G(R)=0:B2(R)=0:B3
(R)=0:B1(R)=0:NEXTR:N1=0:GOSUB640:GOTO100
640 CLS:PRINT@0,"";:PRINTTAB(25)"O T H E L L O":PRINTTAB(24);STRING$(15,131
):PRINT@128,"";:Z=0:FORR=1TO8:FORR1=81TO88STEP1:PRINT"      ";:IFB(R1+Z)=1TH
ENA$="B"ELSEIFB(R1+Z)=2THENA$="W"ELSEA$="."
650 PRINT"  ";A$;:NEXTR1:Z=Z-10:NEXTR:FORR=6TO30:SET(9,R):SET(10,R):NEXTR:F
ORR=9TO127:SET(R,30):NEXTR:PRINT@710,"";:FORR=1TO7:PRINTR;"      ";:NEXTR:PR
INT@767,"8";:R=80:FORR1=128TO576STEP64:PRINT@R1,R;:R=R-10:NEXTR1:IFN=1THENA
$=""ELSEA$="S"
660 IFN=0THENPRINT@896,"NO MOVE FOR ME":GOTO670ELSEIFN=99THEN670ELSEPRINT@8
```

Program continues

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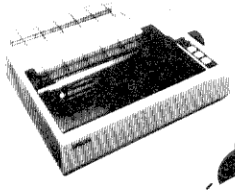

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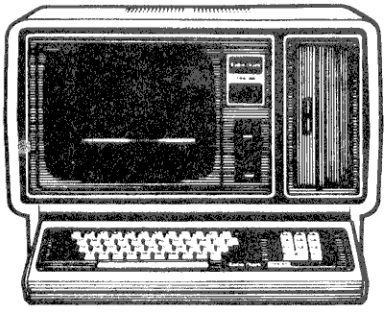

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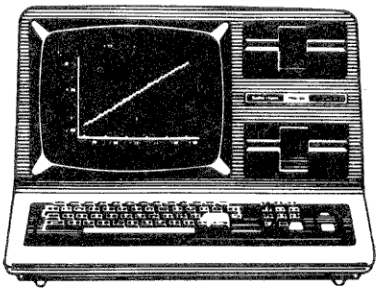

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Program continued

```
96,"LAST MOVE WAS";A;"AND FLIPPED";N;"PIECE";A$;"."
670 RETURN
680 N1=0:N=0:PRINT@768,CHR$(31);:PRINT"GAME OVER"
690 FORR=11TO88:IFB(R)=1THENN=N+1
700 NEXTR
710 PRINT"I HAVE";N;"PIECES"
720 FORR=11TO88:IFB(R)=2THENN1=N1+1
730 NEXTR
740 PRINT"YOU HAVE";N1;"PIECES"
750 IFN>N1THENPRINT"I WIN"ELSEIFN=N1THENPRINT"TIE GAME"ELSEIFN<N1THENPRINT"
YOU WIN"
760 INPUT"ANOTHER GAME (Y/N)";A$:IFLEFT$(A$,1)="Y"THENCLS:RESTORE:GOTO80ELS
EIFLEFT$(A$,1)="N"THEN770ELSE760
770 CLS:END
780 FORR=1TOV:B(H(R))=2:NEXTR:B(S1)=0:RETURN
790 N=N1:D=1
800 D=D*2:IFD<NTHEN800
810 D=INT((D-1)/2)
820 IFD=0THENA=G(1):RETURN
830 IT=N-D
840 FORI=1TOIT
850 J=I
860 L=J+D
870 IFB3(L)>B3(J)THENT=B3(J):T1=G(J):B3(J)=B3(L):G(J)=G(L):B3(L)=T:G(L)=T1:
J=J-D:IFJ>0THEN860
880 NEXTI
890 GOTO810
900 PRINT@832,CHR$(31);:INPUT"ENTER SQUARE NUMBER";S
910 IFS<11ORS>89THENPRINT@832,"ILLEGAL BOARD CO-ORDINATE"ELSEIFB(S)=9THENS=
0:GOTO910ELSE930
920 FORR=1TO1000:NEXTR:GOTO900
930 PRINT@832,CHR$(31);:INPUT"COLOR (B/W)";C$:C$=LEFT$(C$,1)
940 IFC$="B"THENB(S)=1ELSEIFC$="W"THENB(S)=2ELSE930
950 GOSUB640
960 PRINT@832,CHR$(31);:INPUT"MORE CHANGES (Y/N)";C$:C$=LEFT$(C$,1):IFC$="Y
"THEN900ELSEIFC$="N"THEN970ELSE960
970 PRINT@832,CHR$(30);:INPUT"WHOSE MOVE (B/W)";C$:C$=LEFT$(C$,1):IFC$="B"T
HENPRINT@768,CHR$(31):GOTO350ELSEIFC$="W"THENPRINT@768,CHR$(30):GOTO100ELSE
970
980 PRINT@768,CHR$(30);:INPUT"TAPE READY (Y/N)";A$:A$=LEFT$(A$,1):IFA$="N"T
HEN100ELSEIFA$="Y"THEN990ELSE980
990 FORZ=1TO99STEP17:PRINT#-1,B(Z);",";B(Z+1);",";B(Z+2);",";B(Z+3);",";B(Z
+4);",";B(Z+5);",";B(Z+6);",";B(Z+7);",";B(Z+8);",";B(Z+9);",";B(Z+10);",";
B(Z+11);",";B(Z+12);",";B(Z+13);",";B(Z+14);",";B(Z+15);",";B(Z+16)
1000 NEXTZ:N=99:GOSUB640:GOTO100
1010 PRINT@768,CHR$(30);:INPUT"TAPE READY TO LOAD (Y/N)";A$:A$=LEFT$(A$,1):
IFA$="N"THEN100ELSEIFA$="Y"THEN1020ELSE1010
1020 FORZ=1TO99STEP17:INPUT#-1,B(Z),B(Z+1),B(Z+2),B(Z+3),B(Z+4),B(Z+5),B(Z+
6),B(Z+7),B(Z+8),B(Z+9),B(Z+10),B(Z+11),B(Z+12),B(Z+13),B(Z+14),B(Z+15),B(Z
+16)
1030 NEXTZ:N=99:GOSUB640:GOTO100
```

its acquired information. For every move the computer can make it knows two things: How many pieces the computer will flip on each move and the maximum number the human can counter with. It forms a ratio for each of its possible moves and stores these answers in the B3 array. Line 440 is a sorting routine arranging the values in B3 from largest to smallest. Each time something in the B3 array is swapped the corresponding move in the G array is also swapped. One number can point to the best ratio in the B3 array and to the corresponding move in the G array. The computer then makes its move. If the ratio is .66667 the computer flips two pieces and the human three (a 2/3 ratio). However, if the ratio is 1.66667 the computer flips five pieces and the human three (a 5/3 ratio). A higher ratio means a better move for the computer. A ratio of one means the computer and human flip the same number of pieces. ■

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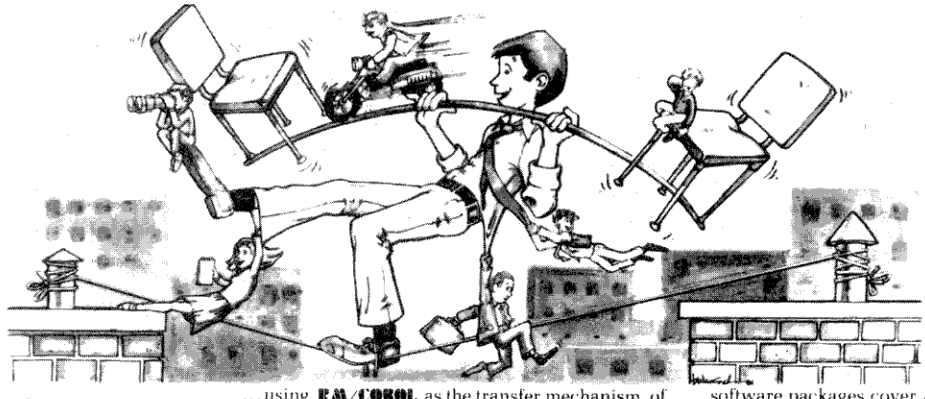

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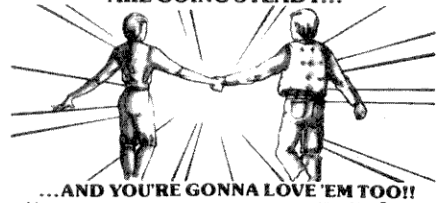

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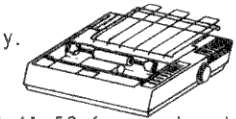

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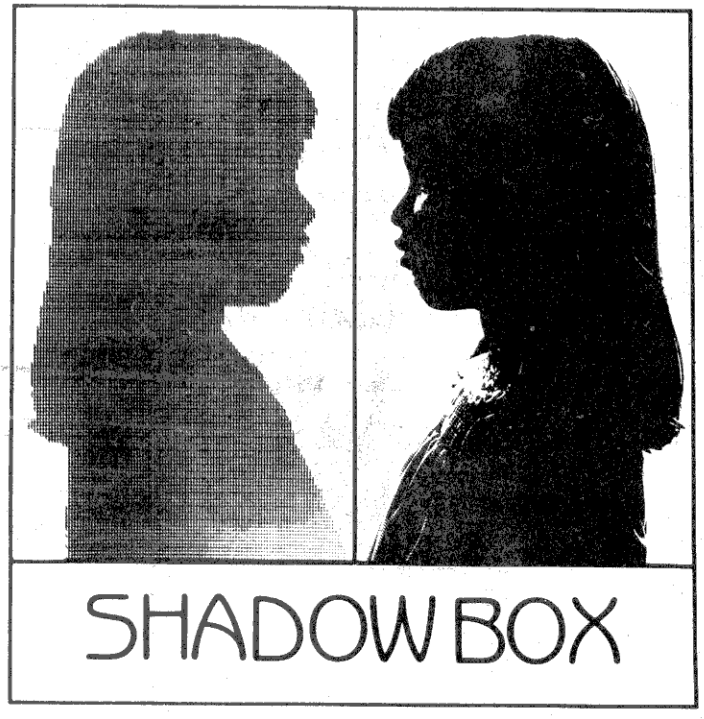

The silhouette copy of the photograph was generated by a Lineprinter III. The original is 12 by 20 inches.

Richard Ramella
1493 Mountain View Avenue
Chico, CA 95926

A visit to the county fair provided the springboard for this program, which has delighted my children and given me a practical way to replicate and store odd two-dimensional shapes—silhouettes.

In turn-of-the-century America it was not unusual to find a silhouette cutter on a city street corner. For a few pennies the artist would scissor away at black paper and create a silhouette. Such artists are rare these days.

But my eight-year-old daughter did spot the silhouette's counterpart at the fair: a T-shirt with a computer portrait of its owner on its front. I promised my daughter we would try a computer portrait on the TRS-80.

I failed in the attempt. For a portrait I needed video scan to read and enter data. So I decided instead to do a silhouette, which only called for 300 Data numbers for a 15 by 20 inch picture. A shaded portrait would have required nearly 20,000 separate entries.

The resulting program not only produced silhouettes but gave me a way to replicate other odd flat shapes. I have since used the program in three practical ways: To help a friend establish a plan for her hourglass-shaped property; to fit a single piece of vinyl flooring across a large kitchen and into several nooks and crannies; and to reduce the templates for a wood project I wanted to do in a size smaller than given in the plans.

But making silhouettes with the program has most charmed me; to explain that process is to open the door to other, more practical uses.

Do not let the brevity of the main program lull you into thinking a silhouette project will be a snap. Not shown are the data lines which contain up to 300 numbers. Each number is a value which must be plotted.

A lineprinter accommodating 15-inch paper is best. The process requires care and patience for optimum results.

To start, load wide paper into the lineprinter and run the following program:

```
100 CLS
110 FOR X = 1 to 150
120 LPRINT STRING$(125,".");
130 NEXT X
```

Make these lines print as tightly as possible. I have a Lineprinter III, which normally produces six lines to the inch but will squeeze in eight on command.

This little program prints 18,750 dots: 150 lines of 125 dots each. Because I am miserly about the ultimate capacity of my printhead, I have only run this program once. I copy segments of the master on a duplicating machine and paste it all together.

Now you have a big piece of paper with dots on it. Next, seat your subject very close to a wall. Turn on a light source (a lamp, a slide or movie projector) that will yield a sharp shadow. Position the dotted paper so the shadow

The Key Box

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Lineprinter required

falls where you want it. Quickly, carefully trace the outline of the shadow. I cheat here. I photograph the subject in silhouette, mount the film as a slide and project it onto the paper for tracing. It ensures stillness by the subject.

Then go back to the TRS-80. First, run this simple program:

```
100 CLS
120 For X = 1 to 150
130 LPRINT X;"--- ---"
```

This gives you a handy listing for entering the Data numbers.

My Lineprinter III prints 10 characters to an inch. Using a ruler, I start at line one at the top, and on the listing paper I enter two numbers for each line. The first is the number of the first dot which falls within the silhouette I have drawn. The second number is the last dot on the same line falling within the sketch.

The beginning of the list might look like this:

```
1 12 101

2 12 102

3 10 102
```

When the list is finished, put those same numbers into data lines in this order:

```
DATA 12,101,12,102,10,102...
```

In the main program, (See Program Listing) the data lines go anywhere between lines 120–1000.

When you have added all the data to the program, run it. You will get a fairly detailed replica of the shape stored by the program.

I can make the silhouette darker and better defined by making two runs, the second starting midway between the first and second lines of the initial printing. Just mark the paper before the first run, print, back up the paper, reposition and run again. ■

Richard Ramella is a former newspaperman.

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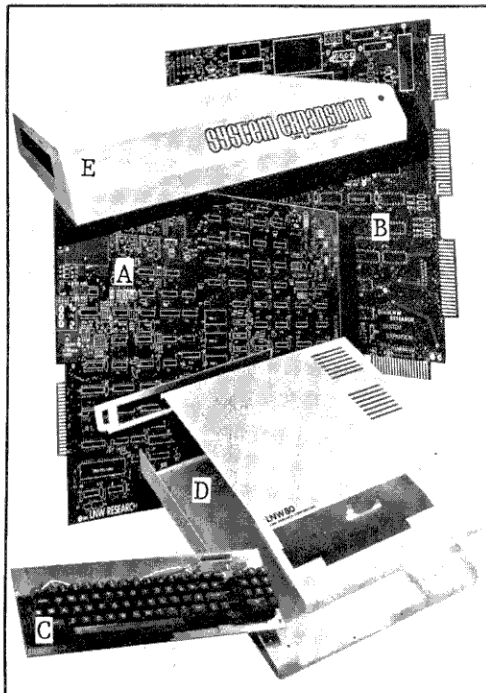

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Sit at this table and have a byte.

Z80 Bit Tables

		000	001	010	011	100	101	110	111 f2
f1 = 00									
	000	NOP	EX AF,AF'	DJNZ e	JR e	JR NZ,e	JR Z,e	JR NC,e	JR C,e
	001	LD BC,nn	ADD HL,BC	LD DE,nn	ADD HL,DE	LD HL,nn	ADD HL,HL	LD SP,nn	ADD HL,SP
	010	LD (BC),A	LD A,(BC)	LD (DE),A	LD A,(DE)	LD (nn),HL	LD HL,(nn)	LD (nn),A	LD A,(nn)
f	011	INC BC	DEC BC	INC DE	DEC DE	INC HL	DEC HL	INC SP	DEC SP
3	100	INC B	INC C	INC D	INC E	INC H	INC L	INC (HL)	INC A
	101	DEC B	DEC C	DEC D	DEC E	DEC H	DEC L	DEC (HL)	DEC A
	110	LD B,n	LD C,n	LD D,n	LD E,n	LD H,n	LD L,n	LD (HL),n	LD A,n
	111	RLCA	RRCA	RLA	RRA	DAA	CPL	SCF	CCF
f1 = 01									
	000	LD B,B	LD C,B	LD D,B	LD E,B	LD H,B	LD L,B	LD (HL),B	LD A,B
	001	LD B,C	LD C,C	LD D,C	LD E,C	LD H,C	LD L,C	LD (HL),C	LD A,C
	010	LD B,D	LD C,D	LD D,D	LD E,D	LD H,D	LD L,D	LD (HL),D	LD A,D
f	011	LD B,E	LD C,E	LD D,E	LD E,E	LD H,E	LD L,E	LD (HL),E	LD A,E
3	100	LD B,H	LD C,H	LD D,H	LD E,H	LD H,H	LD L,H	LD (HL),H	LD A,H
	101	LD B,L	LD C,L	LD D,L	LD E,L	LD H,L	LD L,L	LD (HL),L	LD A,L
	110	LD B,(HL)	LD C,(HL)	LD D,(HL)	LD E,(HL)	LD H,(HL)	LD L,(HL)	HALT	LD A,(HL)
	111	LD B,A	LD C,A	LD D,A	LD E,A	LD H,A	LD L,A	LD (HL),A	LD A,A
f1 = 10									
	000	ADD A,B	ADC A,B	SUB B	SBC A,B	AND B	XOR B	OR B	CP B
	001	ADD A,C	ADC A,C	SUB C	SBC A,C	AND C	XOR C	OR C	CP C
	010	ADD A,D	ADC A,D	SUB D	SBC A,D	AND D	XOR D	OR D	CP D
f	011	ADD A,E	ADC A,E	SUB E	SBC A,E	AND E	XOR E	OR E	CP E
3	100	ADD A,H	ADC A,H	SUB H	SBC A,H	AND H	XOR H	OR H	CP H
	101	ADD A,L	ADC A,L	SUB L	SBC A,L	AND L	XOR L	OR L	CP L
	110	ADD A,(HL)	ADC A,(HL)	SUB (HL)	SBC A,(HL)	AND (HL)	XOR (HL)	OR (HL)	CP (HL)
	111	ADD A,A	ADC A,A	SUB A	SBC A,A	AND A	XOR A	OR A	CP A
f1 = 11									
	000	RET NZ	RET Z	RET NC	RET C	RET PO	RET PE	RET P	RET M
	001	POP BC	RET	POP DE	EXX	POP HL	JP (HL)	POP AF	LD SP,HL
	010	JP NZ,nn	JP Z,nn	JP NC,nn	JP C,nn	JP PO,nn	JP PE,nn	JP P,nn	JP M,nn
f	011	JP nn	CB - Table 2	OUT (n),A	IN A,(n)	EX (SP),HL	EX DE,HL	DI	EI
3	100	CALL NZ,nn	CALL Z,nn	CALL NC,nn	CALL C,nn	CALL PO,nn	CALL PE,nn	CALL P,nn	CALL M,nn
	101	PUSH BC	CALL nn	PUSH DE	DD - Table 3	PUSH HL	ED - Table 4	PUSH AF	FD - Table 5
	110	ADD A,n	ADC A,n	SUB n	SBC A,n	AND n	XOR n	OR n	CP n
	111	RST 00H	RST 08H	RST 10H	RST 18H	RST 20H	RST 28H	RST 30H	RST 38H

f1 f2 f3

Table 1. First-byte Table.

THE VIEW: You can see the curve of the Earth, four orbiting satellites with spinning radar antennae, much of North America, and six major population centers spread out beneath you.

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When I first encountered the Z80 instruction set, it seemed to be a real hodgepodge of information. I realized from my Editor/Assembler manual that a system lies behind the assignment of binary operation codes to instruction. The material, however, was just too spread out for me to decipher.

The instruction listings aren't much help. In one list, the instructions appear in the numerical order of their op codes, and in the other in the alphabetical order of their assembler mnemonics. Again, some structure is apparent, but not much.

Through the Mostek Z80 reference manual, another presentation of the instruction set, more of the patterns began to emerge. Finally, "Secret Codes Revealed" by Edwin E. Freed (*Kilobaud Microcomputing*, April 1981), showed me how to display the Z80 instructions to reveal the most about selection of their op codes.

Here's How. . .

With *only* 62 exceptions, a Z80 instruction consists of a 1-byte or 2-byte op code, possibly followed by a 1-byte or 2-byte

	000	001	010	011	100	101	110	111
f1 = 00								
000	RLC B	RRC B	RL B	RR B	SLA B	SRA B	RLO B	SRL B
001	RLC C	RRC C	RL C	RR C	SLA C	SRA C	RLO C	SRL C
010	RLC D	RRC D	RL D	RR D	SLA D	SRA D	RLO D	SRL D
f 011	RLC E	RRC E	RL E	RR E	SLA E	SRA E	RLO E	SRL E
3 100	RLC H	RRC H	RL H	RR H	SLA H	SRA H	RLO H	SRL H
101	RLC L	RRC L	RL L	RR L	SLA L	SRA L	RLO L	SRL L
110	RLC (HL)	RRC (HL)	RL (HL)	RR (HL)	BLA (HL)	SRA (HL)	RLO (HL)	SRL (HL)
111	RLC A	RRC A	RL A	RR A	SLA A	SRA A	RLO A	SRL A
f1 = 01								
000	BIT 0,B	BIT 1,B	BIT 2,B	BIT 3,B	BIT 4,B	BIT 5,B	BIT 6,B	BIT 7,B
001	BIT 0,C	BIT 1,C	BIT 2,C	BIT 3,C	BIT 4,C	BIT 5,C	BIT 6,C	BIT 7,C
010	BIT 0,D	BIT 1,D	BIT 2,D	BIT 3,D	BIT 4,D	BIT 5,D	BIT 6,D	BIT 7,D
f 011	BIT 0,E	BIT 1,E	BIT 2,E	BIT 3,E	BIT 4,E	BIT 5,E	BIT 6,E	BIT 7,E
3 100	BIT 0,H	BIT 1,H	BIT 2,H	BIT 3,H	BIT 4,H	BIT 5,H	BIT 6,H	BIT 7,H
101	BIT 0,L	BIT 1,L	BIT 2,L	BIT 3,L	BIT 4,L	BIT 5,L	BIT 6,L	BIT 7,L
110	BIT 0,(HL)	BIT 1,(HL)	BIT 2,(HL)	BIT 3,(HL)	BIT 4,(HL)	BIT 5,(HL)	BIT 6,(HL)	BIT 7,(HL)
111	BIT 0,A	BIT 1,A	BIT 2,A	BIT 3,A	BIT 4,A	BIT 5,A	BIT 6,A	BIT 7,A
f1 = 10								
000	RES 0,B	RES 1,B	RES 2,B	RES 3,B	RES 4,B	RES 5,B	RES 6,B	RES 7,B
001	RES 0,C	RES 1,C	RES 2,C	RES 3,C	RES 4,C	RES 5,C	RES 6,C	RES 7,C
010	RES 0,D	RES 1,D	RES 2,D	RES 3,D	RES 4,D	RES 5,D	RES 6,D	RES 7,D
f 011	RES 0,E	RES 1,E	RES 2,E	RES 3,E	RES 4,E	RES 5,E	RES 6,E	RES 7,E
3 100	RES 0,H	RES 1,H	RES 2,H	RES 3,H	RES 4,H	RES 5,H	RES 6,H	RES 7,H
101	RES 0,L	RES 1,L	RES 2,L	RES 3,L	RES 4,L	RES 5,L	RES 6,L	RES 7,L
110	RES 0,(HL)	RES 1,(HL)	RES 2,(HL)	RES 3,(HL)	RES 4,(HL)	RES 5,(HL)	RES 6,(HL)	RES 7,(HL)
111	RES 0,A	RES 1,A	RES 2,A	RES 3,A	RES 4,A	RES 5,A	RES 6,A	RES 7,A
f1 = 11								
000	SET 0,B	SET 1,B	SET 2,B	SET 3,B	SET 4,B	SET 5,B	SET 6,B	SET 7,B
001	SET 0,C	SET 1,C	SET 2,C	SET 3,C	SET 4,C	SET 5,C	SET 6,C	SET 7,C
010	SET 0,D	SET 1,D	SET 2,D	SET 3,D	SET 4,D	SET 5,D	SET 6,D	SET 7,D
f 111	SET 0,E	SET 1,E	SET 2,E	SET 3,E	SET 4,E	SET 5,E	SET 6,E	SET 7,E
3 100	SET 0,H	SET 1,H	SET 2,H	SET 3,H	SET 4,H	SET 5,H	SET 6,H	SET 7,H
101	SET 0,L	SET 1,L	SET 2,L	SET 3,L	SET 4,L	SET 5,L	SET 6,L	SET 7,L
110	SET 0,(HL)	SET 1,(HL)	SET 2,(HL)	SET 3,(HL)	SET 4,(HL)	SET 5,(HL)	SET 6,(HL)	SET 7,(HL)
111	SET 0,A	SET 1,A	SET 2,A	SET 3,A	SET 4,A	SET 5,A	SET 6,A	SET 7,A

Table 2. Second-byte Table (first byte CB).

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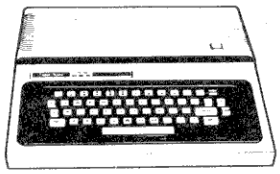

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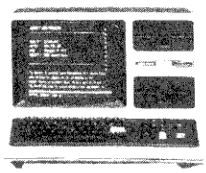

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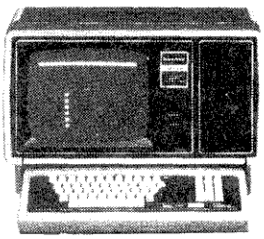

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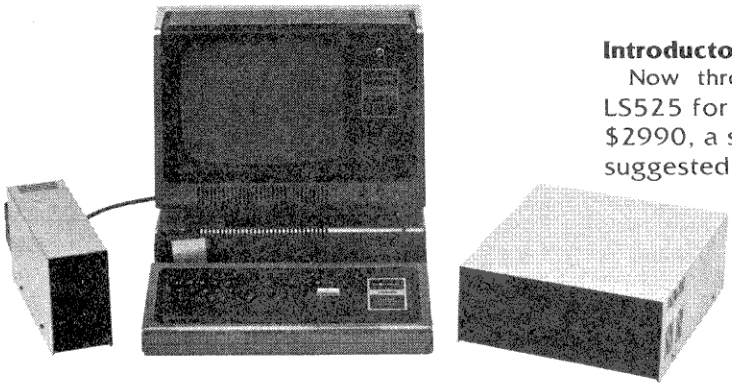

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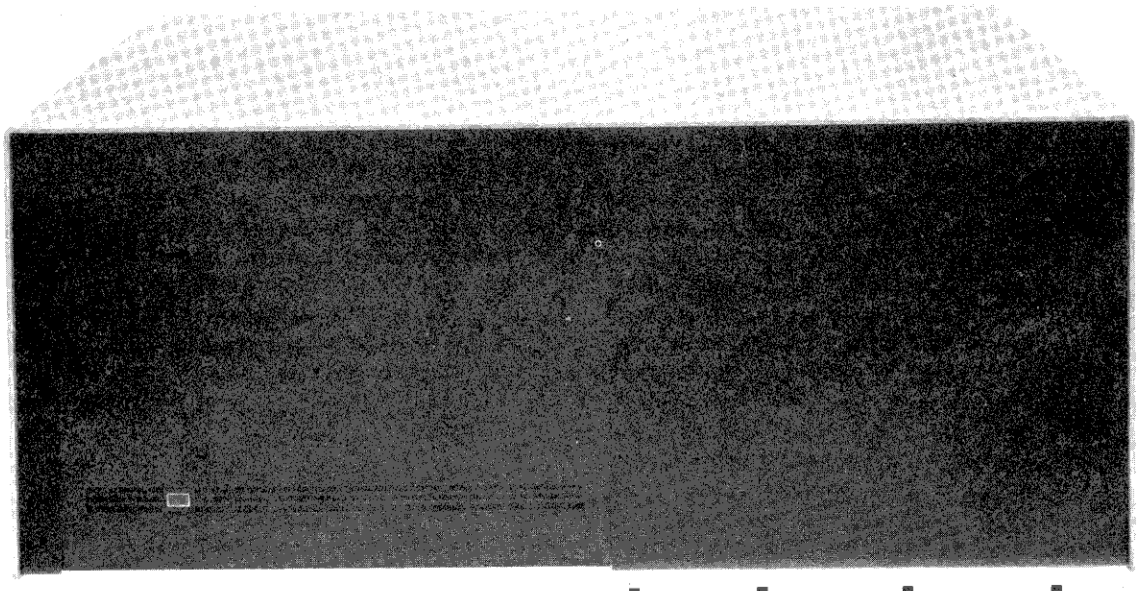

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operand. The bits in each byte of the op codes fall naturally into three fields: the most significant two bits, the next most significant three bits, and the least significant three bits. (I refer to these fields as f1, f2 and f3, respectively. They correspond to the three digits in the octal representation of the byte.)

The instructions should be displayed as follows: For each possible value of one of the three fields, construct a table of instruction mnemonics whose rows are indexed by the possi-

	000	001	010	011	100	101	110	111
f1 = 00								
000								
001		ADD IX,BC		ADD IX,DE	LD IX,nn	ADD IX,IX		ADD IX,SP
010					LD (nn),IX	LD IX,(nn)		
f 011					INC IX	DEC IX		
3 100					INC HX	INC LX	INC (IX+d)	
101					DEC HX	DEC LX	DEC (IX+d)	
110					LD HX,n	LD LX,n	LD (IX+d),n	
111								
f1 = 01								
000					LD HX,B	LD LX,B	LD (IX+d),B	
001					LD HX,C	LD LX,C	LD (IX+d),C	
010					LD HX,D	LD LX,D	LD (IX+d),D	
f 011					LD HX,E	LD LX,E	LD (IX+d),E	
3 100	LD B,HX	LD C,HX	LD D,HX	LD E,HX	LD HX,HX	LD LX,HX	LD (IX+d),H	LD A,HX
101	LD B,LX	LD C,LX	LD D,LX	LD E,LX	LD HX,LX	LD LX,LX	LD (IX+d),L	LD A,LX
110	LD B,(IX+d)	LD C,(IX+d)	LD D,(IX+d)	LD E,(IX+d)	LD H,(IX+d)	LD L,(IX+d)		LD A,(IX+d)
111					LD HX,A	LD LX,A	LD (IX+d),A	
f1 = 10								
000								
001								
010								
f 011								
3 100	ADD A,HX	ADC A,HX	SUB HX	SBC A,HX	AND HX	XOR HX	OR HX	CP HX
101	ADD A,LX	ADC A,LX	SUB LX	SBC A,LX	AND LX	XOR LX	OR LX	CP LX
110	ADD A,(IX+d)	ADC A,(IX+d)	SUB (IX+d)	SBC A,(IX+d)	AND (IX+d)	XOR (IX+d)	OR (IX+d)	CP (IX+d)
111								
f1 = 11								
000								
001					POP IX	JP (IX)		LD SP,IX
010								
f 011		CB - Table 6			EX (SP),IX			
3 100								
101					PUSH IX			
110								
111								

Table 3. Second-byte Table (first byte DD).

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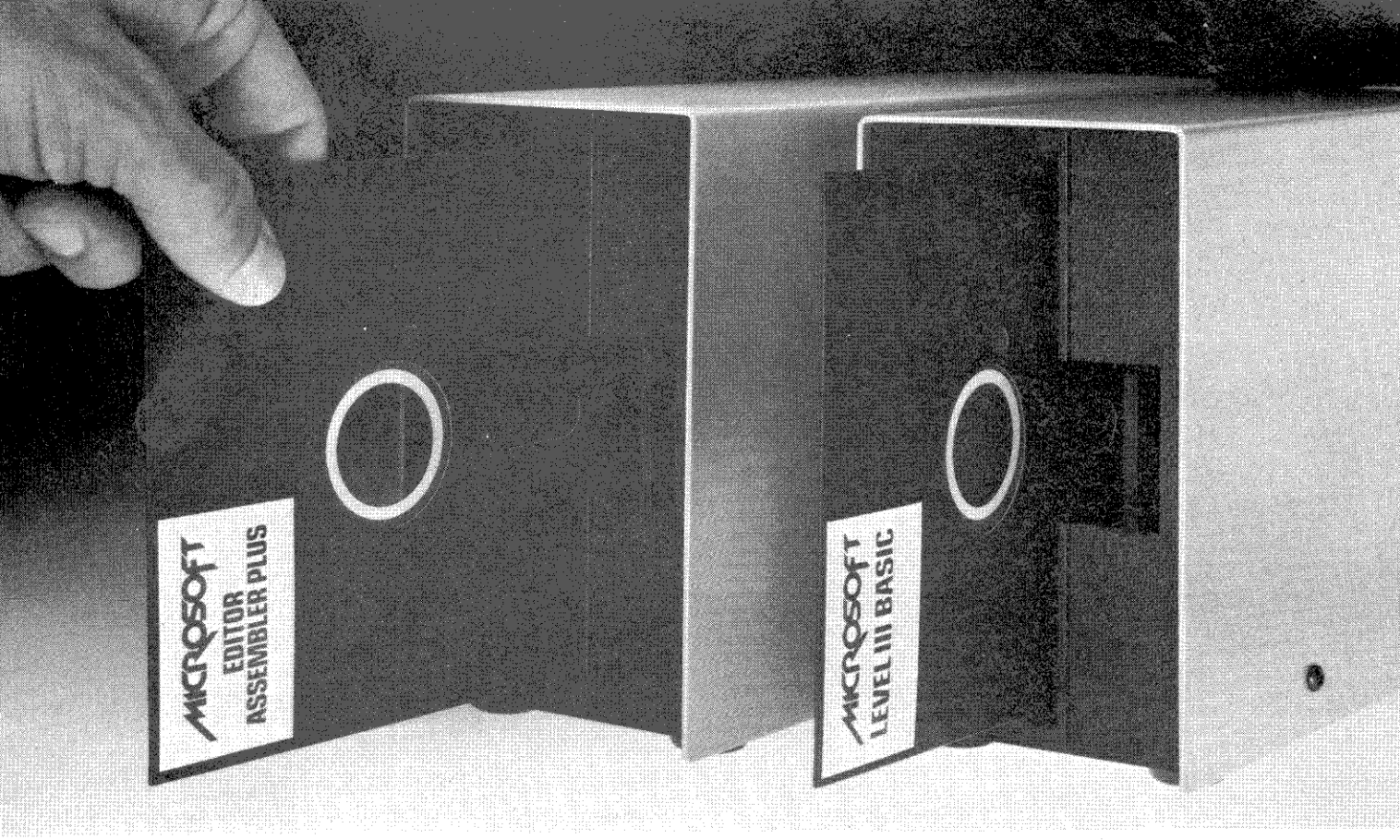

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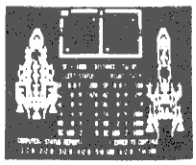

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ble values of one of the other fields, and whose columns are indexed by the possible values of the remaining field. Since the first field has four possible values (00, 01, 10 or 11), and the other two have eight possible values each (000, . . . , 111), there will be four 8 by 8 tables, eight 4 by 8 tables, or eight 8 by 4 tables of mnemonics. The first of these reveals the most structure.

The table of first bytes contains four parts, one for each possible value of f1. In each part the columns are indexed by the possible values of f2, and the rows are indexed by the possi-

	000	001	010	011	100	101	110	111
f1 = 01								
000	IN B,(C)	IN C,(C)	IN D,(C)	IN E,(C)	IN H,(C)	IN L,(C)	IN (HL),(C)	IN A,(C)
001	OUT B,(C)	OUT C,(C)	OUT D,(C)	OUT E,(C)	OUT H,(C)	OUT L,(C)	OUT (HL),(C)	OUT A,(C)
010	SBC HL,BC	ADC HL,BC	SBC HL,DE	ADC HL,DE	SBC HL,HL	ADC HL,HL	SBC HL,SP	ADC HL,SP
f 011	LD (nn),BC	LD BC,(nn)	LD (nn),DE	LD DE,(nn)	LD (nn),HL	LD HL,(nn)	LD (nn),SP	LD SP,(nn)
3 100	NEG							
101	RETN	RETI						
110	IM 0		IM 1	IM 2				
111	LD I,A	LD R,A	LD A,I	LD A,R	RRD	RLD		
f1 = 10								
000					LDI	LDD	LDIR	LDDR
001					CPI	CPD	CPIR	CPDR
010					INI	IND	INIR	INDR
f 011					OUTI	OUTD	OTIR	OTDR
3 100								
101								
110								
111								

Table 4. Second-byte Table (first byte ED).

	000	001	010	011	100	101	110	111
f1 = 00								
000								
001		ADD IY,BC		ADD IY,DE	LD IY,nn	ADD IY,IY		ADD IY,SP
010					LD (nn),IY	LD IY,(nn)		
f 011					INC IY	DEC IY		
3 100					INC HY	INC LY	INC (IY+d)	
101					DEC HY	DEC LY	DEC (IY+d)	
110					LD HY,n	LD LY,n	LD (IY+d),n	
110								
f1 = 01								
000					LD HY,B	LD LY,B	LD (IY+d),B	
001					LD HY,C	LD LY,C	LD (IY+d),C	
010					LD HY,D	LD LY,D	LD (IY+d),D	
f 011					LD HY,E	LD LY,E	LD (IY+d),E	
3 100	LD B,HY	LD C,HY	LD D,HY	LD E,HY	LD HY,HY	LD LY,HY	LD (IY+d),H	LD A,HY
101	LD B,LY	LD C,LY	LD D,LY	LD E,LY	LD HY,LY	LD LY,LY	LD (IY+d),L	LD A,LY
110	LD B,(IY+d)	LD C,(IY+d)	LD D,(IY+d)	LD E,(IY+d)	LD H,(IY+d)	LD L,(IY+d)		LD A,(IY+d)
111					LD HY,A	LD LY,A	LD (IY+d),A	
f1 = 10								
000								
001								
010								
f 011								
3 100	ADD A,HY	ADC A,HY	SUB HY	SBC A,HY	AND HY	XOR HY	OR HY	CP HY
101	ADD A,LY	ADC A,LY	SUB LY	SBC A,LY	AND LY	XOR LY	OR LY	CP LY
110	ADD A,(IY+d)	ADC A,(IY+d)	SUB (IY+d)	SBC A,(IY+d)	AND (IY+d)	XOR (IY+d)	OR (IY+d)	CP (IY+d)
111								
f1 = 11								
000								
001					POP IY	JP (IY)		LD SP,IY
010								
f 011		CB - Table 7			EX (SP),IY			
3 100								
101					PUSH IY			
110								
111								

Table 5. Second-byte Table (first byte FD).

ble values of f3. The instruction is completely determined by this table (except for any immediate operands) unless the first byte is CB, DD, ED or FD. Therefore, separate tables are needed for the second bytes of these instructions (Tables 2, 3, 4 and 5). These tables are constructed in the same way as Table 1. The 62 oddball instructions are displayed in a slightly different manner in Tables 6 and 7 to avoid a large, mostly blank, table.

Following Freed's notation, I underlined those op codes not documented by the Z80 manufacturer. Contrary to the implication in his article, some instructions using H and L cannot be prefixed by DD or FD to produce corresponding instructions using the high and low halves of IX and IY, at least not with my Z80. In fact, I have found that any instruction using H or L whose first byte is CB cannot be so modified. Thus, I have not included those instructions in my tables. Nor have I included the undocumented instructions reported by Freed which are duplicates of documented ones.

I have found these tables indispensable in writing a disassembler, an object code relocator, and a single-stepper. I hope they will be as useful to you. ■

Herb Robinson is a former university assistant professor of mathematics turned full-time micro fanatic.

		000	001	010	011	100	101	110	111
	00	RLC (IX+d)	RRC (IY+d)	RL (IX+d)	RR (IX+d)	SLA (IX+d)	SRA (IX+d)		SRL (IX+d)
f	01	BIT 0,(IX+d)	BIT 1,(IX+d)	BIT 2,(IX+d)	BIT 3,(IX+d)	BIT 4,(IX+d)	BIT 5,(IX+d)	BIT 6,(IX+d)	BIT 7,(IX+d)
1	10	RES 0,(IX+d)	RES 1,(IX+d)	RES 2,(IX+d)	RES 3,(IX+d)	RES 4,(IX+d)	RES 5,(IX+d)	RES 6,(IX+d)	RES 7,(IX+d)
	11	SET 0,(IX+d)	SET 1,(IX+d)	SET 2,(IX+d)	SET 3,(IX+d)	SET 4,(IX+d)	SET 5,(IX+d)	SET 6,(IX+d)	SET 7,(IX+d)

Table 6. Fourth-byte Table (first two bytes DDCB, third byte d).

		000	001	010	011	100	101	110	111
	00	RLD (IY+d)	RRC (IY+d)	RL (IY+d)	RR (IY+d)	SLA (IY+d)	SRA (IY+d)		SRL (IY+d)
f	01	BIT 0,(IY+d)	BIT 1,(IY+d)	BIT 2,(IY+d)	BIT 3,(IY+d)	BIT 4,(IY+d)	BIT 5,(IY+d)	BIT 6,(IY+d)	BIT 7,(IY+d)
1	10	RES 0,(IY+d)	RES 1,(IY+d)	RES 2,(IY+d)	RES 3,(IY+d)	RES 4,(IY+d)	RES 5,(IY+d)	RES 6,(IY+d)	RES 7,(IY+d)
	11	SET 0,(IY+d)	SET 1,(IY+d)	SET 2,(IY+d)	SET 3,(IY+d)	SET 4,(IY+d)	SET 5,(IY+d)	SET 6,(IY+d)	SET 7,(IY+d)

Table 7. Fourth-byte Table (first two bytes FDCB, third byte d).

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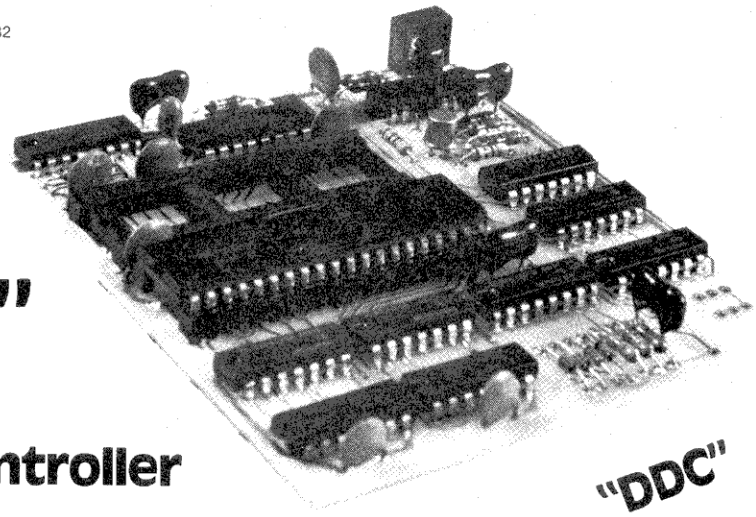

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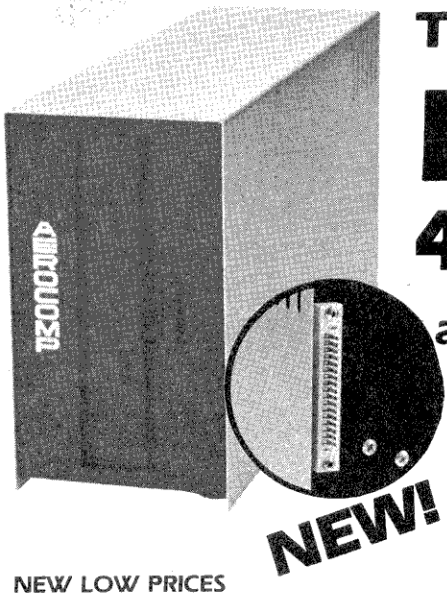

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The Line Printer IV may not be a graphics printer, but it is a versatile instrument. With a little software and patience you can produce elegant charts and graphs on a LP IV to incorporate into your printed reports. Or, just for fun, you can save your pretty screen pictures.

When dealing with graphics think of the screen as consisting of 6144 pixels (48 lines of 128 pixels) which you can Set or Reset either individually or in combination by printing graphics characters. Normally when you LLIST programs or LPRINT text, your LP IV is in its 10 cpi (characters per inch) or proportional spacing mode. Allowing for margins, this produces printed lines of either about 64 or 95 characters. In normal use the LP IV uses six line feeds per inch. In the 10 cpi mode the LP IV can give you a snapshot of the 1024 print positions on your screen, as a block of printed text 6.4 inches wide and 16 lines (about 2.7 inches) deep.

The Line Printer IV also has a 16.7 cpi character set. I will call this print mode the Tiny mode. In the Tiny mode, the LP IV generates a maximum of 132 print positions across a standard 8½ by 11 inch page. Since one line of screen graphics is only 128 pixels long, you have enough room in Tiny mode to reproduce such a line pixel for pixel across the page, with four characters for two-position margins on both ends.

In addition, you can control the LP IV's line feeds. You can advance or roll back the paper in half-line-feed increments (12 per inch). There are 48 lines of pixels on the screen; if you print in the half-line-feed steps In Tiny mode, you can produce a snapshot of the screen in the form of a tightly printed text block 7.7 inches wide by 4 inches deep. This is compressed vertically in comparison with the 8 inch by 6 inch screen display (a depth-to-width ratio of 0.52 versus 0.75), but the resultant distortion is irrelevant for most graphs and charts, and, as we shall see, is untroublesome for pictorial graphics as well.

Program Listing 1, GRAPHIX/SUB, is a Basic subroutine which you can incorporate into your program and then call (by a GOSUB 50000 or an If...Then GOSUB 50000) to produce such a printed snapshot of the screen display. Printing the entire screen takes time (the LP IV prints 50 characters per second at best). Partial screen printing allows you to omit any message lines (such as "Press Enter to continue"). You do not want to output such lines to the printer, when producing a graph or chart.

How the Program Works

GRAPHIX/SUB has two main parts. After a bit of housekeeping, lines 50110-50160 allow you to define the region of the graphics screen you wish sent to the printer. Lines 50180-50290 scan the selected region of the screen and put the LP IV through its paces.

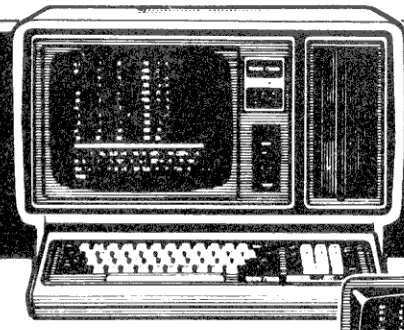
The balance of the listing consists of three internal subroutines. "Move Cursor" and "Enter Corner" are called during the first part of the program; "Load Letters" is called during the second part, to ensure that non-graphic characters (labels, numbers, and the like) are also included in the final printed snapshot.

During "Define Region," line zero of the screen is a message line that helps you keep track of where you are in the procedure. Two points specifying diagonally opposite corners define a rectangular region of the screen. GRAHIX/SUB uses the upper left corner and the lower right corner of the desired region. Consequently, the program successively displays two messages: "Place cursor on upper left corner and press Enter" and "Place cursor on lower right corner and press Enter." Lines 50060 and 50070 set up the strings for these messages. Line 50080 saves the original contents of line zero on the screen in a string Z0$ and prints the first message. The Print instruction in Line 50180 restores the screen to its original condition before output to the LP IV begins.

As a final bit of housekeeping, line 50090 uses two POKEs to set up a non-blinking cursor (you will control its flashing) which fills a full print cell (graphics character 191, all six pixels lighted). The program then positions the cursor at the center of the screen. Two counters, ZR for rows (0-15) and ZC for columns (0-63), keep track of the cursor's position. ZU computes the actual print position (0-1023) for the PRINT@ instructions within the program.

Line 50110 is the first half of a Basic simulation of the Repeat ...Until instruction characteristic of "structured" (or "GOTO-less") programming. (See "Bascal" by Richard C. Metzler in *80 Microcomputing*, September 1981 for a fuller discussion.) It is paired with the NEXTZ1 instruction on line 50160. Notice that the For...Next counter Z1 is set to minus (ZX = 2) just before the NEXTZ1. Since Basic uses minus 1 for its logical true, if ZX is equal to 2, Z1 will be set to minus(minus 1), that is, to plus 1. The NEXTZ1 instruction then increments Z1 to two which, since it is larger than the range set at 50110 in the instruction FOR Z1 = 1TO1 causes an exit from the For...Next loop. If ZX is not equal to two, Z1 will be set to zero (Basics logical false). The NEXTZ1 increments it to one, and you loop back to 50110 since the counter is still in the narrow range originally set by the For instruction.

The net effect is that the instructions 50110-50160 are



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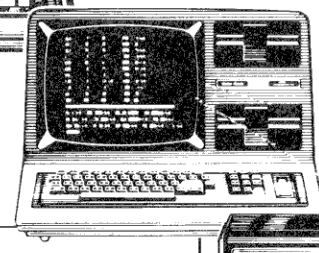

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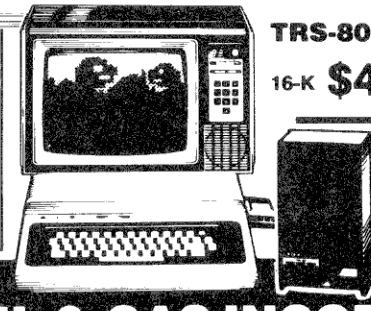

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repeated until ZX equals two, at which time the program proceeds into its next phase. The flag ZX keeps track of how many corners of the intended region you have already specified. Since you need only two (upper left and lower right), ZX is originally set to zero (line 50090) and then incremented by one (in the "Enter Corner" routine) each time you specify one of the corners until ZX reaches two.

Line 50120 is another self-contained Repeat. . . Until loop. It repeatedly flashes the cursor until you input a character from the keyboard. Unlike normal cursor blinking, however, this instruction makes the character on the screen at the cursor's location visible to the user between flashes. The character is found by a PEEK instruction and saved as a one-character temporary string ZT$. The cursor is then turned on (CHR$(14)), and after a short (count-to-15) wait, turned off again. The screen character saved in ZT$ is restored, and, after another short wait, the keylatch is checked to see whether there has been an input (Z$ = INKEY$). If not, Z$ is the null string (Z$ = "") and our test, (Z$<>"") generates a logical false (zero), looping back to the beginning. If there has been input, however, (Z$<>"") generates a minus 1 as a logical true, its negation is a plus 1, and the NEXTZ2 will increment that to two, exiting from the loop.

The next two lines check to see which character you input. You move the cursor with the four arrow keys; when you press one (ASCII code 8, 9, 10, or 91), line 50130 calls the "Move Cursor" routine at 50400. This routine checks to be sure that you are not at the edge of the screen and then increments or decrements the row counter ZR or the column counter ZC appropriately. After a new PRINT@ address (ZU) is computed for the cursor, control returns to the main routine.

You specify one of the corners of the region to be printed by pressing the Enter key (ASCII code 13). Any keypress other than an arrow or Enter (or Break) is ignored. If you press Enter, the instruction at line 50140 calls the "Enter Corner" routine at line 50500. This routine stores the column and row number of the cursor in one of two little arrays. If ZX equals zero, you are stipulating the upper left corner of the region to be printed, so line 50510 stores the column number ZC and the row number ZR in positions 1 and 2 of the array ZT (for top-left). The Return if ZU equals 1023 prevents the unlikely selection of the lower right corner of the screen as the top left corner to be printed.

If ZX equals one, you are stipulating the lower right corner of your region. Line 50520 checks to be sure you have indeed moved downward and to the right from your first corner (or, at least, not upward or toward the left) and then stores the cursor column and row numbers in the little array ZB (for bottom-right). When you have successfully set a corner, line 50530 changes the flag ZX and returns control to the main routine, where line 50150 modifies the instruction message if necessary.

When you have stipulated both corners of the region to be printed, ZX equals two and you pass on to the program's printing phase. Line 50180 restores the original line zero of the screen (and frees the string Z0$, which has been holding it, for other work). It also selects the Tiny mode (LPRINT CHR$(27); CHR$(20)) on the LP IV and advances the paper one half inch (STRING$(3,138)) to leave space between printed outputs. Line 50190 then computes the pixel addresses which you need to control your printing loops.

A pixel is addressed by two coordinates: (O,D). The coordinate O is the pixel-count Over (0–127); D is the pixel-count Down (0–47). Since you need two such pixel addresses (one for each corner of your region) the program again uses some little arrays. The Over and Down counts for the upper-left pixel of the region and will be stored in position one of the arrays ZO and ZD; the Over and Down, counting for the region's lower-right pixel, are in position two of the same two-position arrays. Since there are two pixels Over for each print position, the program multiplies ZT(1), the column address of the top-left corner, by two to get ZO(1). The program multiplies ZB(1), the column address of the bottom-right corner, by two and then adds one (making sure you pick up the rightmost column of pixels) to get ZO(2). Similarly, since there are three pixels Down for each print position, the program multiplies ZT(2), the row address of the top-left corner, by three to get ZD(1), and ZB(2), the row address of the bottom-right corner, by three to get ZD(2), adding two (to ensure that you pick up the two bottom-most rows of pixels in the bottom row of print cells). ZR is reset to the row address of the first row of print cells, ZT(2). It keeps track of your rows for the printing of non-graphic characters, letters and numbers.

Next, the print routine steps through each row of pixels, ZD(1) to ZD(2). Line 50210 initializes two print strings, ZP$(1) and ZP$(2). If you have also arrived at a row of pixels which is the topmost row of the corresponding row of full-character print cells, line 50210 pauses to call the "Load Letters" routine at 50600. This routine loads the non-graphic, alphanumeric information from the row of print cells ZR into a string (Z0$) to be printed later. It successively PEEKs at each screen position in the row ZR of your region, from the leftmost column ZT(1) to the rightmost column ZB(1). If it finds an alphanumeric character there—a letter or a number (ASCII codes 32–127)—it adds it to the string Z0$. If it finds anything else (for example, a

```
50000 '*** GRAPHIX/SUB -- Simulate printer graphics on LPIV
50010 '*   by Jay F. Rosenberg -- 10/23/81
50020 '*   Include CLEAR 1000, DEFINT Z, and DIM ZO(2),ZD(2),
50030 '*   ZP$(2),ZT(2),ZB(2) in Hsekping for calling program
50040 '***
50050 '**  HOUSEKEEPING
50060 ZI$="Place cursor on ": ZJ$=" corner and press <ENTER>"
50070 ZL$="UPPER LEFT": ZR$="LOWER RIGHT"
50080 Z0$="": FOR ZX=0 TO 63: Z0$=Z0$+CHR$(PEEK(15360+ZX)): POKE 1
5360+ZX,32: NEXT ZX: PRINT @ 0, ZI$+ZL$+ZJ$;
50090 POKE 16412,1: POKE 16419,191: ZR=8: ZC=32: ZU=64*ZR+ZC: Z$="
": ZX=0
50100 '**  DEFINE REGION TO BE PRINTED
50110 FOR Z1=1TO1
50120 FOR Z2=1TO1: ZT$=CHR$(PEEK(15360+ZU)): PRINT @ ZU,CHR$(14);:
 FOR ZY=1 TO 15: NEXT ZY: PRINT @ ZU,CHR$(15);: PRINT @ ZU,ZT$;: F
OR ZY=1 TO 15: NEXT ZY: Z$=INKEY$: Z2=-(Z$<>""): NEXTZ2
50130 IF ASC(Z$)=8 OR ASC(Z$)=9 OR ASC(Z$)=10 OR ASC(Z$)=91 THEN G
OSUB 50400
50140 IF ASC(Z$)=13 THEN GOSUB 50500
50150 IF ZX=1 THEN PRINT @ 0, ZI$+ZR$+ZJ$;
50160 Z$="": PRINT @ ZU,"";: Z1=-(ZX=2): NEXTZ1
50170 '**  PRINT LINE PRINTER GRAPHICS
50180 PRINT @ 0,Z0$;CHR$(15);: LPRINT CHR$(27);CHR$(20);STRING$(3,
138)
50190 ZO(1)=2*ZT(1): ZO(2)=2*ZB(1)+1: ZD(1)=3*ZT(2): ZD(2)=3*ZB(2)
+2: ZR=ZT(2)
50200 FOR ZY=ZD(1) TO ZD(2)
50210 ZP$(1)="": ZP$(2)="": IF ZY/3=ZR THEN GOSUB 50600
50220 FOR ZX=ZO(1) TO ZO(2)
50230 IF POINT(ZX,ZY) THEN ZP$(1)=ZP$(1)+"O" ELSE ZP$(1)=ZP$(1)+"
"
50240 IF POINT(ZX,ZY) THEN ZP$(2)=ZP$(2)+"#" ELSE ZP$(2)=ZP$(2)+"
"
50250 NEXT ZX
50260 IF ZP$(1)=STRING$(LEN(ZP$(1)),32) THEN Z1=-1 ELSE Z1=0
50270 IF(ZY-1)/3=ZR THEN: IFZ2 THEN ZR=ZR+1 ELSE LPRINT TAB(ZO(1)+
2) CHR$(27);CHR$(14);Z0$;CHR$(27);CHR$(138): ZR=ZR+1
50280 IFZ1 THEN LPRINT CHR$(27);CHR$(28) ELSE LPRINT TAB(ZO(1)+2)
ZP$(1);CHR$(27);CHR$(138): LPRINT TAB(ZO(1)+2) ZP$(2);CHR$(27);CHR
$(30)
50290 NEXT ZY
50300 '** EXIT FROM GRAPHIX/SUB SUBROUTINE
50310 LPRINT STRING$(3,138);CHR$(27);CHR$(19)
50320 POKE 16419,176: POKE 16412,0: RETURN
50330 '********
50400 '**  MOVE CURSOR
50410 IF ASC(Z$)=8 THEN: IF ZC>0 THEN ZC=ZC-1
50420 IF ASC(Z$)=9 THEN: IF ZC<63 THEN ZC=ZC+1
50430 IF ASC(Z$)=10 THEN: IF ZR<15 THEN ZR=ZR+1
50440 IF ASC(Z$)=91 THEN: IF ZR>0 THEN ZR=ZR-1
50450 ZU=64*ZR+ZC: RETURN
50460 '**
50500 '**  ENTER CORNER
50510 IF ZX=0 THEN: IF ZU=1023 THEN RETURN ELSE ZT(1)=ZC: ZT(2)=ZR
50520 IF ZX=1 THEN: IF ZC<ZT(1) OR ZR<ZT(2) THEN RETURN ELSE ZB(1)
=ZC: ZB(2)=ZR
50530 ZX=ZX+1: RETURN
50540 '**
50600 '**  LOAD LETTERS
50610 Z0$=""
50620 FOR ZC=15360+64*ZR+ZT(1) TO 15360+64*ZR+ZB(1)
50630 IF 31<PEEK(ZC) AND PEEK(ZC)<128 THEN Z0$=Z0$+CHR$(PEEK(ZC))
ELSE Z0$=Z0$+" "
50640 NEXT ZC
50650 IF Z0$=STRING$(LEN(Z0$),32) THEN Z2=-1 ELSE Z2=0
50660 RETURN
50670 '**
```

Program Listing 1

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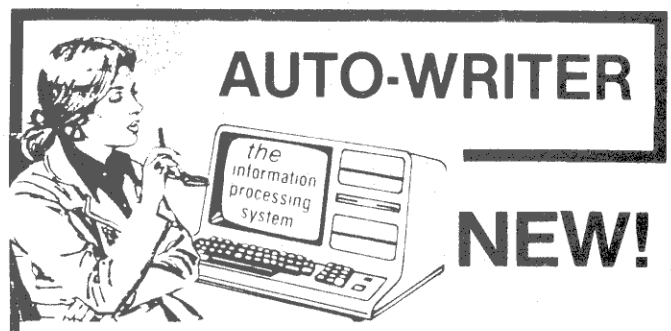

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graphics character) it adds a blank. Finally, before returning, it checks at line 50650 to see if there are any alphanumeric data to be printed or if Z0$ is all blanks (ASCII code 32). The routine sets Z2 to minus 1 (logical true) as a flag meaning "Nothing to be printed" and to zero (logical false) if there is something alphanumeric to print.

Lines 50220-50260 do the same job for your row of pixels. The program Points at each pixel in the row ZY from Over address ZO(1) to ZO(2). If the pixel is set (lighted), Point returns a logical true; O and # are added to the two print strings ZP$(1) and ZP$(2) respectively. The program constructs your line printer pixel by overprinting the O with the ". This operation creates a nice little black rectangle when the LP IV is set in Tiny mode. If the pixel is not set (unlighted), the program adds a blank to your print strings. Line 50260 checks to see if there are any pixels to be printed and sets the flag Z1 appropriately—logical true (minus 1, if there is nothing to be printed, and logical false (zero) otherwise.

Now you are ready to print. Line 50270 checks to see whether you are in the middle row of pixels for the current row (ZR) of print cells. If you are, and if there is alphanumeric information to be printed (IFZ2 checks the flag Z2 for logical true or false), the program LPRINTS it in the appropriate horizontal location. Allowing a two-column margin, you Tab over to your first print position ZO(1)—thus TAB (ZO(1) + 2). Since each print cell is two pixels wide, the program takes advantage of another nice feature of the LP IV and ensures that your alphanumeric string Z0$ lines up properly with the graphics by printing it double width. The CHR$(27);CHR$(14) starts the double width operation; the LP IV terminates it automatically. The CHR$(27); CHR$(138) is a full reverse line feed which keeps you on the same print line by cancelling the automatic full line feed forward inserted by the LP IV.

Finally, line 50280 prints the graphics. If there are no graphics to print (IFZ1 checks the appropriate flag), the program rolls the paper forward one-half line with CHR$(27);CHR$(28). If there are graphics, however, the program prints two ZP$ strings. First, it LPRINTs the string of Os (ZP$(1)), and rolls back the paper to the same line with CHR$(27); CHR$(138). It then overprints the string of #s (LP$(2)) and positions the print head on the next half-line by using only a half reverse, CHR$(27);CHR$(30). Then you are ready for your next row of pixels—NEXT ZY.

The program finishes by rolling the paper up another half inch, returning the LP IV to 10

Program Listing 2

```
1000 '*** SKETCHER -- Screen Drawing Board
1005 '*   by Jay F. Rosenberg -- 10/23/81
1010 '*   Use with GRAPHIX/SUB for Printed Graphics Output
1015 '*
1020 CLEAR 1000: DEFINT A-Z: DIM ZO(2),ZD(2),ZP$(2),ZT(2),ZB(2)
1030 VR=15360: CN$=CHR$(14): CF$=CHR$(15)
1040 POKE 16412,1: POKE 16419,191                    'Solid block
1050 CLS: CU=542: PRINT @ CU,"";                     'Center cursor
1060 FORR=1TO1                                       'Begin Main
1070  X$="": AX=0                                    'Null Inputs
1080  FORR0=1TO1                                     'Begin input
1090   T$=CHR$(PEEK(VR+CU))                          'Save screen
1100   PRINT @ CU,CN$;: FOR N=1 TO 15: NEXT N        'Blink cursor
1110   PRINT @ CU,CF$;: PRINT @ CU,T$;               'Restore screen
1120   FOR N=1 TO 15: NEXT N: X$=INKEY$              'Get keypress
1130  R0=-(X$<>""): NEXTR0                           'Loop if none
1140  AX=ASC(X$)                                     'Find ASCII
1150 IF AX=27 THEN GOSUB 1500                        'SHIFT UP-ARROW = G
rafix
1160  IF AX=8 OR AX=9 OR AX=10 OR AX=91 THEN GOSUB 1600  'Arrow
1170  IF (31<AX AND AX<91) OR (96<AX AND AX<128) THEN POKE VR+CU,A
X
1180 R=-(AX=31): NEXTR                               'Exit on <CLEAR>
1190 POKE 16412,0: POKE 16419,176                    'Normal Cursor
1195 '*
1200 '** Next instruction calls GRAPHIX/SUB. Change if needed.
1205 '*
1210 GOSUB 50000                                     'LP IV Graphics
1215 '*
1220 FORR=1TO1: X$=INKEY$: R=-(X$=CHR$(13)): NEXTR   'Loop here un
til <ENTER>
```

Program continues

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Program continued

```
1230 CLS: END                                          'Program exit
1240 '***
1500 GX$="": I$="": AI=0                              ' Graphics Routine
1510 FORR1=1TO1                                         'Begin input
1520  I$=INKEY$: AI=ASC(I$+CHR$(1))                    'Get keypress
1530  IF 47<AI AND AI<58 THEN GX$=GX$+I$              'Save if numeral
1540 R1=-(AI=13): NEXTR1                               'Exit if <ENTER>
1550 NG=VAL(GX$): IF 31<NG AND NG<192 THEN POKE VR+CU,NG
1560 RETURN
1570 '**
1600 IF AX=8 THEN: IF CU/64<>INT(CU/64) THEN CU=CU-1
1610 IF AX=9 THEN: IF (CU-63)/64<>INT((CU-63)/64) THEN CU=CU+1
1620 IF AX=10 THEN: IF CU<960 THEN CU=CU+64
1630 IF AX=91 THEN: IF CU>63 THEN CU=CU-64
1640 PRINT @ CU,"";: RETURN                            'Move cursor
1650 '**
```

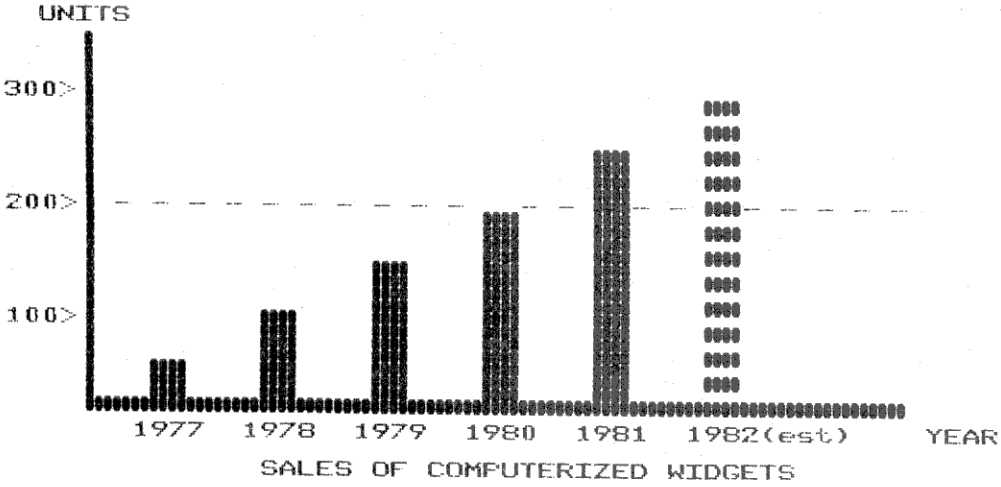

Fig. 1.

cpi mode by CHR$(27);CHR$(19), and POKEing that cursor back to its normal small blinking self before returning from GRAPHIX/SUB to the calling program.

Using GRAPHIX/SUB

Program Listing 2, Sketcher, lets you put graphics on the screen.

Most of Sketcher will by now look familiar to you. The housekeeping lines 1020–1050 establish the string space and arrays GRAPHIX/SUB will use. They define the beginning of video RAM (15360), introduce abbreviations for "cursor on" and "cursor off" control commands, and POKE in a solid block cursor which is then positioned at the center of a blank screen. As before, you handle cursor blinking. Lines 1080–1130 are the "Repeat flash-cursor Until input-from-keyboard" loop which we packed into line 50120 of GRAPHIX/SUB. When a character is input into X$ by the INKEY$ command, the program exits from this loop and (at line 1140) finds the ASCII code for that character.

If you input an arrow (ASCII codes 8, 9, 10 and 91), line 1160 calls the "Move Cursor" subroutine at 1600–1640 which checks for the edge of the screen and moves the cursor one position in the direction corresponding to the arrow. The cursor PRINT@ address is stored in CU and operated on directly, since in

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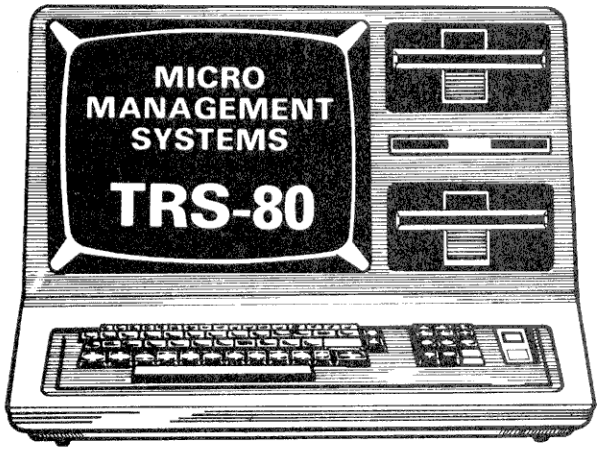

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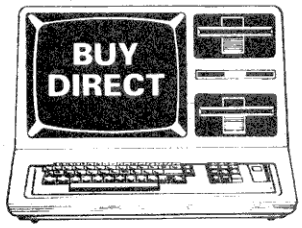

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this case we do not need the row and column counts.

If you input any standard keyboard character (ASCII codes 32-90 and 97-127), line 1170 displays it by POKEing it into the appropriate screen location. The only new twist, in fact, is in line 1150 and the little subroutine (beginning at 1500) which is called there. Line 1150 checks for ASCII code 27, the code corresponding to the combination of Shift and the up arrow. Press Shift and up arrow together whenever you want to display a graphics character at the position of the cursor on the screen. The cursor disappears, and line 1150 calls the graphics routine at 1500.

In the graphics routine, the ASCII code for the graphics character you wish to display (128-191) is input from the keyboard in the form of a string (GX$). Lines 1510-1540 are another Repeat...Until loop which accepts inputs from the keyboard until AI, the ASCII code of the input, equals 13 (that is, until you press Enter). The ASC function used in line 1520 converts each keypress into its ASCII code. (CHR$(1) is added to I$ before using ASC, since the ASC function will crash on a null string input. If there has been no keypress, I$ will be "" and AI will be set to ASC(CHR$(1)), which is 1.) Line 1530 checks to see if you have input a numeral 0-9 (ASCII codes 48-57); if so, the routine adds it to the string GX$. When you press Enter, Basic's logical true for AI equals 13 forces an exit from the input loop. Line 1550 then uses the VAL function to convert the string of numerals (GX$) into an integer (NG).

Finally, if NG is the ASCII code of a valid alphanumeric or graphics character (32-191), the corresponding character is POKEd into the cursor position on the screen and control returns to the main program. The inclusion of all valid alphanumeric codes in addition to the graphics codes allows you to display and print characters from 91-96 which are not otherwise accessable from the keyboard.

Press the Clear key to exit the main program. Clear corresponds to an ASCII code of 31, which line 1180 establishes as the Until condition for the entire Repeat...Until loop begun at line 1060. When the screen looks the way you want it press Clear. The cursor vanishes again (POKEd back to normal by line 1190) and then reappears a few moments later, along with the message line and first instruction for GRAPHIX/SUB (called at line 1210).

Sketcher line 1220 (another Repeat...Until loop) pauses and holds the picture on the screen following the LP IV printer operations so that you can compare the screen graphics with the printer graphics. Press Enter one last time to end.

Load Sketcher and GRAPHIX/SUB, power up your LP IV, and start drawing. Fig. 1 and 2 show sample outputs. Fig. 1 is a bar chart or histogram for the sales of computerized widgets (You know what they are!). Fig. 2 is the graphic representation of a classical zoological equation. The printed versions are a little compressed as a result of the difference in the depth-to-width ratio, but still every bit as recognizable as their screen versions.

Notice in printing alphanumeric data in double width that the labels are horizontally centered in the boxes. You may wish to center the labels vertically as well, by compensating for the fact that the LP IV prints letters and numbers on a single line, while they are two pixels deep on the screen (the top two rows of a print cell). ■

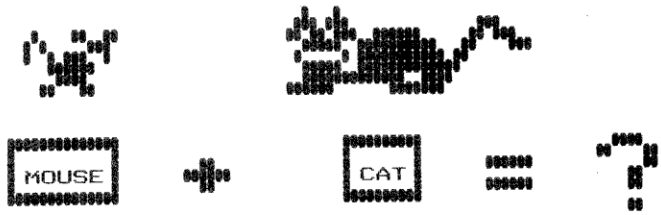

Fig. 2.

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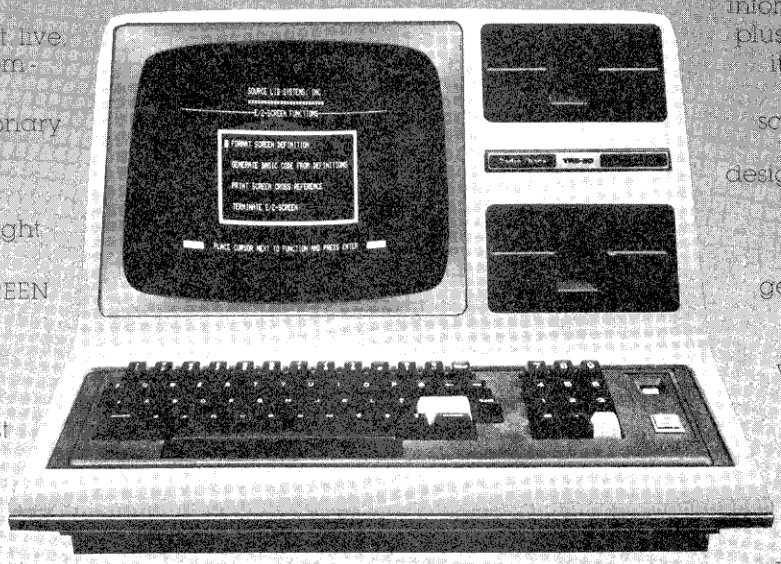

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Use Boothe's techniques on your Model II.

Pictures at a Model II Exhibition

Jesse W. Baker
P.O. Box 145
Fort Kent, ME 04743

A shortage of fun programs for the Model II characterizes all the computer magazines. Everyone writes programs for the Level II or the Model III and by-passes the Model II completely. I own a Model II and I too like to play with my computer; so I rework programs to run on my computer.

The Model II's graphic capabilities are limited, but it can do a nice job with what it has if you take the time. Usually, you can modify programs written for the Level II without much hassle. You can also modify programs

The Key Box

Model II Basic
Model II

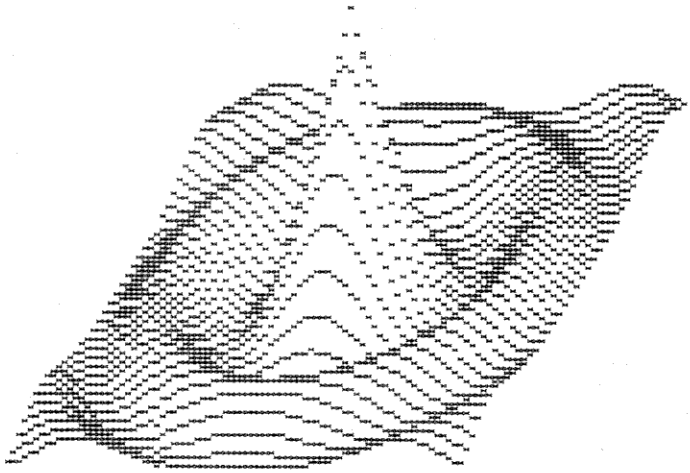

Fig. 1.

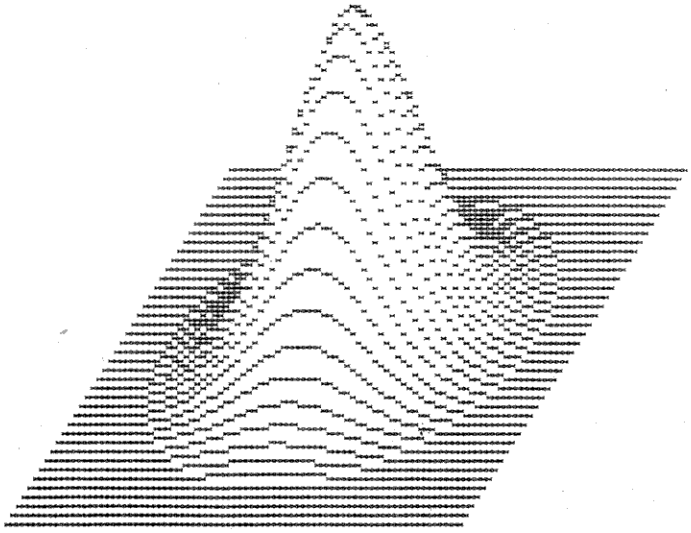

Fig. 2.

```
05   REM*GRAPHICS IN 3-D
06   REM*MODIFIED BY JESSE W. BAKER FOR THE TRS-80
07   REM*MODEL II MICROCOMPUTER AND LINE PRINTER V
08   REM*BASED ON A PROGRAM WRITTEN BY BOB BOOTHE.
20   CLEAR 500
30   GOSUB 270
40   CLS:LPRINT CHR$(27);CHR$(28):LPRINT CHR$(27);CHR$(14)
50   PRINT@910,CHR$(26)" PROGRAM RUNNING "CHR$(25)
60   DEFINT H — Z
70   DIM A$(132)
80   FOR X = 1 TO 121
90   H = 0:L = 200
100  FOR Q = 1 TO 132:A$(Q) = " ":NEXT
110  FOR Y = 1 TO 80
120  X = (X1—Y)*2
130  IF X < 1 THEN 250
140  IF X > 80 THEN 240
150  C = SQR((X—40)*(X—40) + (Y—40)*(Y—40)) + 1
160  A = C*.1213 + .63:M = X—SIN(A + A*A/6)/A/SQR(A)*50 + 40
170  IF M > H THEN 200
180  IF M < L THEN 220
190  GOTO 240
200  H = M
210  IF M > L THEN 230
220  L = M
230  A$(M) = "X"
240  NEXT Y
250  FOR I = 1 TO 132:LPRINT A$(I);:NEXT:LPRINT
260  NEXT X1
270  CLS:PRINT@910,CHR$(26)" END OF PROGRAM "CHR$(25):END
280  SYSTEM"FORMS P = 138,L = 130"
290  RETURN
```

To change the program so it will print different forms, change line 160 as follows:

```
160  M = X + EXP(-.004*C*C)*75 + 5
160  M = X - EXP(-.004*C*C)*75 + 40
```

Program Listing 1.

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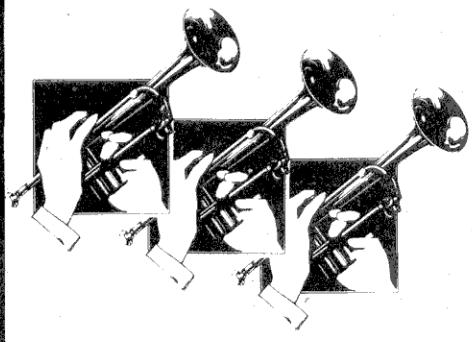

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written in straight Basic.

Bob Boothe's article "A Turn of the Screw" (*80 Microcomputing*, April 1981) featured a series of programs for the TRS-80 and a Base 2 Printer. I wanted to do the same with my equipment. Could I make them work on my Line Printer V?

I modified his program number 5. First I added a GOSUB statement in Line 30 which sends you to the FORMS command. The Line Printer V can print 12 lines per inch, and 15 characters per inch (condensed mode), so I added this instruction to the program (Line 40). An additional line displays the phrase, "PROGRAM RUNNING" (Line 50), on the screen. I prefer an X so I changed another line to print an X instead of a *(Line 230).

I added another line that clears the first message from the screen and replaces it with "END OF PROGRAM" (Line 270). The subroutine set up in Line 30 allows you to use the FORMS command to disable the page default settings, and insert P = 138, L = 130 (Line 280) which allows the program to print everything on standard 8 x 11½ inch paper.

Line 160 changes the shapes you print on the printer (see Figs. 1-3). All three of these programs are identical except for that line.

Two other programs that I modified to run on the Model II print a head of a famous bunny and makes the outline. These also print on 8 x 11½ inch paper.

I made many changes in this program and included a generous supply of remark statements to help you along. If you want just the outline, change Line 110 to read 110 LPRINT TAB(X + 15);.

Send along any graphics programs you may have modified for the Model II and want to share.

Jesse Baker is a high school teacher and is working toward a M.Ed. in Educational Computer Curriculum design and development.

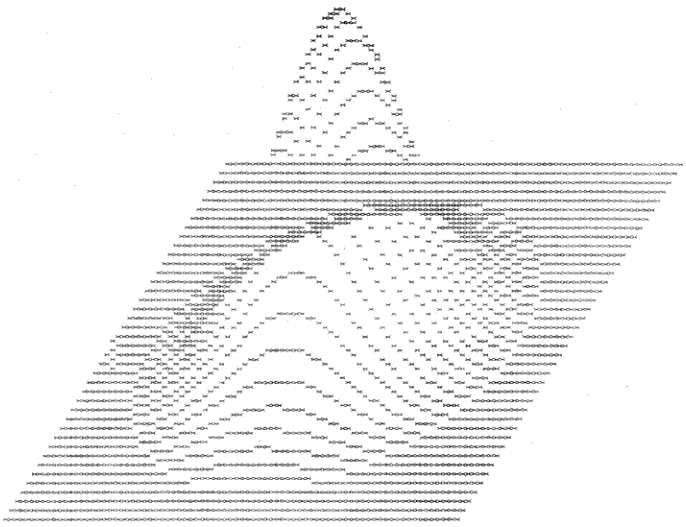

Fig. 3.

```
10   'BUNNY HEAD PROGRAM
20   LPRINT:LPRINT:LPRINT
30   FOR I = 0TO4 'THIS LINE SETS THE COUNTER FOR THE READ STATEMENT
40   READ B(I) 'THIS LINE READS DATA LINES STARTING AT 210
50   NEXT I
60   GOSUB 170
70   L = 42 'THIS LINE DETERMINES WHAT CHARACTER YOU WANT PRINTED
80   LPRINT
90   READX:IF X<0 THEN 80 'X SETS THE LEFT MARGIN OF THE PRINTOUT
100  IF X>128 THEN 160 'THIS SETS THE RIGHT MARGIN OF THE PRINT OUT
110  LPRINTTAB(X + 15);:READY 'THIS LINE TABS LINE 90 OVER TO CENTER
     PRINTOUT
120  FOR I = X TO Y
130  LPRINTCHR$(L); 'THIS LINE PRINTS THE CHARACTER FROM LINE 70
140  NEXT I
150  GOTO90
160  GOSUB170:GOTO360
170  FOR I = 1TO6:LPRINTCHR$(10);:NEXTI 'THIS LINE INPUTS A LINE FEED
180  RETURN
190  'DATA POSITIONS FOR LPRINTING OF *
200  'THIS IS READ BY LINE 40
210  DATA 2,21,14,14,25
220  DATA 1,2, – 1,0,2,45,50, – 1,0,5,43,52, – 1,0,7,41,52, – 1
230  DATA 1,9,37,50, – 1,2,11,36,50, – 1,3,13,34,49, – 1,4,14,32,48, – 1
240  DATA 5,15,31,47, – 1,6,16,30,45, – 1,7,17,29,44, – 1,8,19,28,43, – 1
250  DATA 9,20,27,41, – 1,10,21,26,40, – 1,11,22,25,38, – 1,12,22,24,36, – 1
260  DATA 13,34, – 1,14,33, – 1,15,31, – 1,17,29, – 1,18,27, – 1
270  DATA 19,26, – 1,16,28, – 1,13,30, – 1,11,31, – 1,10,32, – 1
280  DATA 8,33, – 1,7,34, – 1,6,13,16,34, – 1,5,12,16,35, – 1
290  DATA 4,12,16,35, – 1,3,12,15,35, – 1,2,35, – 1,1,35, – 1
300  DATA 2,34, – 1,3,34, – 1,4,33, – 1,6,33, – 1,10,32,34,34, – 1
310  DATA 14,17,19,25,28,31,35,35, – 1,15,19,23,30,36,36, – 1
320  DATA 14,18,21,21,24,30,37,37, – 1,13,18,23,29,33,38, – 1
330  DATA 12,29,31,33, – 1,11,13,17,17,19,19,22,22,24,31, – 1
340  DATA 10,11,17,18,22,22,24,24,29,29, – 1
350  DATA 22,23,26,29, – 1,27,29, – 1,28,29, – 1,4096
360  END
```

Program Listing 2.

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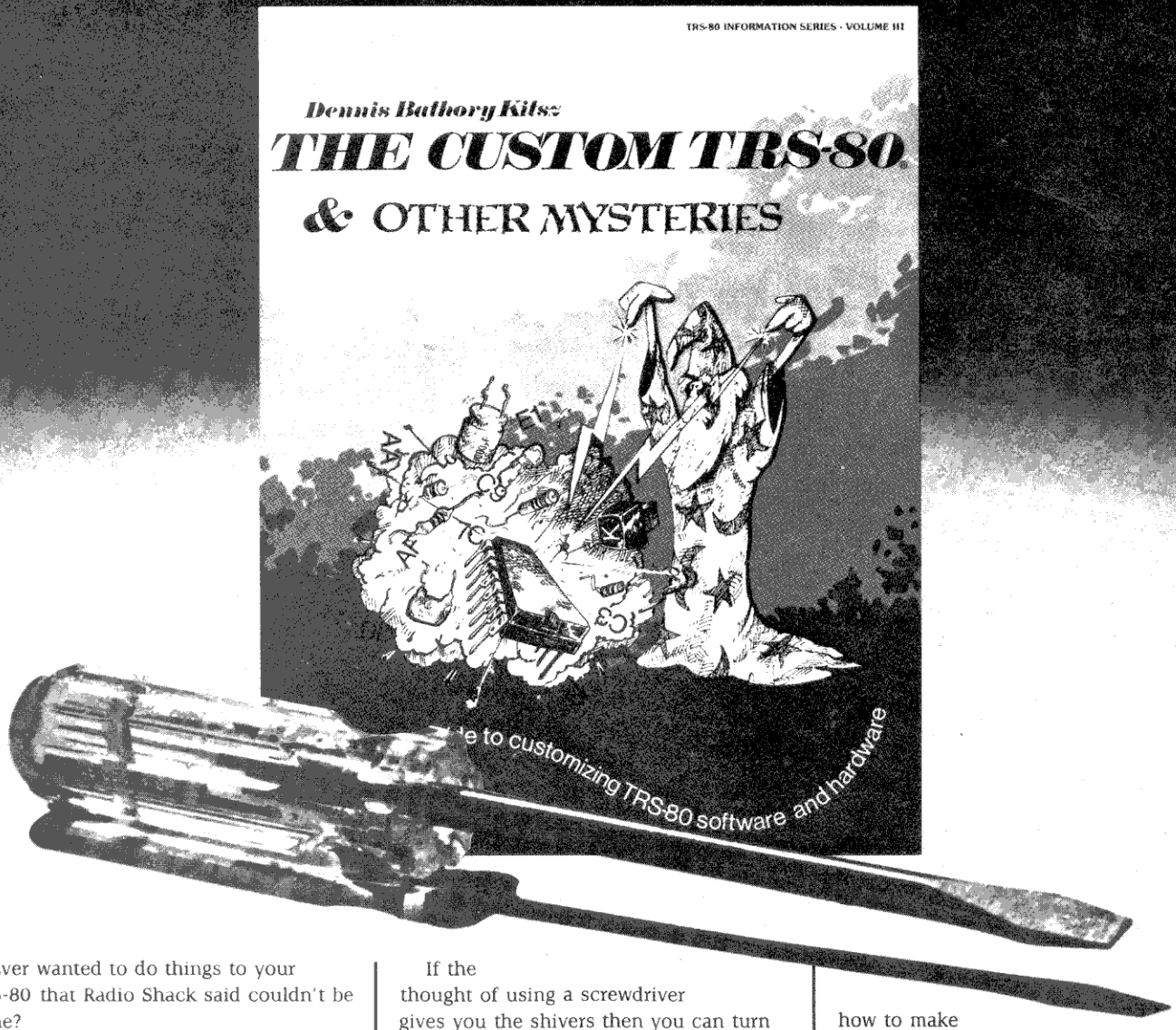

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If the thought of using a screwdriver gives you the shivers then you can turn to the software section. In this you learn how to make BASIC programs auto-execute, reset the memory size, patch into the interpreter, test memory with machine-language, pack program lines with machine code, and generate sound effects.

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Upgrade Model II Profile.

Graphics for Profile

Charles R. Wood
327 Seventh Avenue
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One of the Model II's most useful features is its graphics character set. These graphics should be available for use in Profile for special CRT forms, but Profile does not allow access to them. In addition, the graphics in my Epson MX-80 printer should also be available to underscore columns and headings for reports.

If you want to highlight a certain area on the CRT you can use the graphics to paint fancy borders with matching corners. I use graphics to stress that some fields require a data entry, while other data is optional. When designing reports, I emphasize summary columns with very ornate underlines.

Converted Graphics

I enhanced Profile by adding a graphics converter called PROGRF to the menu (see Program Listing 1). PROGRF, written in Basic, accepts previously created files from Profile. It converts keyboard characters to graphics characters and writes the graphics back to the same files. The augmented CRT forms are compatible with Profile. Data files are not affected. At run time, the graphics are displayed along with the standard character set.

Model II graphics consist of 32 characters (hex 0-1F) and their reverse video equivalents (hex 80-8F). You need all 64 for effective forms creation. To use them, PROGRF translates the keyboard characters from @ (hex 40) to UL (hex 5F) into the graphics group hex 0-1F. Likewise, lowercase alpha characters (hex 60-7F) signal PROGRF to add the eight-bit to the graphics character, causing reversed video for the other 32 graphics. You can make up a chart of graphics versus keyboard characters by writing the alphabetic characters in the graphics column on page 300 of the TRSDOS

Program Listing 1.

```
100 'PROGRF - 9 JULY 1981  Graphics for PROFILE+ by Charles R. Wood
102 'Machine code support is "PROGRF/mc"
112 'char '|' turns on graphics in PROFILE; 'space' for off
114 '@ thru _ (upper case alpha) for normal graphics. Also 160-191 for printer
115 ' thru RO (lower case alpha) for revers graphics. Also 192-223 for printer
120 CLEAR 2000
122 SYSTEM "LOAD PROGRF/mc"
125 DEFUSR8=(&HF050):DEFUSR9=(&HF060) 'RAM2CRT, CRT2RAM
128 DEFUSR7=(&HF070) 'VDCHAR
130 DEFINT I-K:DEFSTR B-D
140 DIM BB(7),KB(240),KV(960),KW(960)
150 CLS:PRINT "PROGRF - PROFILE Graphics Converter":PRINT:PRINT
152 INPUT "Screens(S) or Reports(R)";BB(0)
154 KB(0)=0:IF BB(0)="R" THEN KB(0)=1 'flag for reports
155 IF BB(0)="r" THEN KB(0)=1
156 INPUT "Name of File ";BB(0)
158 I=LEN(BB(0)):IF I>8 GOTO 156
160 BB(6)=LEFT$("/PMP",4) 'Ext for screens
162 IF KB(0)=1 THEN BB(6)=LEFT$("/PRT",4) 'Ext for reports
164 BB(7)=BB(0)+LEFT$("0000000",8-I)
166 BB(1)=BB(7)+BB(6) 'lst screen or report file name
168 BB(0)=LEFT$(BB(1),11) 'Delete last byte of EXT
170 BB(2)=BB(0)+"2" '2nd screen/report
172 BB(3)=BB(0)+"3"
174 BB(4)=BB(0)+"4"
176 BB(5)=BB(0)+"5"
200 ON ERROR GOTO 2000
201 ' Note: Opening a non-existing file will create the file. PROFILE canno
t           accept a null file. Therefore, this program will KILL the null
 file.
204 PRINT:PRINT:PRINT"First ";:IF KB(0)=0 THEN PRINT"screen ";
            ELSE PRINT "report ";
206 INPUT "to edit ";KF
208 INPUT "Last to edit";KL
210 IF KF<1 OR KF>5 OR KF>KL THEN 204
212 IF KL<KF OR KL>5 THEN 204
215 FOR K=KF TO KL 'screens/reports
220 OPEN "D",1,BB(K),256
222 FOR I=1TO960:KV(I)=&H2020:NEXT I 'spaces to CRT array
225 KZ=7:IF KB(0)=1 THEN KZ=8
240 FOR K1=1 TO KZ 'records
242 IF K1=7 AND KB(0)=1 GOTO 912 'Forget Rec#7 of PRT
245 FIELD1,120 AS CA,120 AS CB
250 GET 1,K1
255 IF K1=1 THEN CLS:PRINT"Processing graphics characters"
320 FOR I=1TO120 'KB is array for 3 lines; 1 byte/element. Element has ASCII
330 KB(I)=ASC(MID$(CA,I,1))
340 KB(I+120)=ASC(MID$(CB,I,1))
350 NEXT I
390 J1=1
400 FOR I=J1 TO 239
420 IF KB(I)=124 GOTO 490 'found a |
430 NEXTI
440 GOTO 630 'checked all 3 lines
490 J5=INT((I+80)/80)*80: IF KB(0)=1 THEN J5=132 'End of this line
```

Program continued

The Key Box

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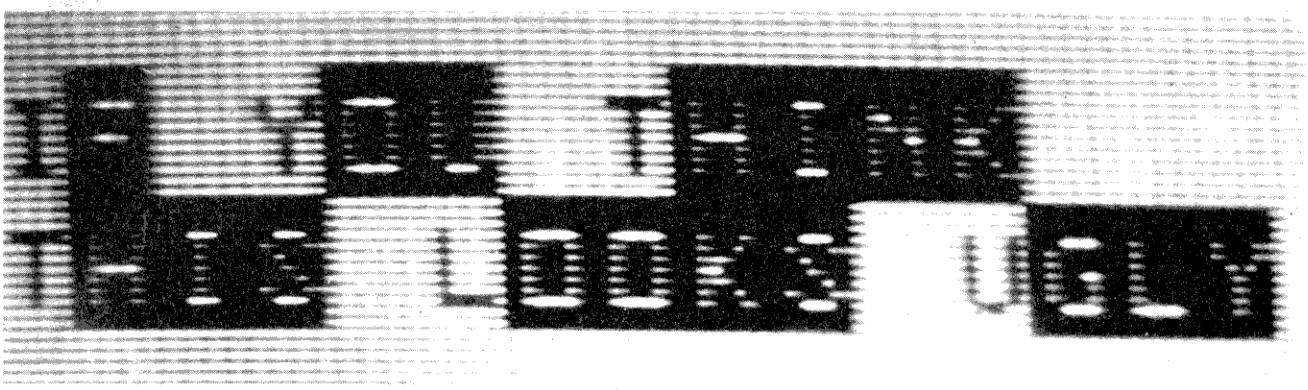

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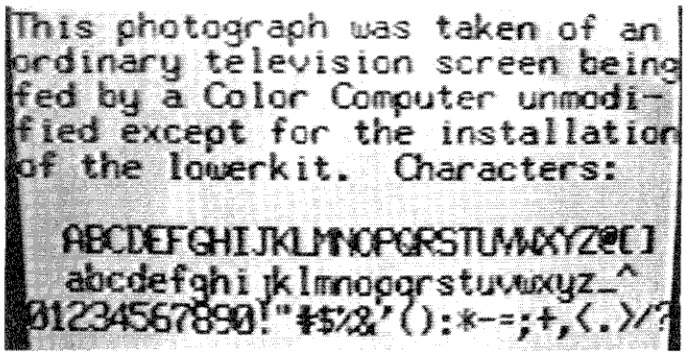

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Program continued

```
491 IF J5>160 AND K1=7 THEN 630 'Don't bother with CRT line #22
500 FOR J3=I+1 TO J5 'Find 1st 'space' before end of line
510 IF KB(J3)=32 THEN 518
516 NEXT J3
517 GOTO 520 'leave J5 at 80,160 or 240; or 132 for printer
518 J5=J3-1
520 FOR J4=I+1 TO J5 'convert to graphics
521 IF KB(J4)<64 OR KB(J4)>127 THEN 532 'Skip existing graphic codes
522 IF KB(0)=1 THEN 599 'EPSON graphics
523 ' Process for MOD II graphics
525 IF KB(J4)>95 THEN KB(J4)=(KB(J4) OR &H80) 'Reverse video
530 KB(J4)=(KB(J4) AND &H9F)  'Drop 6,7 bits
532 NEXT J4
535 KB(I)=32 'replace with a space
540 J1=J5+1 'start again, after converting the last field
543 KW=240:IF KB(0)=1 THEN KW=132:IF J1>KW THEN 630
550 GOTO 400
599 'EPSON graphics
600 KB(J4)=KB(J4)+96:GOTO 532 'Shift into 8bit region
604 GOTO 643 'Bypass CRT display
630 J=(K1-1)*120 'base for video xfer 120 words/3 crt lines
633 FOR I=1TO120
634 J1=(KB(2*I) AND &H7F) 'only + numbers
636 KV(J+I)=(KB(2*I-1) OR (J1*256)) '2 bytes into 1 integer (word)
638 IF KB(2*I)>(&H7F) THEN KV(J+I)=(KV(J+I) OR &H8000) '8-bit added
641 NEXT I
643 GOSUB 840 'write 3 CRT lines to disk
644 PRINT "CRT lines";K1*3-2;" to ";K1*3
646 NEXT K1 'next record
650 PRINT CHR$(30); 'paint complete CRT for editing
651 FOR I=1 TO 960:KW(I)=KV(I):NEXT I 'save assembled screen to KW
653 I=USR8(VARPTR(KV(1)))
655 KF=0 'flag for normal mode
656 PRINT@(22,0), "| (cntrl-zero) to start graphics, 'space' to stop";
657 PRINT@(23,0),"ESC to finish editing, F1 to reinstate screen";
659 I=USR9(VARPTR(KV(1))) 'lines 23/24 into KV
660 PRINT CHR$(20); 'home
662 IK=0 'initial cursor position
664 C=INKEY$:IF C="" THEN 664
666 IC=ASC(C):IF IC=27 THEN 740 ELSE 670 'esc? no disk rewrite needed
668 C=INKEY$:IF C="" THEN 668 ELSE IC=ASC(C) 'loop start
670 IF IC=27 THEN 735 'esc, end edit
671 IF IC=1 THEN 730 ELSE IF IC=17 THEN 735 'cntrl A,Q
674 IF IC<32 GOTO 690 'control codes
676 IF KF=1 GOTO 700 'graphics
678 IF IC=124 THEN KF=1:GOTO 664 'turn on graphics w/ |
680 PRINT CHR$(IC); 'print chrctr
681 IK=ROW(0)*80+POS(0) ' & get its position
682 IF IK>1599 THEN IK=IK-1600:PRINT@IK,; 'wraparound
684 I=USR9(VARPTR(KV(1))) 'update KV
686 GOTO 668 'next character
690 IF IC=31 THEN IC=10 'dn aro
691 IF IC<>30 THEN 695 'up aro
692 IK=IK-80:IF IK<0 THEN IK=IK+1600
693 PRINT @IK,;:GOTO 684
695 IF IC<8 THEN 668 ELSE IF IC>24 AND IC<27 THEN 668 'ignore
696 GOTO 680
700 IF IC<>32 GOTO 704 'test for space bar
702 KF=0:GOTO 681 'graphics off
704 IF IC>95 THEN IC=(IC OR &H80) 'reverse video
706 IC=(IC AND &H9F) 'drop 6,7 bits
708 I=IK/2+1 'word position in KV
710 IF FIX(IK/2)*2=IK THEN 712 ELSE 718 'which byte?
712 KV(I)=(KV(I) AND &HFF00) 'delete old RH byte
714 KV(I)=(KV(I) OR IC) 'add new RH byte
716 GOTO 726
718 KV(I)=(KV(I) AND &HFF) 'delete old LH byte
720 ID=(IC AND &H7F)
722 KV(I)=(KV(I) OR (ID*256)) 'add new LH byte
724 IF IC>127 THEN KV(I)=(KV(I) OR &H8000)
726 I=USR8(VARPTR(KV(1))) 'update PIX
728 IK=IK+1:PRINT@IK,;:GOTO 682
730 CLS:FOR I=1 TO 960:KV(I)=KW(I):NEXT I
732 GOTO 653
735 CLS:PRINT "Do you want to: 1. Re-edit this screen  ";:
736 PRINT@(1,16),"3. Make no changes to disk   4. Return to PROFILE   ";
737 C=INKEY$:IF C="" THEN 737
738 PRINT C:I=ASC(C):IF I<49 OR I>52 THEN 737
739 ON I-48 GOTO 650, 750, 915, 960
740 PRINT@(22,0),"No editing required for screen/report #";K;STRING$(40,32);
741 PRINT@(23,0),STRING$(70,32);
742 GOTO 915
750 'rewrite 7 records after screen edit
751 CLS:PRINT "Copying to disk file ";BB(K)
753 FOR K1=1 TO 7
758 FOR I=1 TO 240 STEP 2 'convert from integer to string
761 J=(K1-1)*120 + (I-1)/2 +1 'integer index
764 KB(I+1)=(KV(J) AND &H7F00)/256
765 IF KV(J)<0 THEN KB(I+1)=(KB(I+1) OR &H80)
767 KB(I)=(KV(J) AND &HFF)
770 NEXT I
773 GOSUB 840 'write k1 record to disk
776 NEXT K1
780 GOTO 912 'next screen
840 CC="":CD="" 'sub to write 1 record back to disk
843 FOR J=1 TO 120 'convert values back to ASCII
846 CC=CC+CHR$(KB(J)):CD=CD+CHR$(KB(J+120))
847 NEXT J
850 LSET CA=CC:LSET CB=CD 'Into write buffer
853 PUT 1,K1
856 RETURN
912 PRINT @(20,0), "Screen/Report #";K; "has been rewritten";STRING$(40,32);
915 CLOSE
930 NEXT K 'Next File
940 FOR I=1 TO 4000:NEXT I
944 CLS:PRINT"Do you want to: 1. Edit another file  2. Review this file";
946 PRINT@(1,16), "3. Return to PROFILE   ";
949 C=INKEY$:IF C="" THEN 949
951 PRINT C:I=ASC(C):IF I<49 OR I>51 THEN 949
953 ON I-48 GOTO 100,200,960
960 SYSTEM "M"
2000 IF ERR=60 OR ERR=62 THEN RESUME 2020
2002 PRINT "ERR #";ERR;" AT ";ERL:STOP
2020 CLS:PRINT "No file name ";BB(K); ", Screen/Report #";K
2022 CLOSE:KILL BB(K):GOTO 930
```

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manual (the ASCII code chart). When composing a screen, control-zero enables the shift to graphics. Hitting space turns off the graphics.

After you design a screen using Profile, PROGRF processes the file and allows further editing of the CRT. PROGRF then displays the finished screen. You can edit using the same control system. When you finish, press Escape to rewrite the forms file to disk. The files affected by this process are filename/PMP, PM2, and so on for screens and filename/PRT, PR2 and so on for reports.

If you are using Profile plus, you can add PROGRF to a menu. Select option one (Define) on the Profile plus menu. When you are prompted for a menu name, remember that PROGRF is used only for programming special forms. As such, it should be accessible to programmers who set up forms; select a menu name accordingly. Likewise, include in this menu only programmer-related functions. You may define up to 12 functions, including the clerk, print and label programs from Profile. Then add PROGRF by typing:

```
G   Graphics Converter and Editor
BASIC PROGRF -F:1
```

The user menu is now linked to PROGRF with keystroke G. Exit from PROGRF (line 960) goes back to menu M. If you are using other versions of Profile, run PROGRF after loading Basic -F:1.

A small machine code program, PROGRF/mc (see Program Listing 2), is required to support the USRx programs. It serves as linkage to TRSDOS SVC's VDGRAF and VDCHAR. To create PROGRF/mc use Debug to type code between F050 and F0A8; use Dump to hold it. PROGRF loads the machine code during initialization.

If you use other printers alter lines 599 and 600 to take advantage of their graphics capabilities. The CRT will not reproduce the graphics of a printer, but you can make equivalencies. ■

Charles Wood, an electronics engineer, specializes in computer interfaces.

```
F050          0100        ORG   F050H
              0110 ;*****************************************
              0120 ;*                                       *
              0130 ;*     SUPPORT PROGRAMS FOR 'PROGRF'     *
              0140 ;*                                       *
              1050 ;*****************************************
              0160 ;
F050 CDA0F0   0170 USR8   CALL  SUB     ;(HL) = RAM BUFFER
F053 3E5E     0180        LD    A,94    ;F CODE
F055 0600     0190        LD    B,0     ;RAM TO VIDEO
F057 CF       0200        RST   8       ;SVC #94
F058 C9       0210        RET
F060          0220        ORG   F060H
F060 CDA0F0   0230 USR9   CALL  SUB     ;(HL) = RAM BUFFER
F063 3E5E     0240        LD    A,94    ;F CODE
F065 0601     0250        LD    B,1     ;VIDEO TO RAM
F067 CF       0260        RST   8
F068 C9       0270        RET
F070          0280        ORG   F070H
F070 CDA0F0   0290 USR7   CALL  SUB     ;(HL) HAS ADRS OF
              0300                      ;FULL INTEGER
F073 46       0310        LD    B,(HL)  ;ADRS IS FOR LS BYTE
F074 00       0320        NOP
F075 3E08     0330        LD    A,8     ;F CODE
F077 CF       0340        RST   8
F078          0350        RET
F0A0          0360        ORG   F0A0H
F0A0 5E       0370 SUB    LD    E,(HL)  ;LS BYTE OF ADRS
F0A1 23       0380        INC   HL
F0A2 56       0390        LD    D,(HL)  ;MS BYTE OF ADRS
F0A3 EB       0400        EX    DE,HL   ;HL HAS ADRS OF INTEGER
F0A4 56       0410        LD    D,(HL)  ;LS BYTE OF INTEGER
F0A5 23       0420        INC   HL
F0A6 5E       0430        LD    E,(HL)  ;DE = INTEGER
              0440                      ;HL = ADRS OF INTEGER
F0A7 2B       0450        DEC   HL      ;RESTORE
F0A8 C9       0460        RET
0000          0470        END
```

Program Listing 2.

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Get rid of those white streaks.

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Video snow, the black streaks against white characters, is most apparent with large, rapidly changing areas of white graphics.

The root of the problem is that the TRS-80 display is memory mapped by the CPU. In addition, the display memory is continually scanned by the video circuitry. This circuitry reads the display memory and translates it into characters on the screen. The CPU and video circuitry cannot access the display memory at the same time: The CPU has higher priority. When the CPU reads or writes part of the display memory, the video circuitry is locked out. The result is a black streak, or glitch, on the screen.

For a more complete description of display circuits' operations read Radio Shack's *TRS-80 Microcomputer Technical Handbook.*

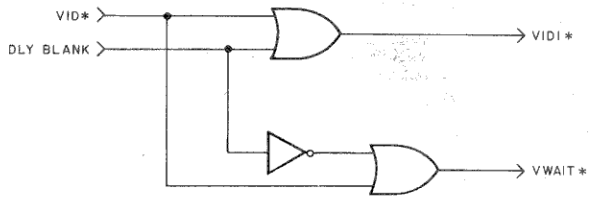

Fig. 1. Conceptual Circuit.

The Solution

My solution is to give the video circuitry higher priority than the CPU.

The display is made up of 192 lines of 384 dots per line. Each character is 12 rows of 6 dots. The maximum display is 16 lines of 64 characters. After displaying a full line of dots the electron beam in the picture tube turns off and moves back to the left side of the screen to begin a new line. When the bottom line is complete the electron beam returns to the top left corner. The TRS-80 maintains black borders along all four sides. I will call these periods when the electron beam is not displaying anything blanking periods.

When the CPU accesses display memory during a blanking period we do not see any black streaks. The snow removal solution is simple: Let the CPU read and write the display memory only during blanking periods. In other words, reverse the priorities of the CPU and video circuitry for reading the display memory.

By using the WAIT* input to the CPU, access is blocked and the CPU is put into a wait state until the video circuitry enters a blanking period. Then the CPU is released and allowed to continue.

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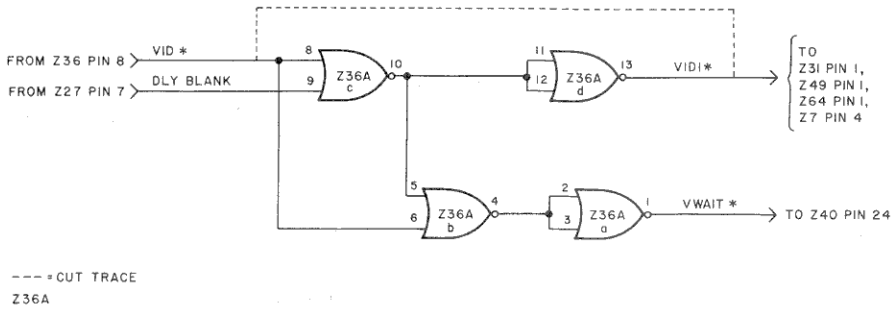

Fig. 2. Version 1 Schematic.

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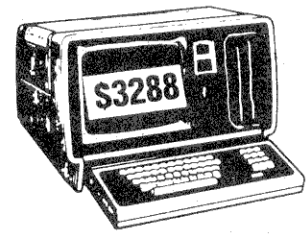

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Even the most intensive graphics program spends little time accessing the display memory. Games that combine intensive graphics with simultaneous sound generation suffer slightly. The sound quality deteriorates because the wait states change timing loops.

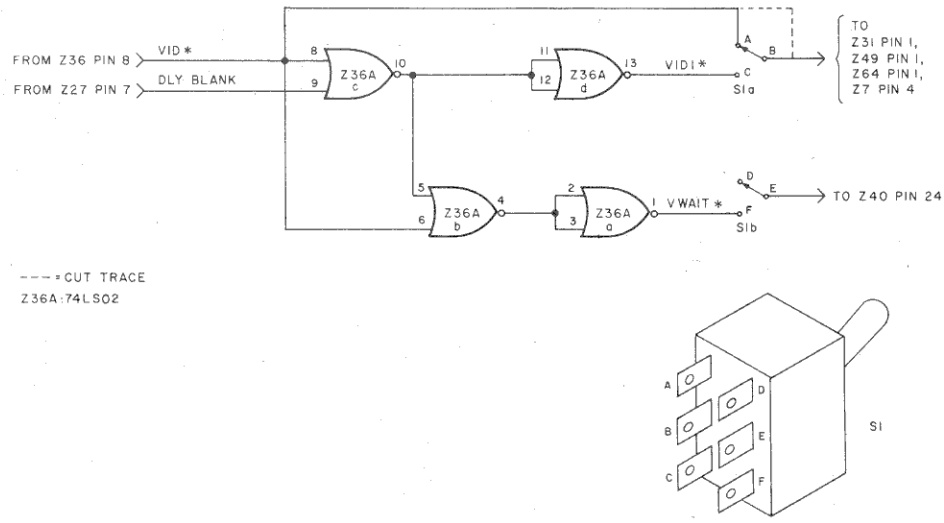

Fig. 3. Version 2 Schematic.

The Circuit

Fig. 1 shows a conceptual version of the video de-glitcher circuit. It functions identically to the actual circuit and is easier to understand. DLY BLANK is high when characters are displayed and low during blanking periods. VID* goes low when the CPU addresses the display memory. Normally, VID* goes directly to the video RAM selectors, allowing the CPU to access the display memory. With the de-glitcher installed, the new signal (VID1*) decides whether the CPU or video circuitry can access the display memory. VID1* is low only when both VID* and DLY BLANK go low. The CPU can access the display memory only during blanking periods.

VWAIT*, when low, puts the CPU into a wait state. It goes low when VID* is low (the CPU is trying to access the display memory), and DLY BLANK is high (the video circuitry is displaying characters). With VWAIT* high the CPU operates normally.

The actual circuit, (Fig. 2 and 3) is less obvious than Fig. 1. Fig. 2 is the simple version and Fig. 3 includes a switch to turn the de-glitcher off. The second version is for those who want no sound distortion in their graphics and sound programs.

To use other modifications or peripherals with the WAIT* input, add a tristate buffer to either of the circuits in Fig. 2 and 3. The buffer removes the VWAIT* signal from the WAIT* line until VWAIT* goes low. If this is not done, the de-glitcher circuit will fight with other devices over whether the WAIT* signal should be low or high. Any other devices using the WAIT* input should also be isolated with a tristate buffer. (See Fig. 4).

"Let the CPU read and write the display memory only during blanking periods."

On the simple version (Fig. 2), the buffer is added between Z36A pin 1 and Z40 pin 24. On the switchable version (Fig. 3) it is installed between Z36A pin 1 and S1 point F.

Installation

The following are step by step instructions for installation of the video de-glitcher. Since only one or two integrated circuits are added, I use piggy-back installation rather than constructing a circuit board.

- ● Open the case and place the main circuit board, component side up, on a flat surface.
- ● Locate Z36 on the board.
- ● Bend all pins except 7, 8, and 14 on the new 74LS02 (Z36A) into a horizontal plane.
- ● Install Z36A on top of Z36, soldering pins 7, 8, and 14 of Z36A to the corresponding pins on Z36 (see Fig. 5).
- ● Solder a wire between pins 5 and 10 of Z36A.
- ● Solder a wire between pins 10 and 11 of Z36A.
- ● Solder a wire between pins 11 and 12 of Z36A.
- ● Solder a wire between pins 8 and 6 of Z36A.
- ● Solder a wire between pins 2 and 3 of Z36A.
- ● Solder a wire between pins 3 and 4 of Z36A.
- ● Solder a wire from Z27 pin 7 to Z36A pin 9.
- ● Cut the trace between Z36 pin 8 and Z31 pin 1 (see Fig. 7).

Depending on which version of the circuit you use follow the indicated steps in Fig. 9.

A1. Solder a wire from pin 13 of Z36A to the point indicated in Fig. 8.
A2. Solder a wire from pin 1 of Z36A to the point indicated in Fig. 6.
B1. Solder a wire from pin 13 of Z36A to the point indicated in Fig. 8.
B2. Locate Z75 on the circuit board.
B3. Bend all pins except 7 and 14 of the new 74LS125 (Z75A) into a horizontal plane.
B4. Install Z75A on top of Z75, soldering pins 7 and 14 to the corresponding pins on Z75.
B5. Solder a wire between pins 1 and 2 of Z75A.
B6. Solder a wire from pin 1 of Z36A to pin 2 of Z75A.
B7. Solder a wire from Z75A pin 3 to the point indicated in Fig. 6.

C1. Install the new switch in a suitable place on the TRS-80s case.
C2. Solder a wire from pin 8 of Z36A to point A on the switch.
C3. Solder a wire from pin 13 of Z36A to point C on the switch.
C4. Solder a wire from point B on the switch to the point indicated in Fig. 8.
C5. Solder a wire from pin 1 of

Z36A:	74LS02
275A:	74LS125 (optional)
S1:	DPDT toggle switch (optional)
	Thin-gauge insulated wire, such as wire wrap wire

Table 1. Parts List.

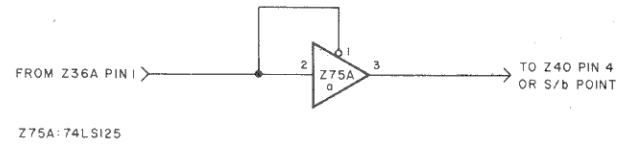

Fig. 4. Buffer Circuit.

Z36A to point F on the switch.
C6. Solder a wire from point E on the switch of the point indicated in Fig. 6.

D1. Install the new switch in a suitable place on the TRS-80s case.
D2. Solder a wire from pin 8 of Z36A to point A on the switch.
D3. Solder a wire from pin 13 of Z36A to point C on the switch.
D4. Solder a wire from point B on the switch to the point indicated in Fig. 8.
D5. Locate Z75 on the circuit board.
D6. Bend all pins except 7 and 14 of the new 74LS125 (Z75A) into a horizontal plane.
D7. Install Z75A on top of Z75, soldering pins 7 and 14 to the corresponding pins on Z75.
D8. Solder a wire between pins 1 and 2 of Z75A.
D9. Solder a wire from pin 1 of Z36A to pin 2 of Z75A.
D10. Solder a wire from pin 3 of Z75A to point F on the switch.
D11. Solder a wire from point E on the switch to the point indicated in Fig. 6.

The video de-glitcher is now installed. Double check your wiring and reassemble the computer.

Testing

Power up to begin testing. If you do not see a normal display, *immediately* turn the machine off and recheck your wiring. If everything looks fine run any program with video glitches or type in the following program:

```
10 'QUICK VIDEO DE-GLITCHER TEST
20 CH = 0
30 FOR I = 15360 TO 16383 'VIDEO
MEMORY ADDRESSES
40 POKE I,CH
50 CH = CH + 1
60 IF CH > 255 THEN CH = 0
70 NEXT I
80 GOTO 20
```

You should see no snow on the screen with this program running. If you installed Version 2, try switching the de-glitcher on and off. Note the difference in the displays. If you still see snow, the circuit is not working properly. Go back and check your wiring.

Postscript

After designing and installing the video de-glitcher, I looked at a Model III schematic. It uses a technique similar to mine to eliminate snow on the new machine. ■

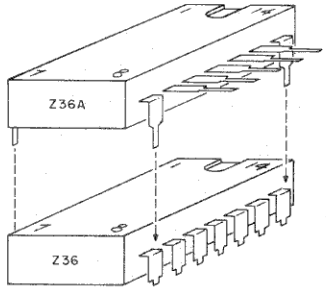

Fig. 5

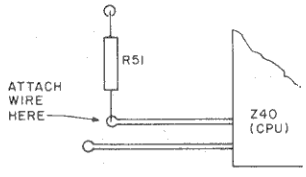

Fig. 6

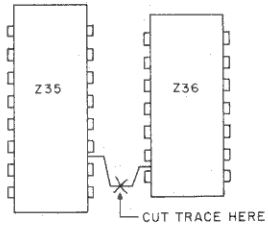

Fig. 7

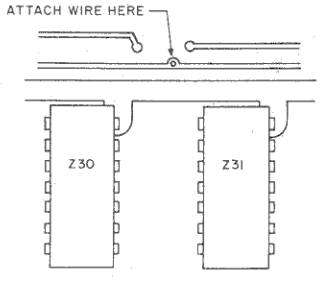

Fig. 8

Version 1 without buffer circuit:	Follow steps starting with A.
Version 1 with buffer circuit:	Follow steps starting with B.
Version 2 without buffer circuit:	Follow steps starting with C.
Version 2 with buffer circuit:	Follow steps starting with D.

Fig. 9

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Computer negatives.

When Black is White

Thomas W. Tache
1522 Melrose Parkway
Norfolk, VA 23508

Readers of *80 Microcomputing* may recall an article by Valerie Vann in the December 1980 issue entitled "Seasons Greetings." In particular, I liked the snow-covered countryside scene so much that I reproduced it on my printer. The beautiful scene on my video display appeared on my printer (as logically it should) reversed. The snow was black! I decided to create the equivalent of a photographic negative of the picture with the graphic characters 128–191.

Graphics Characters

Analysis of the graphics codes reveals an interesting characteristic. A graphics character consists of six segments to a block—all, some, or none of which may be turned on. Those segments of any character which are turned on appear white on the screen. (The segments of the same character, displayed on the printer, appear black.) Since character 191 is all segments on and character 128 is all segments off they are opposites (or complements) of each other. Character 190 has one segment turned off, and character 129 has that segment turned on. Thus, characters 190 and 129 are also complements of each other. This pattern holds true throughout the graphics codes. Character 189 complements 130, 188 complements 131, 187 complements 132, and so on through 160 and 159. With a simple mathematical formula it is possible to convert one graphics character to its negative counterpart.

The formula is based on the above relationship. If we add 128 and 191, we get 319. If we add 129 and 190, we also get 319. Any character code added to its complement equals 319. If we subtract 128 from 319, we get 191; 191 from 319 equals 128; 129 from 319 equals 190, and so on. Thus, subtracting any graphics character in the range 128–191 from 319 yields the complement of that character. Doing this to all characters in a picture results in the negative of that picture. If we let N equal the number of a character code and C equal the complement of that character, then the formula is $C = 319 - N$.

Program Listing 1 demonstrates an application of this formula. Fig. 2 is the equivalent of a photographic negative of Fig. 1. Fig. 3 shows a reference chart of the graphics codes.

Program Analysis

I used remark statements liberally and numbered each section with multiples of one hundred.

The 100 series line numbers identify the program. The 200 series initialize the printer and the program. The 300 series allows the operator to select the negative option. The 400 series processes the data. The 500 series prints the picture. The 600 series on is the data. All but the 300 and 400 series are straightforward.

The 300 series prepares the interpretation of the space compression codes. If you want a negative reproduction of the picture, the program interprets the space compression codes as a string of character 191. If you do not want a negative, the program interprets the space compression codes as a string of character 128. CR holds the character used in the string substituted in place of the space compression code. SELECT$ holds the operator's choice for a negative reproduction.

The 400 series section demonstrates the technique which produces a negative. A For...Next loop beginning at line 402 fills an array of A$(L). The variable N included throughout

The Key Box

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Fig. 1. Black Snowscape.

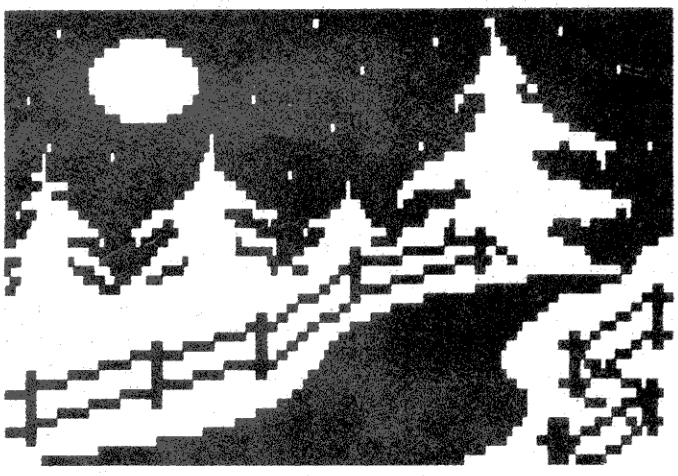

Fig. 2. White Snowscape.

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the data statements indicates the number of data characters in each level of A$(L). It might be a good idea to add a line 409 IF Y < 128 OR N > 128 THEN PRINT "ERROR IN DATA WHEN L = ";L;"AND Z=";Z: STOP. Once the program has run correctly, delete this statement. After N has been read, another For... Next loop reads data statements until the number of data statements read (Z) equals N. As the statements are read, the program performs the tests shown in Table 1.

Line 418 contains the formula. Remember, 319 is the magic number. This technique works with any Level I or Level II system, with or without a printer. The only catch is that you must make the picture using the graphics characters: It will not work for pictures drawn using SET commands. ■

Thomas Tache is systems analyst with Q.E.D. Systems Inc.

Line	Function
412	Data values greater than 191 are space compression codes. My printer interprets them as graphics characters; therefore it was necessary to convert them to strings of spaces. If value is a graphics character, skip 414.
414	The space compression code minus 192 equals the number of spaces to be equated (Y-192). CR will be either character 128 or character 191, as determined in line 318. Add it to the line.
416	Was the negative option selected?
418	If so, and data value is a graphics character, convert the character to its complement.
420	If value is a graphics character, it was not added in 414; add it now.
422	End the For...Next loops.

Table 1. Line Functions.

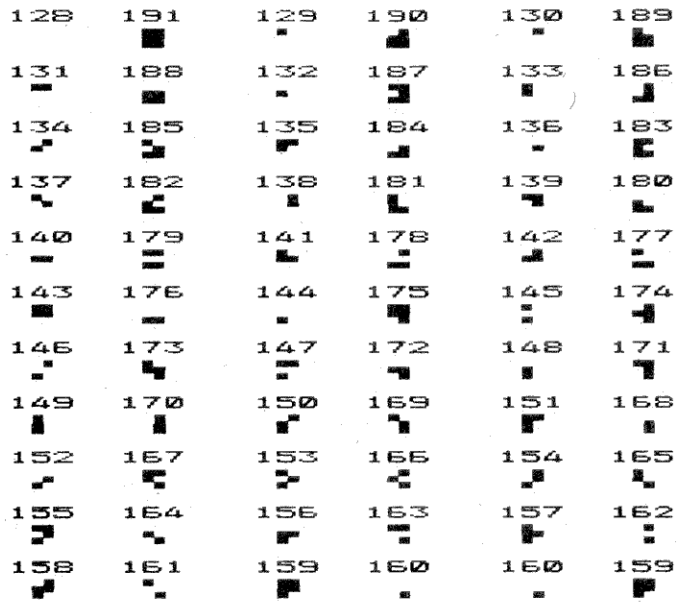

Fig. 3. Graphics codes and their complements.

```
100 '*****************************************************
102 '*                                                   *
104 '*          THIS PROGRAM DEMONSTRATES A TECHNIQUE    *
106 '*          WHICH WILL PRODUCE THE EQUIVALENT OF     *
108 '*          A PHOTOGRAPHIC NEGATIVE OF A PICTURE.    *
110 '*                                                   *
112 '*   WRITTEN:        8/2/81       REV: 8/8/81        *
114 '*   BY:             THOMAS W. TACHE                 *
116 '*                   1522 MELROSE PKWY               *
118 '*                   NORFOLK, VA 23508               *
120 '*                                                   *
122 '*          DATA AND THE BASIC DISPLAY FOR THE       *
124 '*         PICTURE WAS TAKEN FROM AN ARTICLE IN      *
126 '*        THE DEC '80 ISSUE OF 80 MICROCOMPUTING     *
128 '*                  ENTITLED                         *
130 '*              "SEASONS GREETINGS".                 *
132 '*          BY:     VALERIE VANN                     *
134 '*                  631 G STREET                     *
136 '*                  DAVIS, CA 95616                  *
138 '*                                                   *
140 '*****************************************************
142 '
200 '                                  * * * * * * * * * * * *
202 LPRINTCHR$(27);CHR$(65)'           *          SET        *
204 LPRINTCHR$(27);CHR$(54)'           *          UP         *
206 LPRINTCHR$(29)'                    *        PRINTER      *
208 '                                  * * * * * * * * * * * *
210 '
212 '                                  * * * * * * * * * * * *
214 CLEAR2000:DIMA$(16):CLS'           *  INITIALIZE PROGRAM  *
216 '                                  * * * * * * * * * * * *
218 '
300 '                                  * * * * * * * * * * * *
302 PRINT"ENTER ";CHR$(34);"N";'       *     THIS  SECTION    *
304 PRINTCHR$(34);'                    *       ALLOWS         *
306 PRINT" FOR NEGATIVE OF PICTURE "'  *        THE           *
308 PRINT"PRESS <ENTER> ALONE TO ";'   *      OPERATOR        *
310 PRINT"PRINT THE ORIGINAL ";'       *        TO            *
312 PRINT"PICTURE";'                   *      SELECT          *
314 INPUT SELECT$'                     *        THE           *
316 CR=191'                            *      NEGATIVE        *
318 IF LEFT$(SELECT$,1)="N" GOTO 322'  *       OPTION         *
320 CR=128'                            * * * * * * * * * * * *
322 '
400 '                                  * * * * * * * * * * * *
402 FORL=1TO16'
                    *          READ          *
404 A$(L)="":READN'                    *        THE           *
406 FORZ=1TON'                         *       DATA           *
408 READ Y'                            *      VALUES          *
410 '                                  * . . . . . . . . . . .
412 IF Y<=191 GOTO 416'                * . FIND GRAPHIC CHAR . *
414 A$(L)=A$(L)+STRING$(Y-192,CR)'     * .   CREATE SPACES   . *
416 IFLEFT$(SELECT$,1)<>"N"THEN420'    * .   DETECT OPTION   . *
418 IF Y<=191 THEN Y=319-Y'            * .   CONVERT  CHAR   . *
420 IFY<=191THENA$(L)=A$(L)+CHR$(Y)'   * .   ADD  TO  LINE   . *
422 '                                  * . . . . . . . . . . .
424 NEXTZ:NEXTL'                       *    END READ LOOP      *
426 '                                  * * * * * * * * * * * *
428 '
500 CLS'                               * * * * * * * * * * * *
502 PRINTCHR$(28)'                     *        PRINT          *
504 FORL=1TO16'                        *                       *
506 PRINTA$(L);'                       *          THE          *
508 LPRINTTAB(10)A$(L)'                *                       *
510 NEXTL'                             *       PICTURE         *
512 STOP'                              * * * * * * * * * * * *
514 '
600 DATA9,197,144,215,136,208,172,198,144,202
602 DATA19,200,160,184,188,191,191,191,191,189,188,176,215
604 DATA129,195,160,186,189,176,207
606 DATA25,200,191,191,191,191,191,191,191,191,191,191,149
608 DATA207,129,201,176,190,191,191,191,141,176,199,130,197
610 DATA27,194,129,197,130,139,143,191,191,191,191,159,143
612 DATA131,197,130,211,135,128,176,191,191,191,189,188,180,144,
203
614 DATA27,196,144,206,168,203,129,199,160,196,188,191,191
616 DATA191,191,191,191,191,191,143,188,188,180,176,144,194,160,
194
618 DATA30,194,160,186,198,129,199,168,191,176,198,144,197
620 DATA198,176,188,188,191,191,191,191,191,191,191,191,189
622 DATA176,196,130,133,198
624 DATA43,128,160,184,190,183,179,202,176,188,191,191,191
626 DATA191,188,176,200,186,176,195,168,143,131,131,131,131
628 DATA176,187,191,191,191,191,191,191,191,191,191,191,188
630 DATA188,188,176,176,196
632 DATA58,128,129,184,191,191,191,191,188,176,195,176,188
634 DATA143,131,175,191,191,191,191,188,176,178,131,135,194
636 DATA160,140,172,191,191,191,189,176,144,128,176,176,190
638 DATA191,135,191,191,143,191,191,191,191,191,191,135,131
640 DATA131,143,131,131,129,130,196
642 DATA60,140,175,191,191,191,191,172,188,176,129,194,130
644 DATA128,184,190,191,175,191,191,191,191,178,179,179,139
646 DATA128,160,184,188,191,191,191,131,143,140,140,142,179
648 DATA179,179,179,188,140,140,128,172,179,143,191,191,191
650 DATA191,189,188,180,196,160,188,190,191
652 DATA64,134,187,191,191,191,191,189,180,178,139,132,176
654 DATA188,183,179,188,188,191,191,191,191,191,191,191,191
656 DATA189,191,189,188,191,143,179,188,128,143,143,143,179
658 DATA179,179,188,188,188,191,191,140,143,143,143,143,131,131,
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666 DATA191,143,179,188,188,143,143,179,188,191,143,143,131
668 DATA131,131,203,176,188,191,191,191,191,191,159,143,179
670 DATA188,128,188
672 DATA50,191,191,191,191,191,191,191,191,191,191,191,191
674 DATA191,191,143,191,191,143,143,143,179,179,179,188,128
676 DATA188,191,143,179,188,191,143,131,207,176,190,191,191
678 DATA191,143,131,143,179,188,190,191,143,179,128,179
680 DATA49,191,191,143,191,191,191,143,143,143,179,179,179
682 DATA188,188,128,188,188,191,143,143,143,179,179,179,128
684 DATA179,188,191,191,143,129,208,138,191,191,191,191,191
686 DATA191,128,182,131,135,137,188,191,191,191,191
688 DATA45,179,179,128,188,188,188,191,191,143,143,143,179
690 DATA179,179,128,188,188,188,191,191,191,191,191,191,191
692 DATA191,143,135,129,212,131,191,191,191,188,176,152,143
694 DATA175,191,140,132,129,162,191
696 DATA41,143,143,128,179,179,188,188,188,191,191,191,191
698 DATA191,191,191,191,191,191,143,143,143,143,131,131,216
700 DATA160,184,191,191,131,131,191,143,135,179,188,182,139
702 DATA144,162,191
704 DATA32,191,191,188,159,143,143,143,143,143,131,131,131
706 DATA131,131,129,221,176,176,188,188,191,191,191,188,194
708 DATA152,143,143,167,179,188,191
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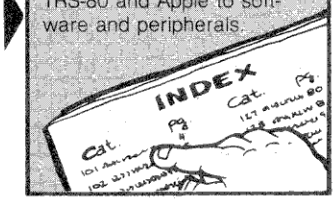
Program Listing

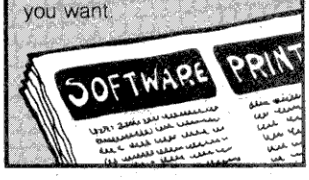
How to Buy or Sell Computer Equipment and Software

Begin your search in the index of Computer Shopper's bargain filled pages. Locate the category and page number of items that interest you from TRS-80 and Apple to software and peripherals.



Start or add to your computer system by finding money saving bargains in each month's issue from individuals who no longer need their personal equipment.

You've got your computer hardware, but what about the software? Use a Computer Shopper ad to find what you need. Someone advertising in Computer Shopper probably has what you want.



If you need help with any computer related problem whether it's an interface problem or advice on the right peripheral for a home-brew system, use the free HELP column especially designed for that purpose.

As you outgrow your system or want to trade up (most dealers won't take trade-ins), use Computer Shopper ads to sell your items to 20,000 readers nationwide for the low cost of 12 cents per word.

Computer Shopper is THE nationwide magazine for buying, selling and trading Micro and Mini-computer equipment and software. Each issue has over 60 pages full of bargains of new and used equipment.

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Now is the time for you to join over 20,000 other computer users who save time and money with a subscription to Computer Shopper.

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✓See List of Advertisers on page 402

A variety of peripherals and expansions make it easy.

Broadening the TRS-80 Horizon

David D. Busch
515 East Highland Avenue
Ravenna, OH 44266

In "Radio Shack versus the Competition" (*80 Microcomputing*, November 1980) I discussed the most common expansion options available to the TRS-80 Model I owner, and compared sticking with Radio Shack with going to an outside supplier for these goodies.

The intervening months have altered the picture considerably; I have reversed my recommendations in some cases. In addition, the Model I is no longer produced in this country, and Model III users have a new set of considerations. Some 300,000 happy owners are ready to expand their sytems.

The Key Box

Model I or III
Disk Drive
Printer
Modem

My original premise was that the computer hobbyist or small business user is not very hardware oriented, and may also be a novice programmer. These users want a plug-in, turnkey computer system; they are at least moderately apprehensive about choosing between Radio Shack's offerings and lower-priced upgrades from the neighborhood House of Computers.

Additional Memory

For the Model I, the upgrade from 4K to 16K was almost automatic. With the Model III, this expansion is even simpler: It is unnecessary to purchase an expansion interface to add memory chips up to 48K. Some enterprising firms have recently introduced "keyboard" memory units so owners of the Model I sans interface can also add the maximum amount of memory without purchasing a disk controller board.

Should you purchase your RAM chips from Radio Shack or some other source? I added "foreign" RAM to my Model I keyboard, and decided to go with Radio Shack for the "touchier" expansion interface memory when I upgraded in late 1979. If I were purchasing a Radio Shack computer today, my choices would be reversed.

The price differential today is as significant as ever. Expanding a Model III 16K machine to 48K costs $198 using Radio Shack memory chips. Other suppliers sell identical sets of chips for about $20 per 16K, or $40–$50 total. Much sifting out of faulty chips has taken place in the last few years; a user should have little difficulty getting a set that works well. Some potential memory problems caused by connectors between the expansion interface and CPU in the original Model I do not exist in the Model III.

With the help of widely available "memory test" programs which root out faulty RAM chips, even neophyte users face little chance of being stuck with an untraceable problem.

To avoid these difficulties, I elected to go with Radio Shack memory in 1979. There seems to be only one solid reason to do so today: A single vendor is responsible for the health and reliability of your computer. Radio Shack will repair computers containing foreign memory chips, but it does not accept responsibility for problems caused by them.

Because Radio Shack bundles its Model III ROM and the first 16K upgrade kit, the simplest course is to add both as a package.

Mass Storage Alternatives

Options for storing programs and data become more numerous every day. Standard cassette recorder use has dropped off severely, replaced, in most cases, by disk systems. Disk offers faster access to data, as well as expanding capabilities through Disk Basic, and sophisticated operating systems like NEWDOS80 and LDOS.

Although Radio Shack's disk drives cost significantly more than others, I purchased two "original equipment" drives for my system. Local servicing seemed preferable to shipping them across country to some other manufacturer. The extra

money was an investment in maintaining close, convenient service facilities. I use my computer in business and can hardly afford to have my machine out of commission for long periods of time.

As it turns out, both drives function poorly at the same time. Taking the drives less than a mile from my home was attractive, but I did not know I would be doing it so often. One drive, a Tandon-built unit, made five trips to the shop during the warranty period, and continued to act up after the warranty expiration.

My second drive, a Shugart model, expired after several years of faithful service. The several days' service I originally enjoyed is a thing of the past.

Meanwhile, my friends who own Percom and other model disk drives are happily computing. Here in the remote reaches of Ohio they must seek service help from distant sources. But some out-of-warranty shops are fast and reliable.

I plan to upgrade to a four drive system in the near future; I will consider seriously drives manufactured by makers other than Radio Shack.

Model III users purchase their disk controller circuitry only at the time they get their initial drive. They must consider whether to get that drive from Radio Shack (which will stand behind the entire computer), or from another supplier. Other firms build disk controllers for first drives, but in most cases, the user must install it.

Another factor is the availability of 80-track drives from outside firms. Given the Model III's double density capabilities, data storage possibilities are prodigious.

Printers

Several years ago, not many printers were available, and all were expensive—$800 and up. Radio Shack offered what was basically a line of Centronics printers sold at prices several hundred dollars higher than the same, frequently discounted, units in Centronics trade dress.

Today, you can buy 80 column dot matrix printers for $300 and up, with fancy features such as proportional spacing, graphics, and near letter-quality offered at very low prices. Radio Shack's printers are competitively priced, and can be purchased on sale from time to time as genuine bargains.

Daisy-wheel printers, gaining in popularity, are available for about $1400–$3500. Radio Shack's own version is priced at the lower middle end of that range.

"... both drives function poorly at the same time."

Radio Shack or the competition? A printer can be large, bulky, heavy and hard to ship. If you plan on heavy use and expect to require service frequently, find a reliable local service outlet. Radio Shack offers thousands of drop-off points for printers. Many local computer stores have their own service technicians.

However, mail-order purchase of a printer is not out of the question. My own Integral Data Systems unit has functioned perfectly for nearly three years without a service call. I give it only light-duty use: 30 pages of program listings a week, and another 30–50 pages of text.

You may use your printer more heavily, but except for those using their computers for writing, issuing invoices, or printing checks or mailing labels, a sidelined printer seldom brings an entire system to a screeching halt.

Modems and Serial Interfaces

Radio Shack stacks up well in this area. I have used my rugged and reliable Modem I, a direct connect unit, for some months. At $149 it cost less than more portable acoustic units, but those have fewer features. Linked through the cassette port, it is one way to give Model I users without an expansion in-

YOU DON'T NEED AN EXPANSION INTERFACE!

Running out of room?

Increase the memory in your TRS-80® Model I or PMC® up to 48K with no external hardware! The INTERNAL MEMORY™ plugs in inside your keyboard case with NO SOLDERING and can be easily removed at any time. Hundreds of satisfied customers have proven that the INTERNAL MEMORY is reliable, does not cause heat or power supply problems, and is compatible with virtually all hardware and software.

IM-1B INTERNAL MEMORY™ (**32K**) $85.50 complete ($59.50 less RAM)
IM-2 INTERNAL MEMORY™ (**48K**) $140.00 complete ($89.50 less RAM)

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The SPRINTER™ plugs into the Z-80 socket in your TRS-80/PMC case with NO SOLDERING. The SPRINTER equips your computer with a standard parallel printer port (extending out the case by the expansion connector) with no other hardware or software needed. In addition, the SPRINTER allows software selection of 8 different speeds from ⅔ to 3 times "normal" (no delay line needed). Speed automatically switches to normal during cassette and disk operations.

SPRINTER™ speed-up/printer port (assembled & tested) $99.50
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COLOR COMPUTER SOFTWARE

EDITOR ASSEMBLER DEBUGGER $6.95

CCEAD: This 8K Basic Program supports cassette files, has full cursor control, line insertion/deletion, and much more. Two pass assembler supports full 6809 instruction set & addressing modes, lists to screen or printer. Debugger allows memory examine/modify, program execution. If not delighted return within 2 weeks for a full refund. You get fully commented Basic source & complete instructions. Requires Ext. Basic & 16K. ... CASSETTE $6.95

DELUXE TERMINAL PROGRAM

COLORCOM/E: This terminal program has everything! PLUS it's in a convenient plug-in cartridge. LOOK at these features.

- Complete upload & download support
- Selectable baud rate & parity
- Full or half duplex
- Write to any printer or cassette
- Supports ANY serial printer
- Automatic or manual capture
- Selectable Capture characters
- Exchange Basic programs
- Word mode means no split words
- And much, much more

Use with Compuserve, The Source, etc. Talk to other Color Computers. Works with any model Color Computer & full duplex RS232 modem. ... CARTRIDGE $49.95

STRIPPER: The Stripper takes off all that excess fat in your Basic Programs. Three valuable commands: (1) Delete Remarks. (2) Pack Lines: (3) Delete Spaces. Fully automatic, is not fooled by GOTO's, GOSUB's, etc. Your programs will run faster and take up much less memory. ... CASSETTE $7.95

BOOTSTRAP: This Cartridge automatically loads and executes Basic programs from cassette at power-up. Can't fail. Ignores data files, Machine Language files, or Basic files that have errors. For those programs that have to run! ... CARTRIDGE $34.40

RS232 EXPANSION CABLE: With this cable you can connect 2 devices at the same time to the RS232 part of your Color Computer. Great for printer & modem. ... RS232 Cable $20.00

CUSTOM CARTRIDGES: Put YOUR Basic program into a convenient ROM Cartridge. It's easy! Runs instantly at power-up, frees up memory. Use for Ad displays, schools, etc. Call or write for info. ... FROM $41.65

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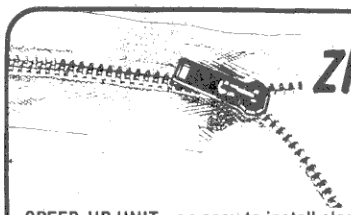

ZIP UP YOUR MODEL I

SPEED-UP UNIT - an easy to install electronic device that enables programs to run 2 to 3 times faster. It's the fastest and finest quality speed-up unit on the market.

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- programs will run up to 3 times faster (5.3 mhz) by adding a Z80B microprocessor and delay line - not supplied.
- returns automatically to normal speed during disk and cassette operation - no software patches required.
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VIDEO I. Reverses the video display to provide black characters and graphics on an all white screen for a much easier to read presentation. Software controlled. Cures pulling and distortion problems commonly experienced with TRS-80 monitors. For use with TRS-80 monitors only. Assembled.

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terface a dial-up connection.

My RS-232 interface is also a Radio Shack unit. The board itself has performed faultlessly. I must jiggle and tighten the connector at intervals to ensure good contact. Fortunately, I use an intelligent terminal program that tests the RS-232 every time the program is run. Only on rare occasions has my serial interface crashed during use.

Other modems, such as the Micro Connection and the Lynx, allow telecommunications without an RS-232 board.

In my case, the RS-232's problems are minor, and would not weigh heavily should I have to choose again. I like the Modem I's low, low price.

Software

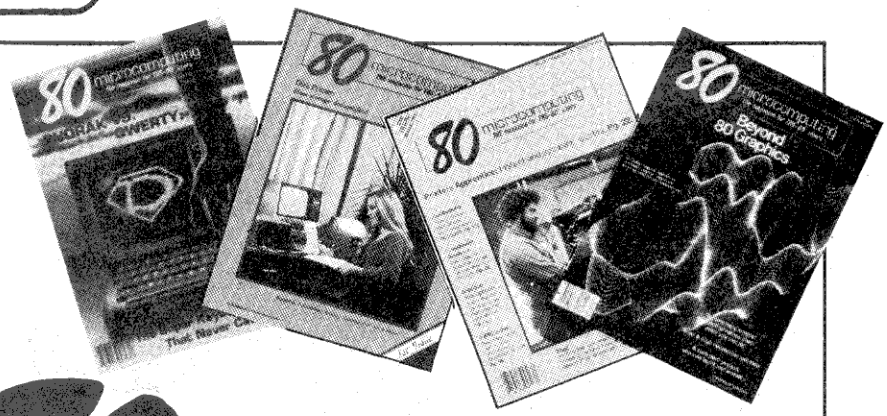
There are no overriding reasons to stick with Radio Shack software for any particular applications. Some offerings are pale imitations of popular programs offered elsewhere. Others, such as Scripsit, become standards against which all similar programs are measured. In a few areas Radio Shack lags badly behind the state of the art (for example, Disk Operating Systems).

If the software you need is not available from Radio Shack, it will generally be offered by outside firms now writing for the TRS-80 Models I and III. Fortunately, many good magazines review software and provide valuable information on the relative worth of each new package.

The hundreds of thousands of TRS-80 owners have a treasure trove of programming available at low cost. Software is possibly the most exciting of all expansion offerings, the area in which it is easiest to go right. ■

David Busch is a partner in a nationwide public relations/photojournalism firm. Since 1974, he has written more than 200 computer and word processing-oriented articles. He owns, operates, or programs five different microcomputers.

Make Money Selling



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the only major journal for the users of the TRS-80*, a sure bet for getting the computer enthusiast into your store. Once through the door you can sell him anything.

We know **80** will make you money . . . it's the only magazine for the TRS-80* users and you know how many of those there are. So call today and join the dealers who make money with **80**.

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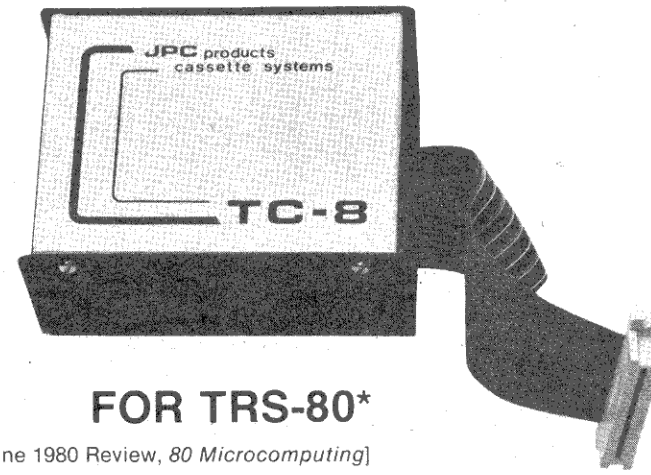
Poor Man's Floppy

HIGH SPEED CASSETTE SYSTEM



FOR TRS-80*

Now the widely acclaimed JPC Cassette System is available for your TRS-80* computer. The price is only $90.00

TC-8 Cassette System
JPC Products
Albuquerque, NM
Kit: $90
Assembled: $120

by Carl A. Kollar

[Reprint of June 1980 Review, *80 Microcomputing*]

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of *Microcomputing* had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly [90] bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free. I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of 8½ × 11 papers stapled together. It is written in the nicest format I've seen in a while. Each command and/or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.
LOAD: Reads the next BASIC program from the cassette.
LOAD"filename": Searches for and loads the specified file from cassette.
LOAD? and LOAD?"filename": Reads file from cassette, and compares contents to memory.
LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.
LOADN"filename": Same as above except the tape will stop at the end of the program named.
KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.
RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.
RUN"filename": TC-8 searches for a specified program and runs it immediately.
PUT"filename": Same as SAVE "filename", except it is for use with system tapes.
GET: Same as LOAD, except it is for use with system tapes.
GET"filename": Same as LOAD "filename", except it is for use with system tapes.
GET? and GET?"filename": Same as LOAD? and LOAD?"filename", except it is for use with system tapes.
GETN and GETN"filename": Same as LOADN and LOADN"filename", except it is for use with system tapes.
OPEN: Required before cassette input or output of a data file can be attempted.
CLOSE: Required to end a cassette data file.
PRINT#: Allows numerical or string data to be output to a cassette file.
INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button. ■

ORDER NOW

To order your TC-8 kit, send your check or money order for $90.00 plus $3.50 postage and handling to JPC PRODUCTS CO., 12021 Paisano Ct., Albuquerque, NM 87112 (New Mexico residents add 4% sales tax). Credit card orders accepted by phone or mail. Personal checks will delay shipment. We will otherwise immediately ship you the TC-8 kit, the cabinet, the ribbon cable, the power adapter, an instruction manual, and a cassette containing the software.

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JPC PRODUCTS CO.
Phone (505) 294-4623
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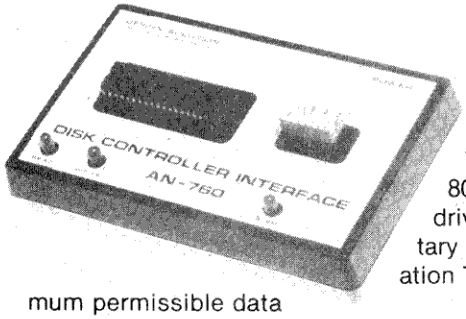
HARDWARE BREAKTHROUGH

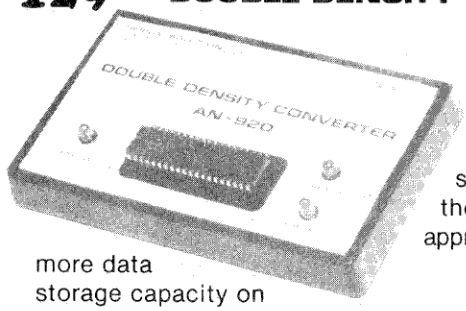
DESIGN SOLUTION INC. presents the AN-SERIES DEVELOPMENT SYSTEM for TRS-80™, Apple II™, Commodore PET™, Superbrain™*

$99.95 DISK CONTROLLER



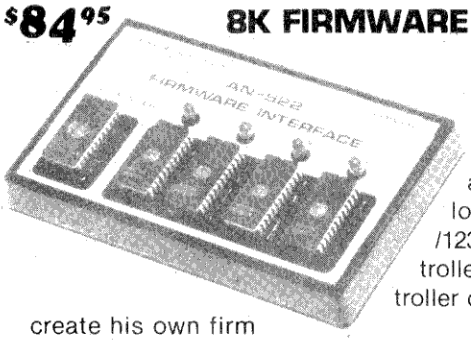
An affordable multidrive floppy disk interface. The AN-760 supports 35, 40, 80 and 160 track drives. Using proprietary Digital Data Separation Techniques, maximum permissible data transfer integrity is assured. Read, write, and step LED indicators prompt operator during all disk I/O. The AN-760 comes complete with power supply module and operation manual. (Operating system software optional.)

$129.95 DOUBLE DENSITY CONVERTER



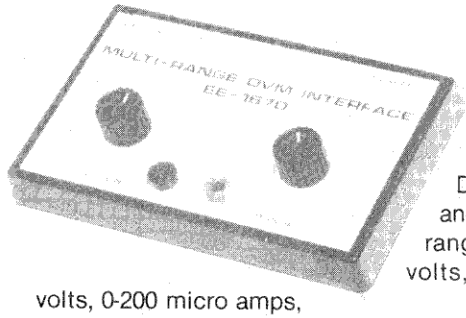
Using DSI Proprietary Data Separation and Write Precompensation Techniques, the AN-920 provides approximately 1.6 times more data storage capacity on your 5¼ disk drives. The AN-920 can be used in conjunction with the AN-760 FDC or the TRS-80 expansion interface. Double Density System comes complete with power supply module and operation manual. (Required Newdos-80 Ver 2.0 Disk Operation System Optional.)

$84.95 8K FIRMWARE INTERFACE



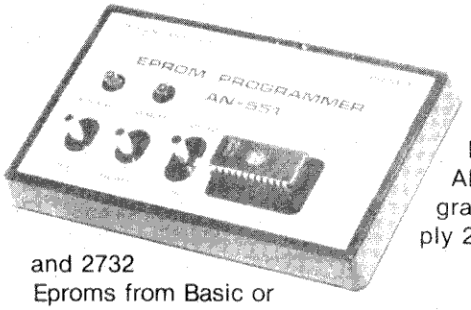
8K Bytes of User Programable Firmware (4-2716 Eproms) are automatically loaded by system /12345 Command controlled by a 2716 controller chip. The user can create his own firm operating system to load and execute programs from Eprom or to provide user defined arithmetic functions. Comes complete with power supply, operation manual and controller chip. (The AN-522 requires AN-551 Eprom programmer.)

$99.95 MULTI-RANGE DVM INTERFACE



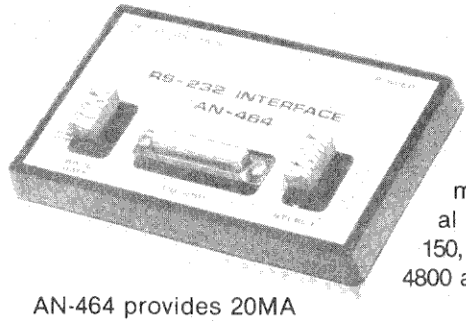
Analog Signal Interface is now as easy as turning a knob. EE-1670 provides DVM functions volts, and milli-amps and 8 ranges, 1-200 millivolts, 0-2, 0-20, 0-200 volts, 0-200 micro amps, 0-2, 0-20, 0-200 milliamps, standard banana jacks and test leads create perfect connection scheme for real time analog data acquisition. EE-1670 system is complete with power supply and manual of operation.

$99.95 EPROM PROGRAMMER



An enhanced version of our original Eprom Programmer, the AN-551 will now program the single supply 2516, 2716, 2532 and 2732 Eproms from Basic or machine language. Software provided will load Eprom from TRS-80 Ram or load TRS-80 Ram from Eprom with complete on-screen verification. The AN-551 comes complete with power supply and operation manual.

$89.95 RS-232 INTERFACE



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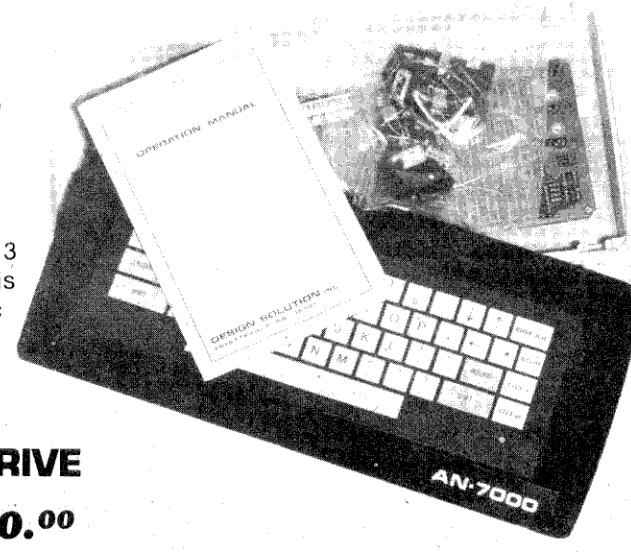

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Most Space Invader games move the aliens two X positions to the left or right and three Y positions down at a time. Even arcade games move the aliens in blocks rather than single X or Y positions at a time. Why? A picture of an invader might occupy three adjacent CHR$ graphic blocks. It is difficult to slide the invaders only one X position at a time, because a CHR$ is two X positions wide. Likewise, a CHR$ is three Y positions tall; it is easier to move the invader three full Y positions. The Assembly Language program shown in Program Listing 1 shifts graphics on the screen ½ of a CHR$ position (one X position) left and right, and ⅓ of a CHR$ position (one Y position) up and down. Use this program to shift banners, to make a picture of a car driving along, or for any other graphics application requiring precise shifting. The shifting ignores all non-graphic characters; shifting the letters by one X or Y position is impossible with software.

Program Listing 1.

```
7D00            00100          ORG     32000
7D00 21003C     00110 A128S    LD      HL,15360        ; LINES 110-
210
7D03 010004     00120          LD      BC,1024         ; CHANGE ALL
 32'S ON
7D06 7E         00130 LOOPB    LD      A,(HL)          ; THE SCREEN
 TO 128'S
7D07 FE20       00140          CP      32              ; SO THE SCR
EEN IS
7D09 2002       00150          JR      NZ,LOOPA        ; COMPATIBLE
 WITH THE
7D0B 3680       00160          LD      (HL),128        ; SHIFTING P
ROGRAM.
7D0D 23         00170 LOOPA    INC     HL
7D0E 0B         00180          DEC     BC
7D0F 78         00190          LD      A,B
7D10 B1         00200          OR      C
7D11 20F3       00210          JR      NZ,LOOPB
7D13 CD7F0A     00220          CALL    0A7FH           ; GET M FROM
 X=USR(M)
7D16 7D         00230          LD      A,L             ; LINES 230-
320
7D17 3D         00240          DEC     A               ; JUMP TO TH
E SHIFT
7D18 280A       00250          JR      Z,UP            ; DIRECTION
REQUESTED
7D1A 3D         00260          DEC     A               ; OR RETURN'
S TO BASIC
7D1B 283F       00270          JR      Z,DOWN          ; IF AN ILLE
GAL NUMBER
7D1D 3D         00280          DEC     A               ; WAS GIVEN.

7D1E 2872       00290          JR      Z,LEFT
7D20 3D         00300          DEC     A
7D21 286D       00310          JR      Z,RITE
7D23 C9         00320          RET
                00330 ;        SHIFT SCREEN UP ROUTINE FROM LINE 34
0 TO 640
7D24 21003C     00340 UP       LD      HL,15360
7D27 010004     00350          LD      BC,1024
7D2A CB7E       00360 LOOP1    BIT     7,(HL)
7D2C 2007       00370          JR      NZ,FIX1
7D2E 0B         00380 NEXT1    DEC     BC
```

Program continues

Sometimes it is unnecessary to shift the entire screen. To modify the shift area for shift up, line 340 should load HL with the lowest spot on the screen you want to move. Line 350 should load BC with the number of positions up from the spot you want to shift. You can modify shift left in the same way; line 970 should load HL and line 980 should load DE (instead of BC). For shift down, line 660 should load HL with the highest screen position to be shifted. Line 670 should load BC with the number of positions down from the first spot you want to shift. Modify shift right like shift down; line 1380 should load HL and line 1390 should load DE. After the program is in memory, you can relocate it. If you call the program from Basic, use X = USR(D). If D equals one then shifting goes up. Two shifts down; three shifts left; and four shifts right. If you call the program from another machine language program delete lines 220 and 230. When calling the program, load A with one for up, two for down, three for left and four for right.

You can combine the program shown in Listing 2 with a Basic program. Change line 45000 to make X equal the starting address you desire (or leave it as is).

The program in Listing 3 must be used with Listings 1 or 2. If you use Listing 1, POKE 16526–16527 with the starting address you choose. Listing 2 takes care of the POKEs for you.

Combination Shifts

There are four possible diagonal shifts—left and up, right and up, left and down, and right and down. The program shown in Listing 4 shifts at a slope. A slope is a vertical increase or decrease divided by a horizontal increase or decrease. The vertical movement is Y and the horizontal movement is X. When running Listing 4, enter the X and Y separated by commas. This program then shifts some graphics along that slope. To enter a new slope, press the space bar while the graphics are moving. ■

The Key Box

Basic Level II
Model I or III
16K RAM

Ron Goodman, a 15-year old Beatles freak, has been working on a TRS-80 for about two years.

Program continued

```
7D2F 23          00390          INC     HL
7D30 78          00400          LD      A,B
7D31 B1          00410          OR      C
7D32 20F6        00420          JR      NZ,LOOP1
7D34 C9          00430          RET
7D35 C5          00440 FIX1     PUSH    BC
7D36 46          00450          LD      B,(HL)
7D37 114000      00460          LD      DE,64
7D3A ED52        00470          SBC     HL,DE
7D3C CB7E        00480          BIT     7,(HL)
7D3E 280C        00490          JR      Z,GOBAK1
7D40 CB40        00500          BIT     0,B
7D42 2802        00510          JR      Z,NEXBT1
7D44 CBE6        00520          SET     4,(HL)
7D46 CB48        00530 NEXBT1   BIT     1,B
7D48 2802        00540          JR      Z,GOBAK1
7D4A CBEE        00550          SET     5,(HL)
7D4C 19          00560 GOBAK1   ADD     HL,DE
7D4D CB3E        00570          SRL     (HL)            ; SHIFT BYTE

7D4F CB3E        00580          SRL     (HL)            ; SHIFT AGAI
N
7D51 CBFE        00590          SET     7,(HL)
7D53 CBB6        00600          RES     6,(HL)
7D55 CBAE        00610          RES     5,(HL)
7D57 CBA6        00620          RES     4,(HL)
7D59 C1          00630          POP     BC
7D5A 18D2        00640          JR      NEXT1
                 00650 ;        SHIFT SCREEN DOWN ROUTINE FROM LINE
660 TO 950
7D5C 21FF3F      00660 DOWN     LD      HL,16383
7D5F 010004      00670          LD      BC,1024
7D62 CB7E        00680 LOOP2    BIT     7,(HL)
7D64 2007        00690          JR      NZ,FIX2
7D66 0B          00700 NEXT2    DEC     BC
7D67 2B          00710          DEC     HL
7D68 78          00720          LD      A,B
7D69 B1          00730          OR      C
7D6A 20F6        00740          JR      NZ,LOOP2
7D6C C9          00750          RET
7D6D C5          00760 FIX2     PUSH    BC
7D6E CB26        00770          SLA     (HL)            ; SHIFT BYTE

7D70 CB26        00780          SLA     (HL)            ; SHIFT AGAI
N
7D72 CBFE        00790          SET     7,(HL)
7D74 CBB6        00800          RES     6,(HL)
7D76 114000      00810          LD      DE,64
7D79 ED52        00820          SBC     HL,DE
7D7B 46          00830          LD      B,(HL)
7D7C 19          00840          ADD     HL,DE
7D7D CB78        00850          BIT     7,B
7D7F 280C        00860          JR      Z,GOBAK2
7D81 CB68        00870          BIT     5,B
7D83 2802        00880          JR      Z,NEXBT2
7D85 CBCE        00890          SET     1,(HL)
7D87 CB60        00900 NEXBT2   BIT     4,B
7D89 2802        00910          JR      Z,GOBAK2
7D8B CBC6        00920          SET     0,(HL)
7D8D C1          00930 GOBAK2   POP     BC
7D8E 18D6        00940          JR      NEXT2
7D90 184B        00950 RITE     JR      RIGHT
                 00960 ;        SHIFT SCREEN LEFT ROUTINE FROM LINE
970 TO 1360
7D92 21003C      00970 LEFT     LD      HL,15360
7D95 110004      00980          LD      DE,1024
7D98 CB7E        00990 LOOP3    BIT     7,(HL)
7D9A 201C        01000          JR      NZ,GRAFC3
7D9C 23          01010 NEXT3    INC     HL
7D9D 1B          01020          DEC     DE
7D9E 7A          01030          LD      A,D
7D9F B3          01040          OR      E
7DA0 20F6        01050          JR      NZ,LOOP3
7DA2 213F3C      01060          LD      HL,15423
7DA5 114000      01070          LD      DE,64
7DA8 0610        01080          LD      B,16
7DAA CB7E        01090 LINE3    BIT     7,(HL)
7DAC 2806        01100          JR      Z,NOGRF3
7DAE CB8E        01110          RES     1,(HL)
7DB0 CB9E        01120          RES     3,(HL)
7DB2 CBAE        01130          RES     5,(HL)
7DB4 19          01140 NOGRF3   ADD     HL,DE
7DB5 10F3        01150          DJNZ    LINE3
7DB7 C9          01160          RET
7DB8 CB2E        01170 GRAFC3   SRA     (HL)            ; SHIFT BYTE

7DBA CBB6        01180          RES     6,(HL)
7DBC CBAE        01190          RES     5,(HL)
7DBE CB9E        01200          RES     3,(HL)
7DC0 CB8E        01210          RES     1,(HL)
7DC2 23          01220          INC     HL
7DC3 46          01230          LD      B,(HL)
7DC4 2B          01240          DEC     HL
7DC5 CB78        01250          BIT     7,B
7DC7 28D3        01260          JR      Z,NEXT3
7DC9 CB40        01270          BIT     0,B
7DCB 2802        01280          JR      Z,NEXBT3
7DCD CBCE        01290          SET     1,(HL)
7DCF CB50        01300 NEXBT3   BIT     2,B
7DD1 2802        01310          JR      Z,MORBT3
7DD3 CBDE        01320          SET     3,(HL)
7DD5 CB60        01330 MORBT3   BIT     4,B
7DD7 28C3        01340          JR      Z,NEXT3
7DD9 CBEE        01350          SET     5,(HL)
7DDB 18BF        01360          JR      NEXT3
                 01370 ;        SHIFT SCREEN RIGHT ROUTINE FROM LINE
 1380 TO 1770
7DDD 21FF3F      01380 RIGHT    LD      HL,16383
7DE0 110004      01390          LD      DE,1024
7DE3 CB7E        01400 LOOP4    BIT     7,(HL)
7DE5 201C        01410          JR      NZ,GRAFC4
7DE7 2B          01420 NEXT4    DEC     HL
7DE8 1B          01430          DEC     DE
7DE9 7A          01440          LD      A,D
7DEA B3          01450          OR      E
7DEB 20F6        01460          JR      NZ,LOOP4
7DED 21003C      01470          LD      HL,15360
7DF0 114000      01480          LD      DE,64
7DF3 0610        01490          LD      B,16
7DF5 CB7E        01500 LINE4    BIT     7,(HL)
7DF7 2806        01510          JR      Z,NOGRF4
7DF9 CB86        01520          RES     0,(HL)
7DFB CB96        01530          RES     2,(HL)
7DFD CBA6        01540          RES     4,(HL)
7DFF 19          01550 NOGRF4   ADD     HL,DE
7E00 10F3        01560          DJNZ    LINE4
7E02 C9          01570          RET
7E03 CB26        01580 GRAFC4   SLA     (HL)            ; SHIFT BYTE

7E05 CB96        01590          RES     2,(HL)
7E07 CBA6        01600          RES     4,(HL)
7E09 CBB6        01610          RES     6,(HL)
7E0B CBFE        01620          SET     7,(HL)
7E0D 2B          01630          DEC     HL
7E0E 46          01640          LD      B,(HL)
7E0F 23          01650          INC     HL
7E10 CB78        01660          BIT     7,B
7E12 28D3        01670          JR      Z,NEXT4
7E14 CB48        01680          BIT     1,B
7E16 2802        01690          JR      Z,NEXBT4
7E18 CBC6        01700          SET     0,(HL)
7E1A CB58        01710 NEXBT4   BIT     3,B
7E1C 2802        01720          JR      Z,MORBT4
7E1E CBD6        01730          SET     2,(HL)
7E20 CB68        01740 MORBT4   BIT     5,B
7E22 28C3        01750          JR      Z,NEXT4
7E24 CBE6        01760          SET     4,(HL)
7E26 18BF        01770          JR      NEXT4
0000             01780          END
00000 TOTAL ERRORS
```

```
45000 X=32000
45005 READA$:IFA$<>"/**"THEN45005:DATA/**
45010 M=INT(X/256):L=X-M*256:POKE16526,L:POKE16527,M
45020 READA:CS=CS+A:IFA<>-1THENPOKEX,A:X=X+1:GOTO45020
45030 IFCS<>32245THENPRINT"BAD CHECKSUM, CHECK DATA AND TRY AGAI
N."
45040 RETURN
50000 DATA33,0,60,1,0,4,126,254,32,32,2,54,128,35,11,120,177,32
50010 DATA243,205,127,10,125,61,40,10,61,40,63,61,40,114,61,40
50020 DATA109,201,33,0,60,1,0,4,203,126,32,7,11,35,120,177,32
50030 DATA246,201,197,70,17,64,0,237,82,203,126,40,12,203,64,40
50040 DATA2,203,230,203,72,40,2,203,238,25,203,62,203,62,203
50050 DATA254,203,182,203,174,203,166,193,24,210,33,255,63,1,0
50060 DATA4,203,126,32,7,11,43,120,177,32,246,201,197,203,38
50070 DATA203,38,203,254,203,182,17,64,0,237,82,70,25,203,120
50080 DATA40,12,203,104,40,2,203,206,203,96,40,2,203,198,193,24
50090 DATA214,24,75,33,0,60,17,0,4,203,126,32,28,35,27,122,179
50100 DATA32,246,33,63,60,17,64,0,6,16,203,126,40,6,203,142,203
50110 DATA158,203,174,25,16,243,201,203,46,203,182,203,174,203
50120 DATA158,203,142,35,70,43,203,120,40,211,203,64,40,2,203
50130 DATA206,203,80,40,2,203,222,203,96,40,195,203,238,24,191
50140 DATA33,255,63,17,0,4,203,126,32,28,43,27,122,179,32,246
50150 DATA33,0,60,17,64,0,6,16,203,126,40,6,203,134,203,150,203
50160 DATA166,25,16,243,201,203,38,203,150,203,166,203,182,203
50170 DATA254,43,70,35,203,120,40,211,203,72,40,2,203,198,203
50180 DATA88,40,2,203,214,203,104,40,195,203,230,24,191,-1
```

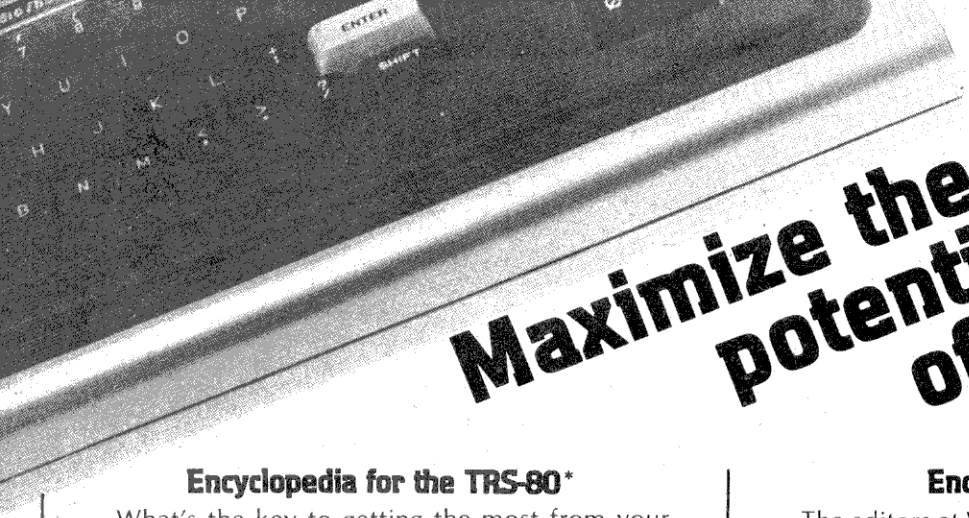
Program Listing 2.

```
5 GOSUB45000:REM LEAVE THIS LINE OUT IF YOU ARE USING LISTING 1
10 CLS:CLEAR100:FORX=1TO15:PRINTSTRING$(64,191);:NEXTX
20 PRINT@474,"LITTLE SHIFT";
30 G(1)=1:G(2)=3:G(3)=2:G(4)=4:FORA=1TO20STEP4:FORD=1TO4:FORC=1T
OA:X=USR(G(D)):NEXTC,D,A
40 CLS:FORX=470TO598STEP64:FORY=0TO5:READG:PRINT@X+Y,CHR$(G):NEX
TY,X
50 PRINT@0,"USE THE FOUR ARROW KEYS TO MOVE THE FACE."
60 A=PEEK(14400):IFA=8THENG=1ELSEIFA=16THENG=2ELSEIFA=32THENG=3E
LSEIFA=64THENG=4ELSE60
70 X=USR(G):GOTO60
100 DATA152,163,147,163,147,164
110 DATA149,160,136,132,144,170
120 DATA130,164,179,179,152,129
```

Program Listing 3.

```
5 GOSUB45000:REM DELETE THIS LINE IF YOU ARE USING LISTING 1
10 CLS:DEFINTX-Z:INPUT"ENTER THE SLOPE Y/X (USE THIS FORM - Y,X)
";Y,X:CLS
15 PRINT@472,CHR$(191);STRING$(5,179);CHR$(140);STRING$(5,179);C
HR$(191);
20 IFX>0THENFORM=1TOX:S=USR(4):NEXTM:GOTO40
30 IFX<0THENFORM=XTO-1:S=USR(3):NEXTM
40 IFY>0THENFORM=1TOY:S=USR(2):NEXTM:GOTO60
50 IFY<0THENFORM=YTO-1:S=USR(1):NEXTM:GOTO60
60 IFPEEK(14400)=128THENRUNELSE20
```

Program Listing 4.



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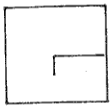

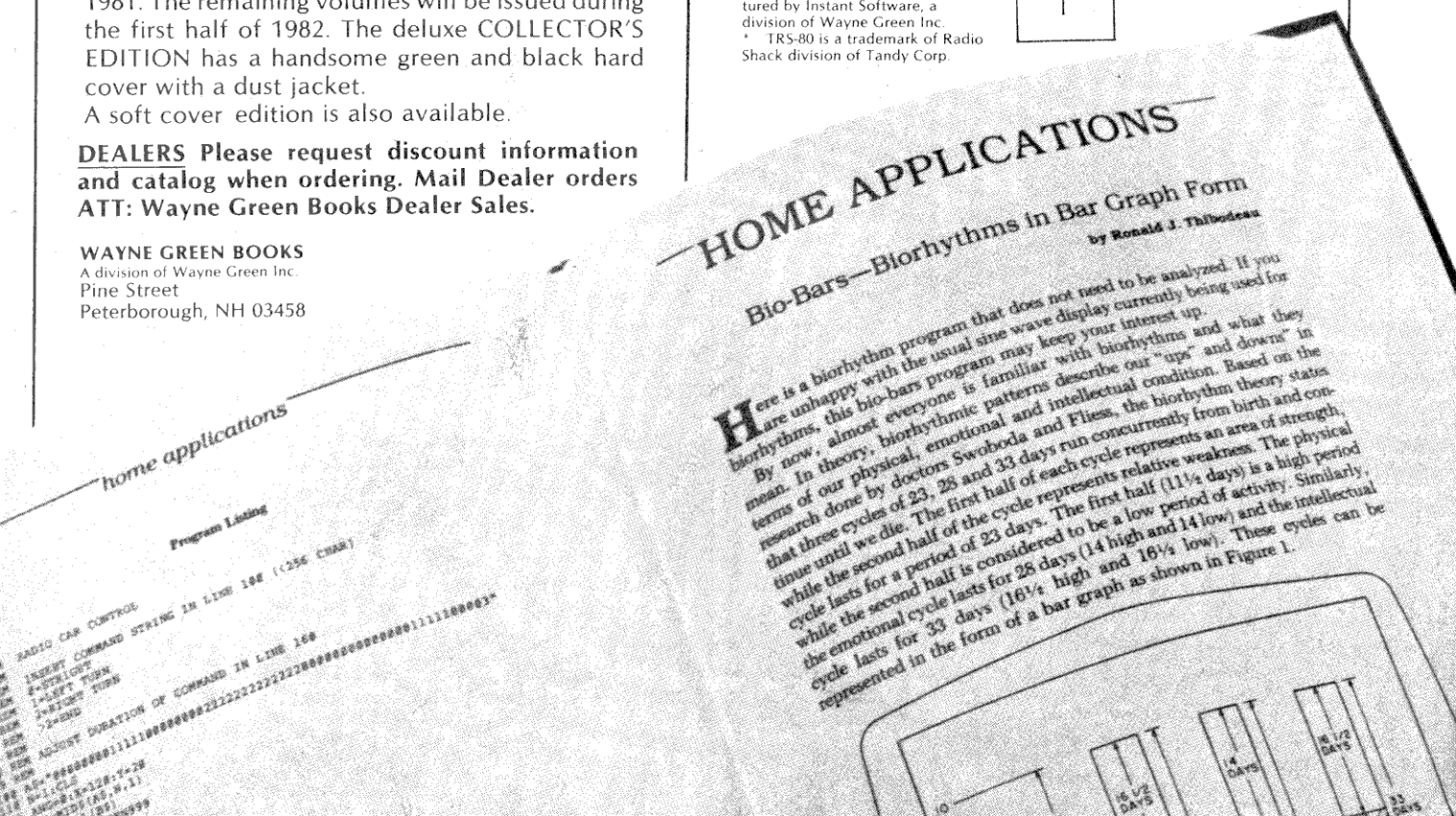

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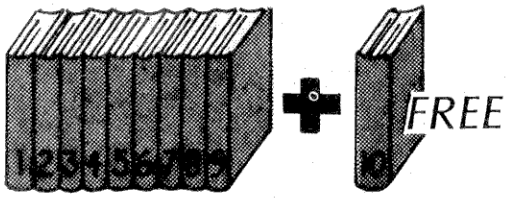

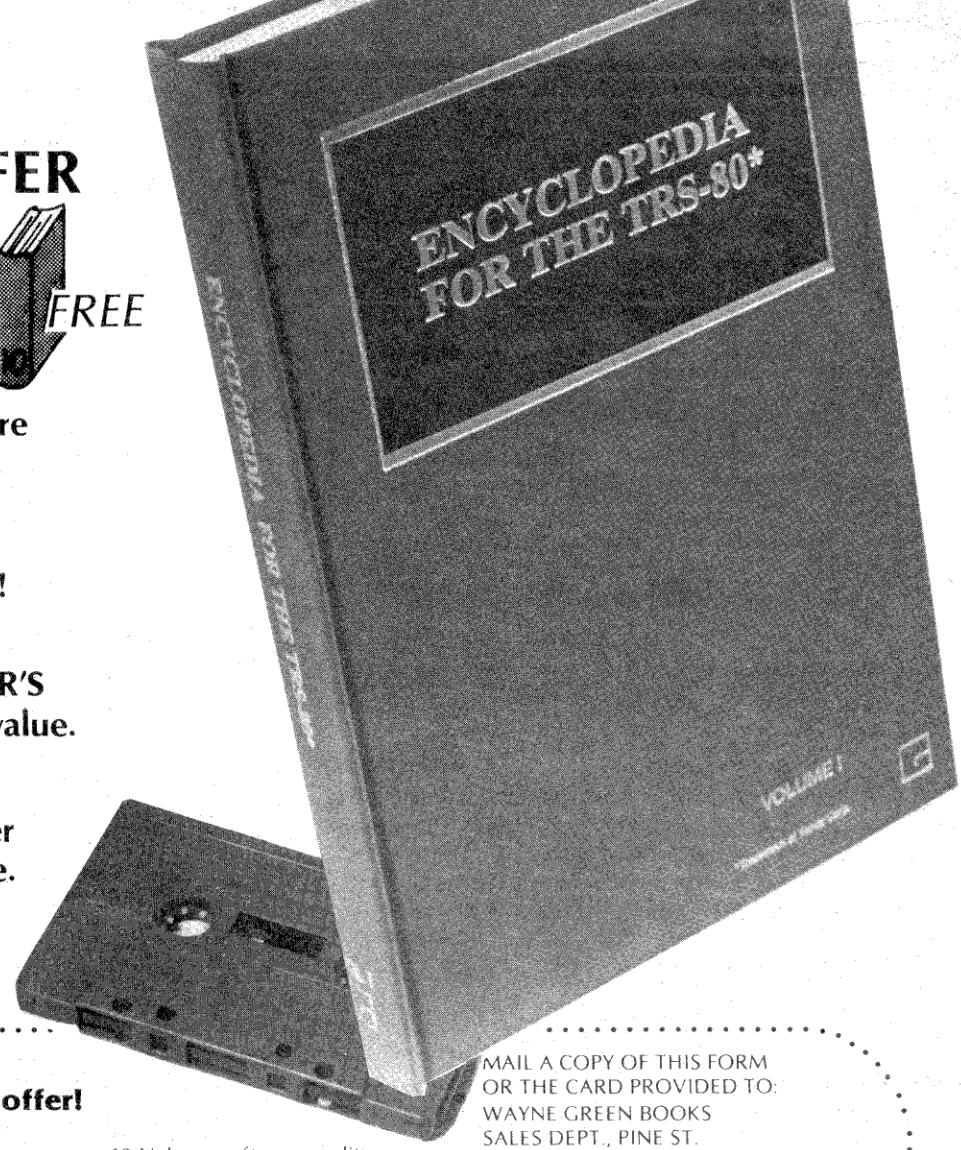

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Trials and tribulations of mail order.

When the Postman Doesn't Even Ring Once

Robert E. Averill
P.O. Box 99
Belfair, WA 98528

It was time for me to up-grade my TRS-80 computer system. I wanted an expansion interface, a disk drive, a good printer and a lowercase modification so that I could use a disk version of Scripsit instead of the tape version.

I had seen plenty of good sounding advertisements for the hardware and software that I wanted, and most of them promising that if I just dialed their 800 toll free number I could have anything I wanted.

I made a very careful list and narrowed down the selection of possible suppliers to five that seemed to have what I wanted at a price I felt I could afford. Next, I telephoned a friend and asked him where he had bought his new Epson MX-80 printer, which he was very happy with and had ordered c.o.d. from one of the suppliers on my list. He said that he had received it via UPS three days from the date he ordered on their toll free number.

By this time I was nearly jumping up and down with excitement—just imagine—I could be using my new printer in just three or four days if I phoned in now. I picked up the phone, dialed the number from the advertisement, and placed an order for an Epson model MX80FT printer and the necessary interconnecting cables. I gave my purchase order number and asked what the full price would be including c.o.d. charges.

I decided I didn't want to pay the extra c.o.d. charges so I told the order taker that I would put a cashiers check in the mail tomorrow for the whole amount to avoid mailing charges. I mailed a cashiers check for the amount, air mail and started my wait for the printer.

Toll Free Fever

I felt so excited that I called another 800 number and, using the same method, placed an order for a Radio Shack expansion interface, 16K of memory installed and an MPI disk drive complete with an Apparat 40 track NEWDOS+. I also gave them a purchase order number and sent them a cashiers check via air mail to avoid the mailing charges. I started to wait.

Pacing the Floor

On the fourth day, every time the phone rang or I heard a car or truck nearby I became breathless with anticipation. The fifth day was Saturday and I didn't expect to hear anything until Monday. By Friday of the next week, frustration and anger forced me to the telephone again.

Once again I dialed the toll free numbers. The nice people who were going to send my printer right out to me told me that for some unfathomable reason, their supplier was slow in filling their orders. Would I settle for a standard Epson printer and a friction drive kit? "Yes, that would be OK, just get it here." They assured me that it would go right out and they would send me a refund of the extra money, about $25.

Out of Stock

The business that was supposed to be sending me an expansion interface and a disk drive had suddenly run out of stock of these items. They did have a disk drive in stock, but the only expansion interface they had was one that one of their employees was using at home. Would I mind receiving that one? I assured them that I didn't mind a slightly used unit as long as it was in good working order. They would send it right to me.

Next on my order list was a lowercase modification kit. By this time I was beginning to think that although sending money with an order was less expensive it was a little foolish. My friends chided me for this action when I told them about my trials. When I ordered a lowercase unit I gave my credit card number for billing. I was told that there would be a slight delay because of a delivery problem but that I could expect to receive the unit in about three weeks. By now I knew how to wait and I agreed.

Three weeks had passed since my first phone call and I still hadn't received anything. The expansion interface and disk drive arrived 24 days after date of order. Three more phone calls and 33 days after order date brought the printer. The friction drive kit was another three weeks

in coming. At the time of this writing, the refund check for the overpayment on the printer has not yet arrived.

The equipment arrived in excellent condition and went into immediate operation as soon as it was installed and is still operating well without difficulty of any sort.

After four weeks of waiting for the lowercase unit I called; I got an answering machine which asked me to leave my phone number. I did. I received no answer back. Several calls later a person answered the phone telling me that delivery problems were causing delays but that the unit should be on its way by Friday. Monday; still no unit. Another call on the phone connected me to the answering machine again. Again, I left my number and received no phone call.

Two months and four days after date of order I received the lowercase modification kit. It did not work. I sent the unit back, requested a credit to my credit card which I still have not received. I have since had a Radio Shack lowercase modification installed which works magnificently.

A friend who wants to increase his computing capabilities recently asked me what I thought about ordering from advertisers in magazines. I told him that he should order equipment sent c.o.d. with the stipulation that if it does not arrive within a reasonable period of time, 7 days for example, the order should be cancelled.

My experience with this type of ordering indicates that suppliers need to police their activities much more closely. Promises of delivery should be kept if possible and immediate notice given if they cannot be met. There seems to be need for these suppliers to clean up their PR act, their sales policies, and their bookkeeping procedures. ■

Mr. Averill is a free lance writer with Educational, Sales and Employee Orientation films.

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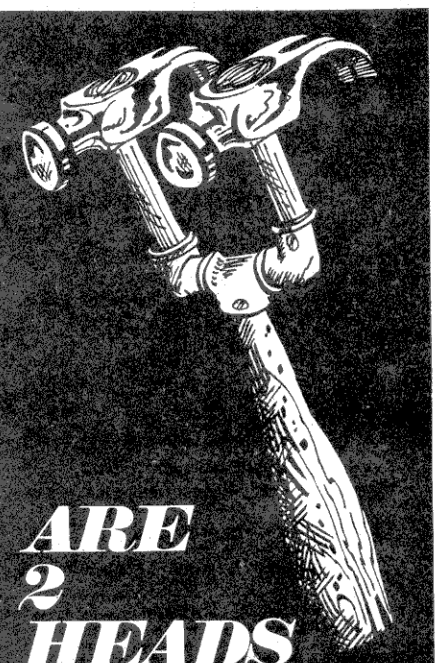

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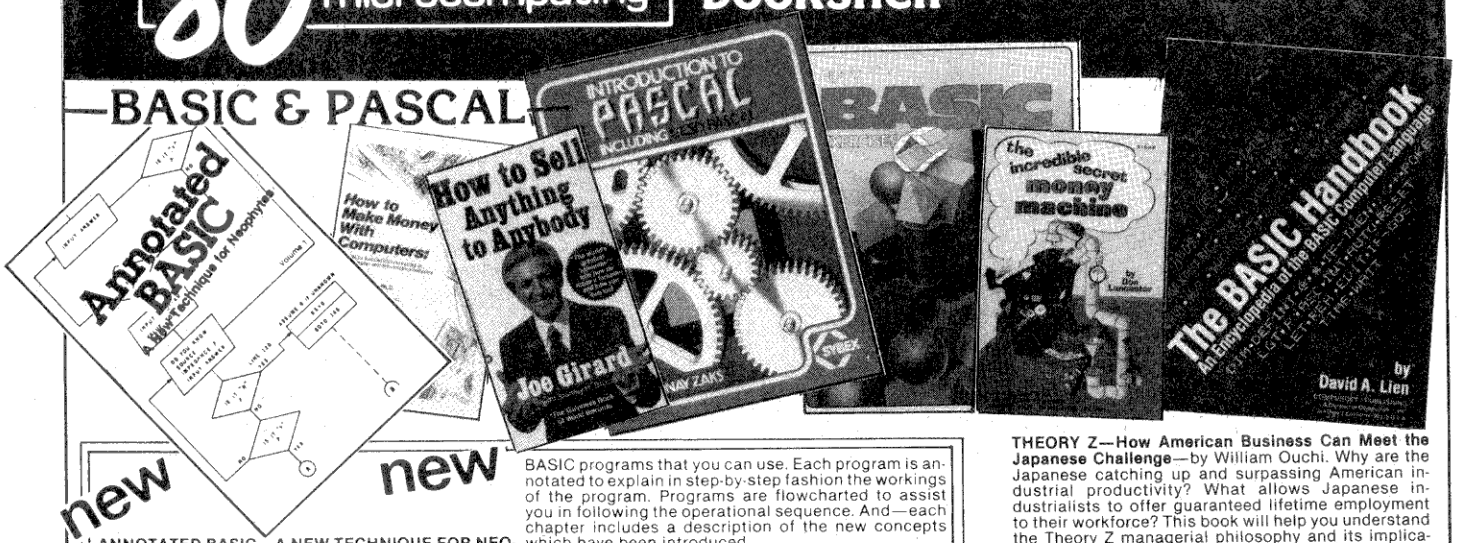

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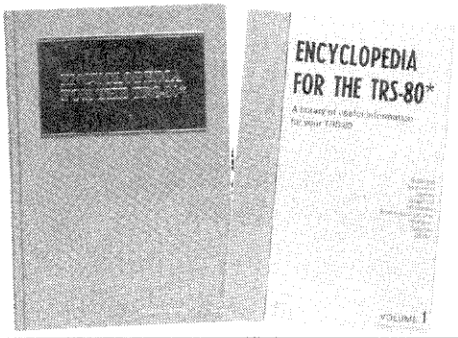

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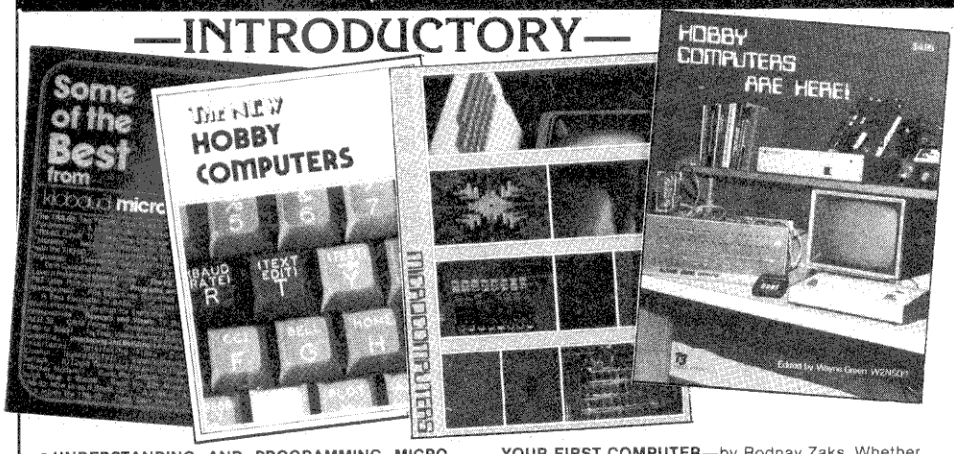

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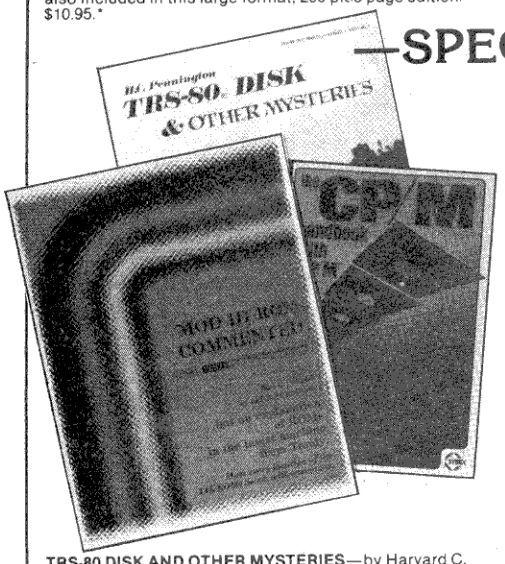

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It has been about a year since I bought my Telephone Interface II from Radio Shack. At the time I was not sure if I could justify the investment, as there were no bulletin board systems within the range of a local phone call. CompuServe and The Source were too far away and expensive. Nonetheless, long-distance phone rates started to get the better of me and my monthly phone bill quadrupled.

As I used the various computerized bulletin board services, I felt I had to get something similar running on my system. Excellent community bulletin boards were running on TRS-80's with 48K and two eight-inch drives. I figured it could be done on my system—with one 40-track V-80 disk drive.

Before I started, I had a problem: How could I handle the basics of input/output through the modem? I thought about designing the whole thing in machine code, but heaved a sigh of relief when I remembered the Host utility in Radio Shack's communications package. It allows a remote terminal to access the master TRS-80 and echoes keyboard input, so users can log-on in full-duplex mode.

Host patches the video and keyboard drivers to call the program before printing. If an active modem is present, Host echoes the typed character over the RS-232 serial board and past the modem, while displaying it on the screen. When the keyboard is scanned, Host is called again to see if a byte has been input from the modem. If so, it jumps to the keyboard decoder in ROM where Basic handles the byte as if it were strobed from the keyboard.

With the tough problem out of the way, I did a little surgery on Host to make it more efficient. (See Program Listing 1.) Instead of loading from DOS and executing from Basic, I modified it so the routine loaded and set Basic's memory size pointer by itself. Eventually it returns to the calling program instead of jumping to Ready.

Now I worked on the program itself. An early version used random file access for message handling, fast but cumbersome for long messages. Sequential techniques are excellent for the storage of messages, but slow for individual access. I combined the best of both worlds. A random-access file contains all the data necessary for indexing into a sequential file holding the messages. One more small sequential file is for bulletin messages.

The bulletin file, Bullfile, is a simple sequential file read by the community bulletin board program and displayed at the beginning. The message file, Textfile, is another simple sequential file; every message is delimited by a graphics block (CHR$(191)). A delimiter is not necessary, but it does make distinguishing messages easy with List in DOS.

Random File Access

The random-access file, MSGfile, contains all the important information pertaining to any given message set up by the Field statement in line 20:

- ST$: This one-byte string represents the status of the

Program Listing 1

```
10 '*** TDSNET - REV. 2.0 by John Hodgson ***
20 CMD"R":POKE&H40B1,254:POKE&H40B2,189:FORX=&HBE00TO&HBF0C:READ
Y:POKEX,Y:NEXT:POKE-16699,0:DEFUSR=&HBE00:CLS:CLEAR6000:DEFINTA-
Z:DIMA$(500),C(50):OPEN"R",2,"MSGFILE":FIELD2,1ASST$,4ASMN$,4ASL
N$,8ASDT$,10ASPW$,30ASFR$,30ASTN$,60ASSB$:ONERRORGOTO670
30 OPEN"I",1,"BULLFILE":GET#2,1:IFVAL(MN$)=0THENA=1:GOTO450
40 INPUT"PLEASE ENTER DATE (MM/DD/YY)";D$:CMD"DATE "+D$:PRINT:IN
PUT"SYSOP --- PRESS ENTER TO START";A$:CMD"TIME "+"00:00:00":CMD
"CLOCK":CLS:X=USR(0):Y$=INKEY$
50 PRINTSTRING$(5,13)"TDS MESSAGE SYSTEM - PRESS ENTER TO CONTIN
UE"
```

Program continues

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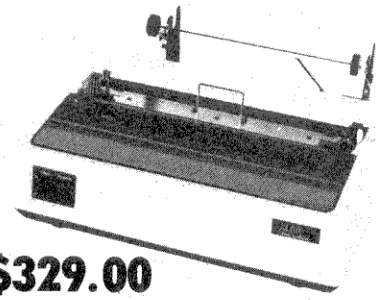

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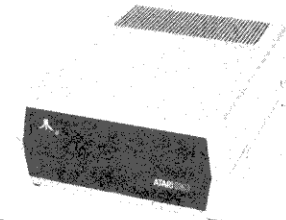

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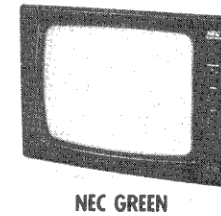

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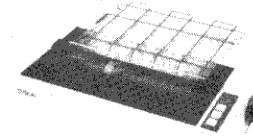

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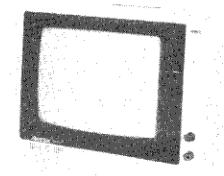

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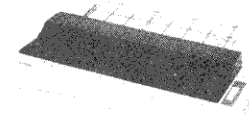

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message. An O means the file is accessible; a K means it has been killed.

- MN$: This four-byte string points to the number of the message. Any message up to 9999 may be represented if you have enough disk space.
- LN$: LN$ is the length of the message in lines. Useful during the Quick message retrieval (Q) option, it saves valuable phone time by telling the user which messages are long. It is also used to display or skip the correct lines of any message in Textfile.
- DT$: This is the date that the message was written.
- PW$: PW$ is a 10-byte string holding the password of a protected message. If the message is not protected, it is a string of 10 blanks.
- FR$: This string contains the sender's name, up to 30 bytes.
- TN$: This string holds the receiver's name, up to 30 bytes.
- SB$: The subject of the message is contained here. It can be up to 60 characters long. If the first three characters of the subject are (P) the message is password protected.

Random file access allows fast retrieval of any message by any field, quickly and easily. It also means that at a minimum any given file will take up one sector plus one byte; one sector for message data in MSGfile, and one delimiter byte in Textfile. Since all DOS files need a minimum of one granule of disk space, and an average message (six lines) takes up three sectors, you can calculate the number of message files your disk can hold.

Runs Under NEWDOS

This modified version of Host runs under NEWDOS version 2.1 or NEWDOS/80. NEWDOS/80 is nice for initialization because it does a Filespec command much faster than the original version of NEWDOS.

Since I do not have an auto-answer modem I must put the handle into the cradle. However, it is possible to use INP to check various status bits on the RS-232 to detect if the user has hung up or logged on and react

Program continued

```
60 IFINKEY$<>CHR$(13)THEN60
70 PRINTSTRING$(3,13)STRING$(63,"#"):PRINTTAB(8)"WELCOME TO THE
TOP DOG SOFTWARE MESSAGE SYSTEM":PRINT:PRINTTAB(9)"ESTABLISHED F
OR THE EXCHANGE OF MESSAGES AND":PRINTTAB(9)"IDEAS OF INTEREST T
O THE MICROCOMPUTER USER.":PRINTSTRING$(63,"#")
80 NM$="":CT$="":PRINT:LINEINPUT"ENTER YOUR FULL NAME? ";NM$:LIN
EINPUT"WHERE ARE YOU CALLING FROM? (CITY, STATE) ";CT$:PRINT:PRI
NTNM$" FROM "CT$:PRINT
90 A$="":LINEINPUT"IS THIS CORRECT? (Y/N) ";A$:A$=LEFT$(A$,1):IF
A$<>"Y"ANDA$<>"N"THEN90ELSEIFA$="N"THENGOTO80
100 NM$=LEFT$(NM$,30)+STRING$(30-LEN(NM$)," "):PRINT:PRINT"*****
 BULLETINS *****"'* LEFT-JUSTIFY NM$ *
110 IFEOF(1)=0THENLINEINPUT#1,A$:PRINTA$:GOTO110ELSECLOSE#1:PRIN
T
120 X=LOF(2):GET#2,1:A=VAL(MN$):GET#2,X:B=VAL(MN$):PRINT"MESSAGE
S IN SYSTEM :"A"THROUGH"B:PRINT
130 C=1:PRINT"CHECKING FOR MAIL...";:FORX=1TOLOF(2):GET#2,X:IFTN
$=NM$ANDST$="O"THENA(C)=X:C=C+1:NEXTELSENEXT
140 C=C-1:IFC>0THENPRINT:IFC=1THENPRINT"BE SURE AND ANSWER MESSA
GE #"A(C)ELSEPRINT"BE SURE AND ANSWER THESE MESSAGES ...":PRINT:
FORX=1TOC:PRINTA(X),:NEXT:PRINTELSEPRINT" SORRY, NO MAIL TODAY."
150 PRINT
160 CM$="":B=LOF(2):LINEINPUT"COMMAND? (Q,H,E,R,P,K,T,?) ";CM$:C
M$=LEFT$(CM$,1):IFINSTR("QHERPKT?",CM$)=0ORCM$=""THEN160
170 IFCM$="Q"THEN210ELSEIFCM$="H"THEN390ELSEIFCM$="E"THEN450ELSE
IFCM$="R"THEN250ELSEIFCM$="P"THEN320ELSEIFCM$="K"THEN410ELSEIFCM
$="?"THEN380
180 IFLEN(NM$)=0THENNM$=" "
190 PRINT:PRINT"THANKS FOR CALLING, "LEFT$(NM$,INSTR(NM$," ")-1)
".":PRINT:PRINT"TOTAL TIME ON SYSTEM : "RIGHT$(TIME$,8):CLOSE
200 GOTO200
210 PRINT:GOSUB570
220 FORX=STTOEN:GET#2,X:IFST$="K"THEN240ELSEPRINT"MSG: "MN$,LN$"
 LINES":PRINT"DATE : "DT$:PRINT"FROM : "FR$:PRINT"TO : "TN$:PRIN
T"SUBJECT : "SB$:Y$=INKEY$
230 IFY$="P"ANDINKEY$=""THEN230ELSEIFY$="S"THEN150
240 Y$="":NEXT:GOTO160
250 PRINT:OPEN"I",3,"TEXTFILE":GOSUB570:FORX=1TOST
260 INPUT#3,A$:IFA$=CHR$(191)THENNEXTELSE260
270 FORX=STTOEN:GET#2,X:IFST$="K"THENFORY=1TOVAL(LN$):INPUT#1,A$
:NEXT:GOTO300ELSEPRINT"MSG : "MN$,LN$" LINES":PRINT"DATE : "DT$:
PRINT"FROM : "FR$:PRINT"TO : "TN$:PRINT"SUBJECT : "SB$:Y$=INKEY$
280 IFST$<>"K"ANDLEFT$(SB$,3)="(P)"THENPRINT"THIS MESSAGE IS PAS
SWORD PROTECTED.":PRINT:FORZ=1TOVAL(LN$):INPUT#1,A$:NEXTELSEFORZ
=1TOVAL(LN$):LINEINPUT#3,A$:PRINTA$:NEXT:PRINT
290 IFY$="P"ANDINKEY$=""THEN290ELSEIFY$="S"GOTO150
300 IFEOF(3)=0THENINPUT#3,A$:NEXT'* ELIMINATE CHR$(191) *
310 CLOSE#3:GOTO160
320 ST=0:PRINT:INPUT"ENTER PROTECTED MSG #";ST:GET#2,ST:IFST$="K
"THENPRINT"NO SUCH MESSAGE ON FILE.":GOTO150ELSEIFPW$=STRING$(10
," ")THENPRINT"MSG NUMBER"ST"IS NOT PASSWORD PROTECTED!":GOTO150
330 A$="":LINEINPUT"ENTER PASSWORD ---> ";A$:A$=LEFT$(A$,10)+STR
ING$(10-LEN(A$)," "):IFA$<>PW$THENPRINT:PRINT"ACCESS DENIED.":GO
TO150ELSEPRINT'* LEFT-JUSTIFY PW *
340 OPEN"I",3,"TEXTFILE":FORX=1TOST
350 INPUT#3,A$:IFA$=CHR$(191)THENNEXTELSE350
360 PRINT"MSG: "MN$,LN$" LINES":PRINT"DATE : "DT$:PRINT"FROM : "
FR$:PRINT"TO : "TN$:PRINT"SUBJECT : "SB$
370 FORX=1TOVAL(LN$):LINEINPUT#3,A$:PRINTA$:NEXT:CLOSE#3:GOTO150
380 PRINT:PRINT"TOTAL TIME ON SYSTEM : "RIGHT$(TIME$,8):GOTO150
390 PRINT:PRINT"LIST OF COMMANDS :":PRINT
400 PRINT"Q - QUICK SUMMARY OF MSGS IN SYSTEM":PRINT"H - HELP :
PRINTS THIS LIST":PRINT"E - ENTER MESSAGE":PRINT"R - RETRIEVE ME
SSAGE":PRINT"P - RETRIEVE PROTECTED MESSAGE":PRINT"K - KILL MESS
AGE":PRINT"T - LOG OFF":PRINT"? - PRINT TOTAL TIME ON SYSTEM":G
OTO150
410 PRINT
420 X=0:INPUT"INPUT NUMBER TO KILL";X:IFX=0THEN150ELSEIFX>BORX<A
THEN420ELSEGET#2,X:IFST$="K"THEN420
430 IFLEFT$(SB$,3)="(P)"THENA$="":LINEINPUT"ENTER PASSWORD? ";A$
:A$=LEFT$(A$,10)+STRING$(10-LEN(A$)," "):IFA$<>PW$THENPRINT"ACCE
SS DENIED.":GOTO150
440 A$="K":LSETST$=A$:PUT#2,X:GOTO150
450 OPEN"E",3,"TEXTFILE":B=B+1:PRINT"THIS WILL BE MSG NUMBER"B
460 PRINT:PRINT"REMEMBER TO USE "CHR$(34)"(P)"CHR$(34)" AS FIRST
 THREE LETTERS"
470 PRINT"IN SUBJECT TO PROTECT IT IF DESIRED"
480 PRINT:A$="O":LSETST$=A$:A$="":LINEINPUT"FROM? ";A$:LSETFR$=A
$:A$="":LINEINPUT"TO? ";A$:LSETTN$=A$:A$="":LINEINPUT"SUBJECT? "
;A$:LSETSB$=A$:LSETMN$=STR$(B):LSETDT$=LEFT$(TIME$,8)
490 IFLEFT$(SB$,3)="(P)"THENA$="":LINEINPUT"PASSWORD? (10 CHARS
MAX) ";A$:LSETPW$=A$ELSEA$="":LSETPW$=A$
500 PRINT:PRINT"ENTER YOUR LINES, 1 AT A TIME - HIT CR WHEN DONE
":PRINT:C=0
510 C=C+1:A$(C)="":PRINT"#"C">";:LINEINPUTA$(C):IFA$(C)<>""THEN5
10ELSEPRINT:C=C-1
520 A$="":LINEINPUT"(L)IST, (E)DIT, (S)AVE, (T)ERMINATE & SAVE O
R (Q)UIT ?";A$:IFINSTR("LESTQ",A$)=0ORA$=""THEN520
```

Program continues

Program continued

```
530 IFA$="E"THEN550ELSEIFA$="S"THEN560ELSEIFA$="T"THENP=1:GOTO56
0ELSEIFA$="Q"THENB=B-1:CLOSE#3:GOTO150
540 PRINT:FORX=1TOC:PRINTX;A$(X):NEXT:PRINT:GOTO520
550 X=0:PRINT:INPUT"WHICH LINE DO YOU WISH TO CHANGE";X:IFX<1ORX
>CTHENPRINT:GOTO520ELSEPRINT:PRINT"LINE #"X": "A$(X):PRINT:LINEI
NPUT"ENTER NEW LINE --> ";A$(X):PRINT:GOTO520
560 LSETLN$=STR$(C):PUT#2,B:B=B+1:PRINT#3,CHR$(191):FORX=1TOC:PR
INT#3,A$(X):NEXT:CLOSE#3:IFP=1THEN180ELSE150
570 ST=0:INPUT"ENTER STARTING NUMBER (BEGINNING IS DEFAULT)";ST:
IFST=0THENST=AELSEIFST<AORST>BTHEN570
580 EN=0:INPUT"ENTER ENDING NUMBER (END IS DEFAULT)";EN:IFEN=0TH
ENEN=BELSEIFEN<AOREN<0OREN>BTHEN580
590 Y$=INKEY$:PRINT"HIT P TO PAUSE, S TO STOP (CR TO CONTINUE)
600 IFINKEY$<>CHR$(13)THEN600ELSEPRINT:RETURN
610 '* DATA FOR 32K HOST PROGRAM - CHECKSUM IS 35243 *
620 DATA245,58,8,191,254,1,40,52,197,229,62,1,50,8,191,33,0,190,
34,30,64,33,164,190,34,22,64,211,232,219,233,230,248,246,4,50,7,
191,211,234,219,233,230,7,33,255,190,6,0,79,9,126,211,233,225,19
3,241,201,0,0,229,219,232,203,119,194,159,190
630 DATA24,21,42,32,64,58,9,191,189,194,203,190,58,10,191,188,19
4,203,190,35,34,9,191,219,234,203,119,40,250,121,211,235,254,13,
202,148,190,225,241,195,88,4,42,42,42,32,67,79,80,89,82,73,71,72
,84,32,49,57,55,57,32,66,89,32,84,65,78,68,89
640 DATA32,67,79,82,80,46,32,42,42,42,32,219,234,203,119,202,148
,190,62,10,211,235,225,241,195,88,4,245,219,232,203,119,194,199,
190,219,234,203,127,202,199,190,241,219,235,230,127,254,17,40,58
,254,5,250,196,190,254,27,192,62,1,201,241
650 DATA195,227,3,219,234,203,119,202,203,190,62,18,211,235,35,3
4,9,191,43,203,29,203,20,219,234,203,119,202,223,190,124,211,235
,219,234,203,119,202,233,190,125,211,235,195,91,190,62,0,50,68,1
90,50,69,190,201,34,68,85,102,119,170,204,238
660 DATA0,0,0,0,0,0
670 IFERR<>106THENONERRORGOTO0
680 C=1:CLS:PRINT"ENTER YOUR BULLETINS! (ENTER TO TERMINATE)":PR
INTSTRING$(42,131):PRINT
690 A$(C)="":LINEINPUT"---> ";A$(C):IFA$(C)=""THEN700ELSEC=C+1:G
OTO690
700 PRINT:C=C-1:OPEN"O",3,"BULLFILE":FORX=1TOC:PRINT#3,A$(X):NEX
T:CLOSE#3:RESUME
```

accordingly.

The check-sum for the data is 35243, and can be computed as follows:

```
FORX = &HBE00TO&HBF0C:READY:
Q = Q + Y:NEXT:?Q
```

If Q is not 35243 go back and check your data.

Forum-80 users will be familiar with the format of the program while executing; new users can type H for help. This program requires at least one message on the system, along with a bulletin message. If the program detects that these have not been written, it will ask you to enter the files. The Host routine allows keyboard input from your terminal as well as the remote terminal. Files are killed only in that they are prevented from listing; they still take up disk space.

I have set up the welcoming messages to represent my own cottage software business; change them to display whatever you wish. ■

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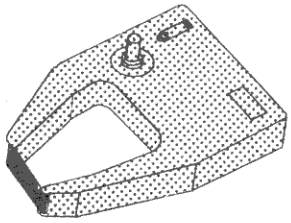

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Learn the routines for disk I/O.

Reading, Writing and Assembly Language

Patrick Morgan
12919 Warren Avenue
Los Angeles, CA 90066

The following program is the result of my learning to program disk read and write routines in Assembly.

I wanted to add disk routines to a communications program that I wrote, so I could send and receive files. I couldn't find any Assembly programming information that might help me, so what follows is a simple program, modified and re-modified by trial and error.

Once you understand my methods, I'm sure you'll be able to add sections of this program to creations of your own.

I wanted to write a clear, easily understood program, so economical memory usage was secondary. You can make several improvements. I used only three ROM routines, the keyboard scan (0049H), the buffer load (05D9H) and the video display (0033H), and they are documented them for both Model I and Model III.

To follow the program explanation you will have to enter the source code and you will need a monitor with break points such as Debug or RSM, a disk monitor such as Apparat's Superzap and a file to work with. A Basic program saved in ASCII format will be fine.

Program Explanation

Load Program Listing 1 and enter Debug. Single-step through the first section, until you enter the filespec. Line 700 loads the filespec into the FCB (file control block).

Look at the FCB (7004H) and you will see the filespec as entered. Step through the Open command (call 4424H) and look at the FCB again. Assuming you have no errors, your filespec is now replaced by 32 bytes that look something like Fig. 1.

The FCB is set up as follows: The first three bytes are used as flags to show the status of the directory. I really don't know what format is used. Bytes four and five are the DOSBUF address that you entered in HL before Open. (All addresses and two byte numbers are in the least significant-most significant format.)

Byte six is an offset used for logical records (not used here). Byte seven is the drive that contains the open file. It is set, even if you didn't specify a drive number. Byte eight is unknown. Byte nine is the location of the last byte of the disk file in the last sector. The disk file itself contains no end marker, only the directory knows where the end is.

Byte 10 is the logical record length. This should be 00. It is the value of register B at Open. Later we will see what happens when B is not 00.

Bytes 11 and 12 are the next record (sector) number and should be 0000, since you haven't read any sectors yet. Bytes 13 and 14 are the last record number and tell you how many sectors are in the file.

I use terms record and sector interchangeably in this program because we set the record length to 256 bytes, which is one sector.

Bytes 15 through 32 tell where to find the file on the disk. Byte 15 is the file's beginning track number. If byte 16 is 1FH or less, then the file starts on sector 0, otherwise it starts on sector 5 of that track.

Now that you have successfully opened the file, read in a sector. Line 340 loads DE with the FCB location. Next, line 350 calls 4436H, which reads a sector (256 bytes) from disk to the DOSBUF (7025H–7124H).

Use Debug and you will see it there. Also look at the AF registers. If you have any read errors, A register will contain the error code and the zero flag will not be set. Remember, an "end of file" is considered an error.

Next, you must move the data from the buffer to main memory. I tried changing the FCB buffer pointer as each sector was read, but that didn't work. Therefore, I called the Move subroutine that uses the powerful LDIR instruction.

Register DE' is the move-to location in RAM. HL' is the move-from location, which is DOSBUF, and BC' is the number of bytes to move (0100 hex or 256 decimal). Both DE' and HL' increment themselves as each byte is moved. I use the alternate (prime) registers for this routine so that you can maintain pointers without a lot of Push and Pops.

The program is in a read-move loop until it reaches the "end of file." After each call to 4436H (read sector) there is a JR NZ,ERRCK instruction. If there are any disk errors, the zero flag will be set, and the program will

```
80 20 00 25 70 00 01 26 56 00 00 00 0D 00 02 02
03 00 FF FF 23 00 FF FF 43 00 FF FF 63 00 FF FF
```

Fig. 1.

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jump to ERRCK.

The A register contains the error code. The OR 80 sets bit seven of A. Thereafter, a call to 4409H displays an error message. If bit seven is not set, the program displays the error message and jumps to DOS READY.

If you stop the program during this loop and look at the FCB, you will see the next record number, bytes 11 and 12, incremented as each sector is read. When the next record and the last record are equal, the program ends. It generates an error code 1D (end of file) and the program jumps to LAST to close the file.

If you have partially loaded a file and wish to stop, be sure to issue a CLOSE command or you'll mess up your directory. Use Debug command G 4428.

Assuming you have transferred all the data from disk to RAM, you must close the file. Line 560 calls 4428H which adjusts the disk directory and replaces your filespec in the FCB.

The final step in my routine marks the "end of file" in RAM. Byte nine of the FCB, loaded into a "end of file" flag earlier, is the byte number of the file end in the last 256 bytes moved. Mark this point with a 00 or 03.

Writing Files to Disk

Since writing a file from RAM to disk is similar to reading one, I'll cover only the differences. Load the filespec into FCB as before; however, this time call 4420H instead of 4424H.

Call 4420H opens either a new or existing file, whereas 4424H causes an error if the file doesn't exist.

Yes, you can add a simple routine here to see if a file exists before writing over it. Your external software will provide the starting and ending addresses and load them into STRAD and ENDAD. Line 880 subtracts the two addresses and puts the difference in HL. This is the number of bytes to write.

Before each write loop the program decrements the H register. If it is less than zero, then there is less than a full sector to write, and the program jumps to its closing housekeeping (LSEC).

Program Listing 1.

```
                00010 ;  DISK I/O ROUTINES
                00020 ;
7000            00030          ORG     7000H
0002            00040 STRAD    DEFS    2                ; LOAD FILE
HERE
0002            00050 ENDAD    DEFS    2                ; LOAD END A
DDR HERE
0020            00060 FCB      DEFS    32               ; FILE CONTR
OL BLOCK
0001            00070 EOF      DEFS    1                ; END OF FIL
E MARKER
0100            00080 DOSBUF   DEFS    256              ; 256 BYTE B
UFFER
                00090 ;
7125            00100 START    EQU     $
7125 210080     00110          LD      HL,8000H
7128 220070     00120          LD      (STRAD),HL       ; SET FILE L
OAD ADDR
712B 24         00130          INC     H                ;   AND END
ADDR
712C 220270     00140          LD      (ENDAD),HL       ;   IN RAM
                00150 ;  CORRECT VALUES SHOULD BE ENTERED FOR YOUR
 FILE
                00160 ;
712F 21FE71     00170          LD      HL,MSG1          ; READ OR WR
ITE MESSAGE
7132 CDA471     00180          CALL    TEXT
7135 CD4900     00190          CALL    0049H            ; KEYBOARD S
CAN
7138 FE57       00200          CP      'W'
713A 2872       00210          JR      Z,WRITE          ; ANYTHING E
LSE IS READ
713C CD9571     00220 READ     CALL    FSP              ; GET FILESP
EC
713F 212570     00230          LD      HL,DOSBUF
7142 110470     00240          LD      DE,FCB
7145 0600       00250          LD      B,00
7147 CD2444     00260          CALL    4424H            ; OPEN FILE
714A 2024       00270          JR      NZ,ERRCK         ; ERRORS
714C D9         00280          EXX                      ; LOAD DE' W
ITH
714D ED5B0070   00290          LD      DE,(STRAD)       ;  MEMORY AD
DR.
7151 D9         00300          EXX
7152 3A0C70     00310          LD      A,(FCB+8)        ; END OF FIL
E LOC
7155 322470     00320          LD      (EOF),A          ;   ON LAST
SECTOR
                00330 ;
7158 110470     00340 RD1      LD      DE,FCB
715B CD3644     00350          CALL    4436H            ; READ SECTO
R
715E 2010       00360          JR      NZ,ERRCK         ; ERRORS
7160 CD6571     00370          CALL    MOVE
7163 18F3       00380          JR      RD1              ; GET ANOTHE
R SECTOR
7165 D9         00390 MOVE     EXX                      ; USE PRIME
REG.S
7166 212570     00400          LD      HL,DOSBUF        ; MOVE FROM
BUFFER
7169 010001     00410          LD      BC,0100H         ;   TO MEMOR
Y
716C EDB0       00420          LDIR                     ; DE' WAS SE
T EARLIER
716E D9         00430          EXX
716F C9         00440          RET
                00450 ;
7170 FE1C       00460 ERRCK    CP      1CH              ; END OF FIL
E
7172 280E       00470          JR      Z,LAST
7174 FE1D       00480          CP      1DH              ; RECORD OUT
 OF RANGE
7176 280A       00490          JR      Z,LAST
7178 F680       00500          OR      80H              ; SET BIT 7
717A CD0944     00510          CALL    4409H            ; SHOW ERROR

717D CD2844     00520          CALL    4428H            ; CLOSE FILE

7180 18A3       00530          JR      START
7182            00540 LAST     EQU     $
7182 110470     00550          LD      DE,FCB
7185 CD2844     00560          CALL    4428H            ; CLOSE
7188 D9         00570          EXX                      ; BACK TO PR
IME REGS
```

Program continues

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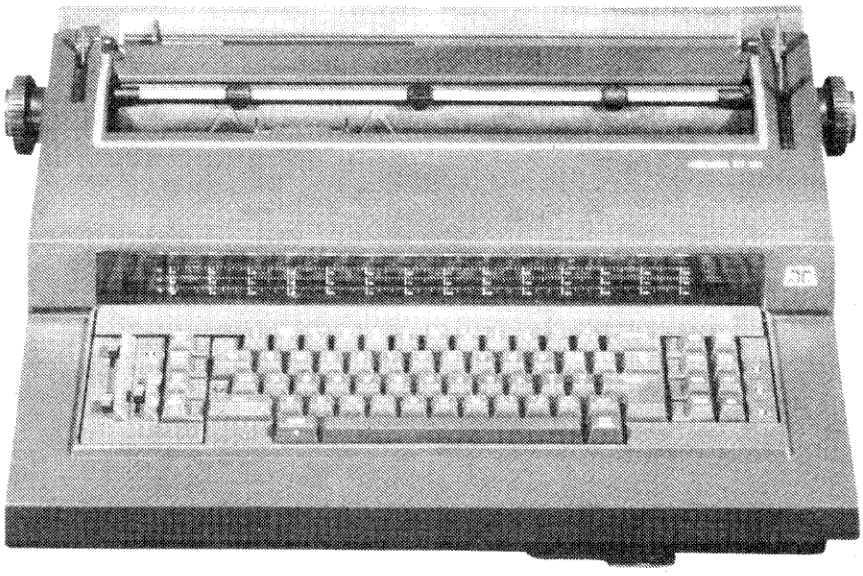

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Program continued

```
7189 15          00580          DEC     D                  ; BEG OF LAS
T SECTOR
718A 3A2470      00590          LD      A,(EOF)            ; GET OFFSET

718D 5F          00600          LD      E,A
718E 3E03        00610          LD      A,03               ; END OF FIL
E MARKER
7190 12          00620          LD      (DE),A             ; PUT IN MEM
ORY
7191 D9          00630          EXX                        ; BACK TO NO
RMAL
7192 C32D40      00640          JP      402DH              ; EXIT
                 00650 ;
7195 211772      00660 FSP      LD      HL,MSG2            ; GET FILESP
EC
7198 CDA471      00670          CALL    TEXT
719B 0617        00680          LD      B,23               ; 23 CHAR MA
X
719D 210470      00690          LD      HL,FCB
71A0 CDD905      00700          CALL    05D9H              ; INPUT ROUT
INE
71A3 C9          00710          RET                        ;   ENDS WIT
H <ENTER>
                 00720 ;
71A4 7E          00730 TEXT     LD      A,(HL)             ; DISPLAYS M
ESSAGE ON
71A5 FE03        00740          CP      03                 ;   SCREEN
71A7 C8          00750          RET     Z
71A8 CD3300      00760          CALL    0033H
71AB 23          00770          INC     HL
71AC 18F6        00780          JR      TEXT
                 00790 ;
71AE             00800 WRITE    EQU     $                  ; WRITE MEMO
RY TO DISK
71AE CD9571      00810          CALL    FSP
71B1 212570      00820          LD      HL,DOSBUF
71B4 110470      00830          LD      DE,FCB
71B7 010000      00840          LD      BC,00
71BA CD2044      00850          CALL    4420H              ; OPEN NEW O
R EXISTING
71BD 2A0270      00860          LD      HL,(ENDAD)
71C0 ED5B0070    00870          LD      DE,(STRAD)
71C4 ED52        00880          SBC     HL,DE              ; HL=NO. OF
BYTES TO LOAD
71C6 7D          00890          LD      A,L
71C7 322470      00900          LD      (EOF),A            ; END IN LAS
T SECTOR
71CA D9          00910          EXX
71CB 2A0070      00920          LD      HL,(STRAD)         ; DE' IS RAM
 POINTER
71CE D9          00930          EXX
71CF 23          00940          INC     HL                 ; ONE MORE B
```

Program continues

The MOVE2 routine is similar to MOVE except it goes in the opposite direction.

While single-stepping through this section, look at the FCB. Byte 15 will show where the DOS chose to write your file on the disk, and bytes 11 and 12 will show how many sectors have been written.

The write close routine is similar to the read, except now it loads the "end of file" location into byte nine of the FCB so that it can be written into the disk directory. Upon CLOSE (call 4428H), the routine writes the FCB information in the directory so that the DOS can find it again.

Program Options

In the Open command we set the B register to 00 which causes one logical record to equal one physical record.

This simplifies housekeeping because we are dealing with whole sectors at a time.

Listing 1 works similar to Basic's sequential access mode; it loads the whole file, modifies it, then dumps it back to disk.

It can also function similar to Basic's random access mode, by setting B equal to a logical record length (the Field command). Bytes 11, 12, 13 and 14 will now be in terms of records,not sectors. Your software will be responsible for packaging the records into sectors before writing and separat-

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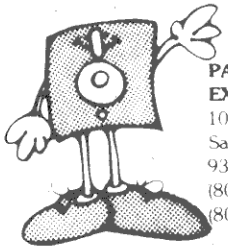

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There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer™. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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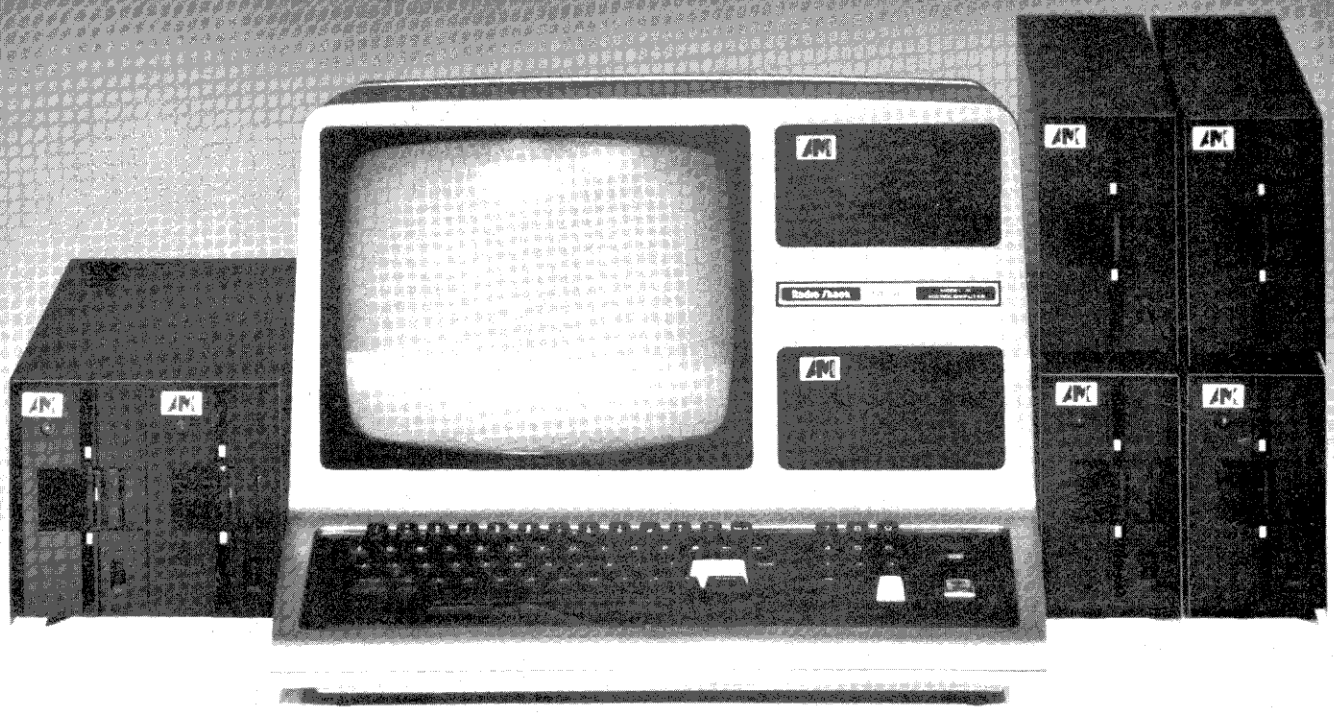

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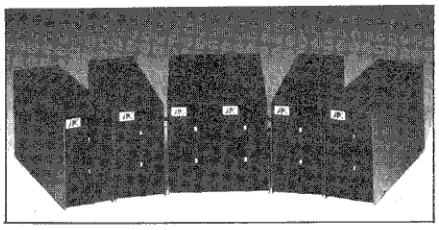

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Program continued

```
YTE
71D0 CDF371    00950 WR1     CALL    MOVE2          ; LOAD BUFFE
R
71D3 25        00960         DEC     H              ; NEXT 256 B
YTES
71D4 FAE171    00970         JP      M,LSEC         ; LAST SECTO
R
71D7 110470    00980         LD      DE,FCB
71DA CD3944    00990         CALL    4439H          ; WRITE SECT
OR ON DISK
71DD 2099      01000         JR      NZ,ERRCK+8     ; WRITE ERRO
RS ?
71DF 18EF      01010         JR      WR1
71E1 3A2470    01020 LSEC    LD      A,(EOF)        ; EOF IN LAS
T SECTOR
71E4 320C70    01030         LD      (FCB+8),A      ; PUT IN FCB

71E7 110470    01040         LD      DE,FCB
71EA CD3944    01050         CALL    4439H          ; WRITE LAST
 SECTOR
71ED CD2844    01060         CALL    4428H          ; CLOSE FILE

71F0 C32D40    01070         JP      402DH          ; EXIT
71F3 D9        01080 MOVE2   EXX
71F4 112570    01090         LD      DE,DOSBUF      ; MOVE FROM
MEMORY
71F7 010001    01100         LD      BC,0100H       ;   TO BUFFE
R
71FA EDB0      01110         LDIR                   ; HL' WAS SE
T EARLIER
71FC D9        01120         EXX
71FD C9        01130         RET
71FE 0D        01140 MSG1    DEFB    0DH
71FF 45        01150         DEFM    'ENTER <R>EAD OR <W>RITE'
7216 03        01160         DEFB    03
7217 0D        01170 MSG2    DEFB    0DH
7218 46        01180         DEFM    'FILESPEC '
7221 03        01190         DEFB    03
7125           01200         END     START
00000 TOTAL ERRORS
```

ing the records after reading.

Programs such as mailing lists show the advantage of logical record files. Not only are the data in neat packages, but you can go directly to a particular record on the disk.

Set BC to a record number and call 4442H to "position" the FCB for a read or write. You can also sort and organize a file greater than 48K by moving data back and forth between disk files. Think about the necessary housekeeping software for a while, and you will appreciate the $200 mail list programs.

References

While the technical information section of the TRSDOS manual contains much valuable information about disk files, I find it difficult to understand. Apparat's NEWDOS 80 manual may amplify this information for you. Also Harvard Pennington's *TRS-80 Disk and Other Mysteries* gives a good description of how files are organized and how the directory works. ■

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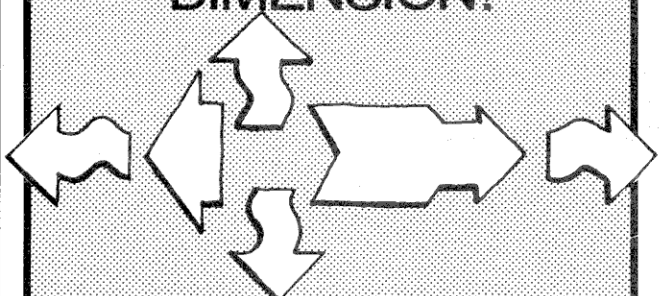

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Dizzy Decimals

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I have found four decimal values that consistently lead to subtraction errors on the TRS-80. Two produce a fractionally high answer and two produce fractionally low answers.

Let's set up a program to observe these problems, and then develop a technique to eliminate the errors. How about a simple accounts receivable routine with only three variables:

- DA as previous balance
- DB as amount paid
- DC as balance due

Simple Program

Type the following program:

```
10 INPUT"INPUT PREVIOUS BALANCE
   ";DA
20 INPUT"INPUT AMOUNT PAID ";DB
30 DC=DC-DB
40 PRINT"BALANCE DUE EQUALS "DC
50 INPUT"TO TRY ANOTHER PRESS
   ENTER ";YZ
60 GOTO10
```

Line 10 is simply the customer's previous balance; that is, how much money an individual owes. Line 20 shows the customer's payments.

Line 30, which is where the problem lies, subtracts the value in line 20 from the value in line 10 to calculate the number printed in line 50—the balance due.

Using this sample program I can illustrate the four subtraction problems.

Problem 1

Input previous balance	$30.20
Input amount paid	30.00
Balance due	.200001

When the TRS-80 subtracts the above numbers, it produces an erroneous answer, one digit too high in the sixth place.

Problem 2

Input previous balance	$30.30
Input amount paid	30.00
Balance due	.299999

When subtracting these numbers, the 80 produces an erroneous answer, one digit too low in the sixth place, just the opposite of the previous error.

Problem 3

Input previous balance	$30.70
Input amount paid	30.00
Balance due	.700001

This produces the same error as in Problem 1.

Problem 4

Input previous balance	$30.80
Input amount paid	30.00
Balance due	.799999

This produces the same error as in Problem 2. In my experience the above four decimal values, .2, .3, .7, and .8 are the only values that the TRS-80 fails to subtract properly.

In the subtracted values, which the computer rounded too high or low, the rounding error occurs at the sixth place after the decimal. Conveniently, when dealing with dollars and cents, two decimal places is sufficient.

But that is not the case in many other fields—engineering, for example. The rounding error six places out will eventually result in an incorrect balance. This is more noticeable when the computer rounds too low. Here the one cent error is immediately recognizable.

One seemingly obvious way to eliminate the problem is the "print using" statement. Add a line 45 between lines 40 and 50. The program now looks like this:

```
10 INPUT"INPUT PREVIOUS BALANCE
   ";DA
20 INPUT"INPUT AMOUNT PAID ";DB
30 DC+DA-DB
40 PRINT"BALANCE DUE EQUALS "DC
45 PRINTUSING"###.##";DC
50 INPUT"TO TRY ANOTHER PRESS
   ENTER ";YZ
60 GOTO10
```

At first glance we seem to have solved the problem. The expected values in both examples are correct. However, a more in-depth analysis suggests that the problem is merely masked.

I left line 40 in the program to show you that the actual values have not changed. The final answer printed by the computer is rounded either up or down. But the calculations done by the computer still use the incorrect value. Therefore, the problem remains.

Rounding Off

Why not round variable DC? Since the above looks so good, let's give it a try. Change line 30 to:

```
30 DC+DA-DB+.005
```

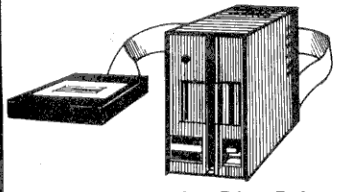
This rounds the DC value to two places.

Once again, the answers in two places are correct, but we are maintaining digits beyond two places that will have the same effect as the original error. Removing those extra digits should solve the problem.

Again, let's revise line 30 to:

From Computer Plus to YOU . . .

PLUS after PLUS after PLUS



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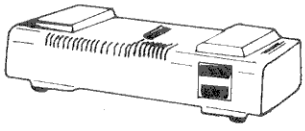

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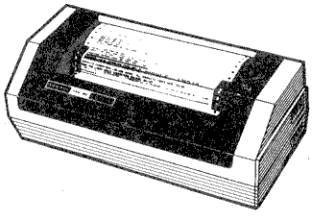

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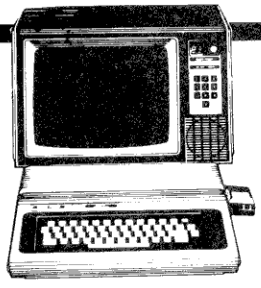

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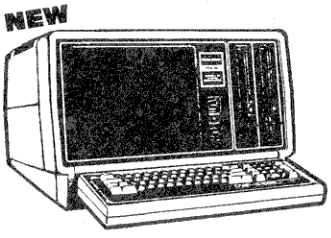

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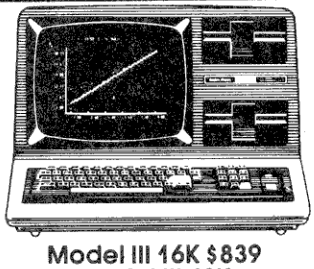

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```
30 DC = INT(((DA – DB)*100) + .5)/100
```

The line looks complicated, but going through it step by step clarifies it. The line subtracts DB from DA, multiplies by 100 to move the decimal point the two places desired; then it adds .5 which rounds off the answer. By taking the integer value, the program removes the extra digits to the right of the decimal.

Dividing by 100 returns the decimal point to the proper location.

Running this program with a variety of values seems to produce the correct answers for our balance due. In essence, it rounds to the next higher digit, two places after the decimal.

Now return to the first problem that produced a result rounded high in the sixth digit. With the above method we are adding to the third digit and this can again cause trouble with specific entries. Try a few and check the results. The following again produces an error:

```
Previous balance   $1234567.2
Amount paid         1234567.
Balance due                .25
```

We are using seven digits to the left of the decimal and only one to the right, a total of eight. Single-precision values should handle this. However, this is actually rounding two places to the right of the decimal (remember those 100 values in line 30). Seven places, plus two places, equals nine places. Single precision only handles eight places.

By using only six places to the left of the decimal, it appears we can correct the error.

When using .2, .3, .7 and .8 with six places to the left of the decimal, the answers are correct most of the time. However, using 333333.8 results in an answer of .81. Obviously there is still an error.

It is possible that the decimal takes up one of the eight single-precision places. Therefore, there may be a limit of five places to the left of the decimal. Trying several entries with five digits to the left of the decimal, I produced no errors.

It looks as if the error condition is now solved with the following limits:

- single-precision values
- five places to the left of the decimal
- two places to the right of the decimal

To sum up the results, first list the program:

```
10 INPUT"INPUT PREVIOUS BALANCE
   ";DA
20 INPUT"INPUT AMOUNT PAID ";DB
30 DC = INT(((DA-DB)*100) + .5)/100
40 PRINT"BALANCE DUE EQUALS "DC
50 INPUT"TO TRY ANOTHER PRESS
   ENTER ";YZ
60 GOTO10
```

Extending the Decimal

For larger figures, you can use the TRS-80's double-precision function. With double precision, the 80 can extend the number of places to the right of the decimal point.

Let's add a line 5 to the program:

```
5 DEFDBLD
```

If we now run the programs leaving line 30 as is, the result is more digits in the answer than we need.

Now we have seven places to the right of the decimal and eight places more consisting of garbage digits. The Level II manual says that we must use double-precision values throughout our equations, but we have constants in our program that are not double precision. One more revision in line 30 and we will be able to input most any number.

Add the # sign after each constant in line 30. It now looks like this:

```
30 DC = INT(((DA-DB)*100#) + .5#)/100#
```

Our limits are now:

- double-precision values
- thirteen places to the left of the decimal
- two places to the right of the decimal

Some of you (like engineers) would probably like more than two places to the right of the decimal. If so, revise line 30 to:

```
30 DC = INT(((DA-DB)*1000#) + .5#)/1000#
```

You can move the decimal point in this fashion to any location up to fifteen places.

There, now you can subtract with accuracy for nearly any application, from simple bookkeeping to engineering. Let me know how you handle the problem. ■

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Interference is "the mutual effect of two beams of light resulting in a loss of intensity in certain areas (destructive interference) and reinforcement of intensity in others (constructive interference)." Light and dark bands are formed when monochromatic light passes through two narrow slits. In a physics class these bands are observed by the use of diffraction gratings, ripple tanks, or two lines scratched into a black-coated glass plate.

Program Listing 1 allows a student to study the relationship between the wavelength of the light, the distance between sources, and the resulting diffraction pattern. It also gives the equation for interference patterns caused by two point sources. From $\sin\theta = \lambda/d$ it can be deduced that a smaller angle (resulting in more light and dark bands) will result from a shorter wavelength or a larger distance between sources. Fig. 1 shows the result of changing the distance between sources.

The program allows you to set up two different conditions of wavelengths and distances, then flash back and forth from one pattern to the other. It is easier to comprehend what is happening if you change either the wavelength or the distance (but not both) on one run of the program. More information on these patterns can be found in a high school or college physics book. ■

Line description

30–60 inputs distance between sources and wavelengths for two patterns.
80–110 constructs first interference pattern.
120–160 constructs second interface pattern.
170–220 shifts from first pattern to second pattern five times.

The Key Box

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```
0 REM JAMES W. WOOD, ATWOOD ILLINOIS
10 CLS:PCLEAR8:PRINT"INTERFERENCE PATTERNS"
15 PMODE4,1:PCLS:PMODE4,5:PCLS
20 PRINT"FORMED BY TWO POINT SOURCES"
30 PRINT:INPUT"RELATIVE WAVELENGTH FOR FIRST   PATTERN";F
40 INPUT"RELATIVE DISTANCE BETWEEN THE   SOURCES";R:R=R/2
50 INPUT"RELATIVE WAVELENGTH FOR SECOND  PATTERN";A
60 INPUT"RELATIVE DISTANCE BETWEEN THE   SOURCES";B:B=B/2
70 PMODE4,1:PCLS:SCREEN1,0
80 FORW=1TO165STEPF
90 CIRCLE(128-R,96),W
100 CIRCLE(128+R,96),W
110 NEXTW
120 PMODE4,5:PCLS:SCREEN1,0
130 FORW=1TO165STEPA
140 CIRCLE(128-B,96),W
150 CIRCLE(128+B,96),W
160 NEXTW
170 FORY=1TO5
180 PMODE4,1:SCREEN1,0
190 FORX=1TO1000:NEXTX
200 PMODE4,5:SCREEN1,0
210 FORX=1TO1000:NEXTX
220 NEXTY
230 PRINT"TYPE 1 TO REPEAT LAST PATTERNS"
240 PRINT"TYPE 2 TO PUT IN NEW DATA"
250 PRINT"TYPE 3 TO END"
260 X$=INKEY$:IFX$=""THEN260
270 XX=VAL(X$)
280 ON XX GOTO 170,10,290
290 END
```

Program Listing 1.

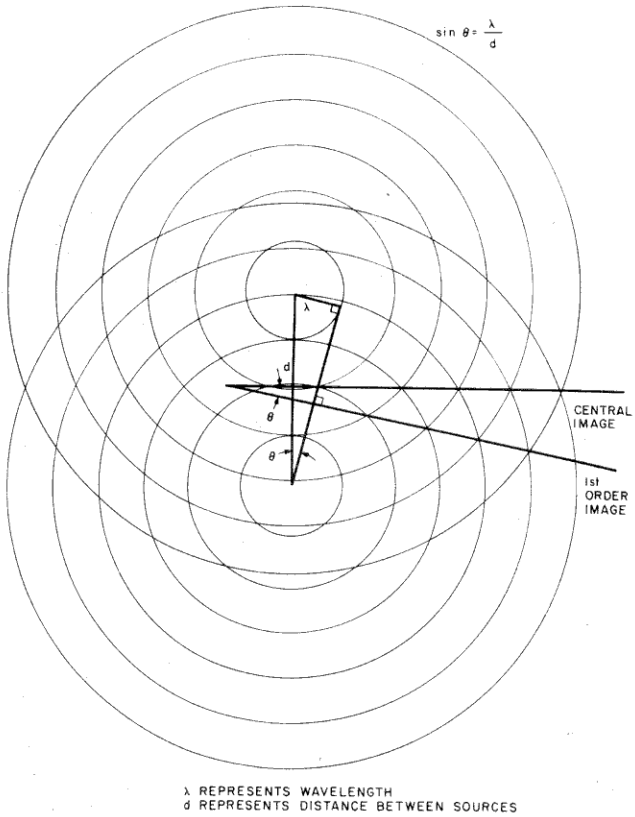

Fig. 1. Interference patterns caused by two point sources.

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```
TRS-80 Model II DEBUG Program
3060    3E 39 CF 54 7A 34 4D 35   30 4F F6 33 41 6F 32 45   >9.Tz4M50O.3Ao2E
3070    C4 30 53 B0 30 42 34 31   4C 1D 31 50 9A 30 57 DE   .0S.0B41L.1P.0W.
3080    30 47 B7 32 58 0F 34 52   B0 33 43 28 33 44 7B 33   0G.2X.4R.3C(3D{3
3090    46 1D 32 56 06 32 51 54   30 FF 21 67 37 3E 80 AE   F.2V.2QT0.!g7>..
30A0    77 CB 7E 21 1B 3A 20 03   21 30 3A CD 92 35 18 8F   w..!.: .!0:..5..
30B0    21 8C 3B 06 1C 0E 50 11   CA 3D CD 49 37 EB 3E 26   !.;...P..=.I7.>&
30C0    CF C3 3F 30 21 67 37 06   00 CB E8 7E A8 77 CB 6E   ..?0!g7......w.n
30D0    21 46 3A 20 03 21 5A 3A   CD 92 35 C3 3F 30 3A 0F   !F: .!Z:..5.?0:.
   PC     SP  SZHPNC  AF   BC   DE   HL   IX   IY   AF'  BC'  DE'  HL'
 2800  21FE  000000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
```

Fig. 1.

```
TRS-80 Model II DEBUG Program
3060    C3 F8 3F 54 7A 34 4D 35   30 4F F6 33 41 6F 32 45   ..?Tz4M50O.3Ao2E
3070    C4 30 53 B0 30 42 34 31   4C 1D 31 50 9A 30 57 DE   .0S.0B41L.1P.0W.
3080    30 47 B7 32 58 0F 34 52   B0 33 43 28 33 44 7B 33   0G.2X.4R.3C(3D{3
3090    46 1D 32 56 06 32 51 54   30 FF 21 67 37 3E 80 AE   F.2V.2QT0.!g7>..
30A0    77 CB 7E 21 1B 3A 20 03   21 30 3A CD 92 35 18 8F   w..!.: .!0:..5..
30B0    21 8C 3B 06 1C 0E 50 11   CA 3D CD 49 37 EB 3E 26   !.;...P..=.I7.>&
30C0    CF C3 3F 30 21 67 37 06   00 CB E8 7E A8 77 CB 6E   ..?0!g7......w.n
30D0    21 46 3A 20 03 21 5A 3A   CD 92 35 C3 3F 30 3A 0F   !F: .!Z:..5.?0:.
   PC     SP  SZHPNC  AF   BC   DE   HL   IX   IY   AF'  BC'  DE'  HL'
 2800  21FE  000000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
```

Fig. 2.

SVC 39H

A disassembled listing of the program showed that the program was mainly Supervisor Calls (SVC's), and looking at 40 pages of disassembled code was not my idea of fun. Luck was with me. On the first page there was a call to SVC 39H at memory location 3060H. I looked it up, and found the SVC named CLRXIT. It involves no parameters, no possible error conditions, no questions; it clears user memory and returns to

Tom Mornini is a sophomore at Bella Vista High School and is the author of Dark Forest by Sirius Software Inc.

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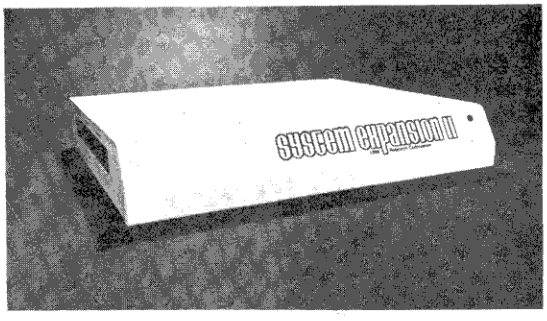

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TRSDOS READY! That had to be it! Here is how the SVC was called:

```
3060   LD   A,39H
3062   RST  08H
```

This assembles to:

3E 39—Load register 'A' with 39H
CF—Restart #8, to call SVC
(See Fig. 1)

That left just enough room to put a jump statement in so it could go to another routine in memory to make it do something else. I studied it and decided on: 3060 JP 3FF8H This assembles to: C3 F8 3F—Jump to 3FF8H (See Fig. 2).

I picked 3FF8H because that was the very bottom of the program minus the number of bytes required by the routine to make it do any exit needed. The routine is simple, and uses another SVC.

```
3FF8   LD   HL,3FD5H
3FFB   LD   B,23H
3FFD   LD   A,25H
3FFF   RST  08H
```

This assembles to:

21 D5 3F–Load register pair 'HL' with 3FD5H
06 23–Load register 'B' with 23H
3E 25–Load register 'A' with 25H
CF–Restart #8, to call SVC
(See Figs. 3 and 4)

I now had all I needed to go in and change the program, except for the command to execute. In the last routine, I loaded the HL pair with 3FD5H. When the SVC is called, it starts to read the command string at that location and ends at HL + B, because the B register is loaded with the length of the command string. All there was left to do was put in a command no longer than 35 bytes long, starting at memory location 3FD5H. I picked 35 bytes because it is enough room to call up Basic, execute a program, set the number of files, and even set memory size in the form: BASIC 12345678/123:1 -F:12 -M:12345. Remember to pad the end with blanks, or TRSDOS might not like some of the characters that get into the command string.

Debug On

Armed with this information, we can make all the changes with the Debug monitor. First it is necessary to clear memory—so enter Clear! It is summoned from the depths of a TRSDOS system disk by entering DEBUG ON. Now type LOAD TERMINAL to load the Terminal program without executing it. And for the final step, type DEBUG. You are now in Debug.

Press M to get into the RAM mode; Debug will respond A = . Now enter 3060; the screen should look like Fig. 1.

To get into the modify mode, type the F1 key. The cursor should jump up to the line that starts with 3060 and be positioned over the 3 in 3E. Now you can change the program. Type in C3 F8 3F (without spaces) so the screen looks like Fig. 2. When that is done, press the F2 key to exit the modify mode.

Debug will be waiting for your command; press M to enter the RAM mode again. Type in 3FD0; the screen should look like Fig. 3.

Again use the F1 key to get into the modify mode. The cursor will be on the line that starts with 3FD0 and will be positioned over the first 0 in 00. Press the down arrow key twice so the cursor is on the line that starts with 3FF0 and then press the tab key. The cursor will be on the second half of the display. Type in 21 D5 3F 06 23 3E 25 CF (again without spaces, so that the screen looks like the corresponding part of Fig. 4.

Now enter the command you want to have the program execute at location 3FD5H. Move the cursor back up to the top left with the arrow keys, press the right arrow key 10 times, and press the '/' (slant) key. The cursor will jump over onto the right side of the screen on the ASCII display. Type the command you want, but make sure that it is not longer than 35 characters. Pad the remainder with spaces making sure not to go past the halfway mark on the third line which is an exclamation point on the ASCII display. After you type in the last character, or padded space, the cursor should blink on top of this exclamation point. Since the '/' character is a toggle between the HEX and ASCII displays, when you want to type a '/' in a command, such as in a program name, you should type it, type in '2F', and press it again.

Your modified Terminal program is alive and well in memory, and the cursor is blinking on top of the exclamation point. Now what? Press the F2 key to exit the modify mode. Type an 'O' for DEBUG OFF, and enter: DUMP progname START = 3000 END = 3FFF.

"Your modified terminal program is alive and well in memory..."

The disks will run for a while, and you will be faced with that TRSDOS READY. Enter the program name saved, and you will be greeted by the Terminal program menu. Type 'Q' and your command will be executed.

Errors, Errors, Errors

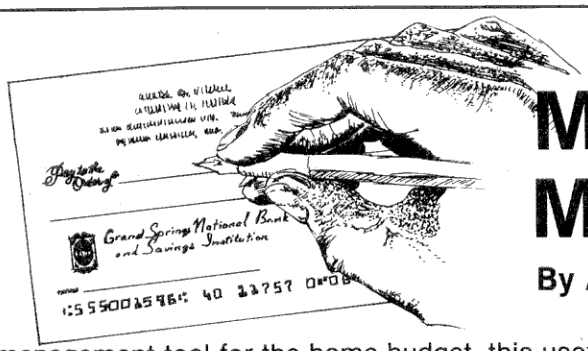
If you made any errors in the command string, you will get an error message when you press 'Q'. Reenter the Debug monitor, reload the program, and load the progname. Type DEBUG, and use the M command to go to the memory locations previously discussed. Check everything carefully, and use 'F1' to get into the modify mode to fix any bugs. Then dump the program and try again. ■

```
TRS-80 Model II DEBUG Program
3FD0    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
3FE0    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
3FF0    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4000    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4010    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4020    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4030    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4040    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
   PC     SP  SZHPNC  AF   BC   DE   HL   IX   IY   AF'  BC'  DE'  HL'
 2800  21FE  000000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
```

Fig. 3.

```
TRS-80 Model II DEBUG Program
3FD0    00 00 00 00 00 43 4F 4D    4D 41 4E 44 20 53 54 52    .....COMMAND STR
3FE0    49 4E 47 20 20 54 48 45    4E 20 50 41 44 44 45 44    ING  THEN PADDED
3FF0    54 4F 20 20 48 45 52 45    21 D5 3F 06 23 3E 25 CF    TO  HERE!.?.#>%.
4000    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4010    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4020    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4030    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
4040    00 00 00 00 00 00 00 00    00 00 00 00 00 00 00 00    ................
   PC     SP  SZHPNC  AF   BC   DE   HL   IX   IY   AF'  BC'  DE'  HL'
 2800  21FE  000000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
```

Fig. 4.



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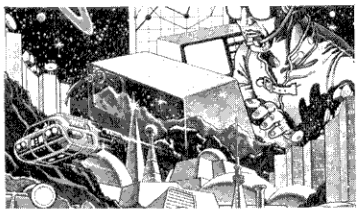

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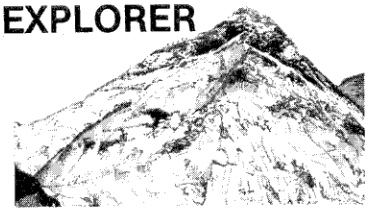

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Bruce Evans
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Several programs for slowing down screen listings on the Level II TRS-80 reduce it to one slow speed or use the down arrow key to scroll the screen one line at a time, like the Level I. I wanted a routine to slow the running, as well as the listing speed; also, I wanted several speed options. It seemed that if I could slow the Basic interpreter I could also slow down the listing.

How It Works

My program uses a delay routine (see the Program Listing) patched into the keyboard scan; the keyboard is scanned constantly for a Shift @ to halt the running or listing.

The Key Box

Basic Level II
Model I

Ten variable speeds range from a delay of about four lines per second (normal speed) to about one line per two seconds. When you run your Basic program, the same amount of delay results between the interpretation of each instruction. Shift Enter gives a Speed? message in the upper left corner of the screen. A single keystroke of 0–9 slows down or speeds up the program or listing.

Many times the Speed? message overwrites and ruins your display; when you hit the key of your choice, the display is restored.

The program instructions are written to the screen as the tape loads into memory, and the program Auto Starts. The assembler version can be relocated to any spot in memory.

Listing 1 was created with Radio Shack's Editor/Assembler; any assembler would do just as well. You may delete lines 120–370 as they only write instructions to the screen as the tape loads. Also delete line 430; this instruction waits for a key to be depressed before clearing the screen.

To put exactly 64 characters on one line after a DEFM instruction, make sure the second remark apostrophe appears exactly one space past the first apostrophe on the next line.

This may not be an elegant program, but it is the first useful machine language program I have written. I must say I'm happy with the results.■

Program Listing

```
41E2          00130        ORG     41E2H
41E2 E9       00140        DEFB    233
3C00          00150        ORG     3C00H
3C00 20       00160        DEFM    '                    SLOW L
IST V 1.0                           '
3C40 20       00170        DEFM    '                      BRUC
E EVANS                             '
3C80 20       00180        DEFM    '
                                    '
3CC0 54       00190        DEFM    'THIS PROGRAM WILL ALLOW YOU
 TO SLOW YOUR LIST OR SLOW YOUR     '
3D00 50       00200        DEFM    'PROGRAM . YOU ARE ALLOWED 1
0 SPEEDS , FROM 0 TO 9 , WITH 0 BEING'
3D40 54       00210        DEFM    'THE NORMAL SPEED . EACH NUM
BER FROM 1 THRU 9 SLOW THE COMPUTER  '
3D80 44       00220        DEFM    'DOWN IN INCREMENTS OF ABOUT
 1/2 SECONDS PER LINE DURING A LIST  '
3DC0 4F       00230        DEFM    'OR THE SAME AMOUNT BETWEEN
INSTRUCTIONS DURING A RUN OF YOUR    '
3E00 50       00240        DEFM    'PROGRAM .
                                    '
3E40 20       00250        DEFM    '
                                    '
3E80 20       00260        DEFM    ' TO INVOKE THE SLOW UTILITY
 , JUST HIT SHIFT ENTER , YOU WILL   '
3EC0 53       00270        DEFM    'SEE          SPEED ?
                                    '
3F00 4E       00280        DEFM    'NOW ENTER THE NUMBER CORRES
PONDING TO THE SPEED YOU WISH .      '
3F40 20       00290        DEFM    ' JUST REMEMBER THE NORMAL S
PEED IS 0 , AND EACH HIGHER NUMBER IS'
3F80 41       00300        DEFM    'A SLOWER SPEED.'
7EF5          00310        ORG     32501
```

Program continues

Program continued

```
7EF5 21097F   00320          LD      HL,ROUT
7EF8 221640   00330          LD      (4016H),HL
7EFB 21E241   00340          LD      HL,41E2H
7EFE 36C9     00342          LD      (HL),201
7F00 CD4900   00360          CALL    49H
7F03 CDC901   00370          CALL    1C9H
7F06 C3191A   00380          JP      1A19H
7F09 CD647F   00390 ROUT     CALL    DELAY
7F0C CDE303   00400          CALL    3E3H
7F0F B7       00410          OR      A
7F10 C8       00420          RET     Z
7F11 4F       00430          LD      C,A
7F12 3A8038   00440          LD      A,(3880H)
7F15 B7       00450          OR      A
7F16 79       00460          LD      A,C
7F17 C8       00470          RET     Z
7F18 FE0D     00480          CP      13
7F1A 21003C   00482          LD      HL,3C00H
7F1D 117E7F   00483          LD      DE,BUFF
7F20 010800   00484          LD      BC,8
7F23 EDB0     00485          LDIR
7F25 C0       00490          RET     NZ
7F26 2A2040   00500          LD      HL,(4020H)
7F29 227C7F   00510          LD      (CURSOR),HL
7F2C 212040   00520          LD      HL,4020H
7F2F 3600     00530          LD      (HL),00H
7F31 23       00540          INC     HL
7F32 363C     00550          LD      (HL),3CH
7F34 21727F   00560          LD      HL,MSG
7F37 CDA728   00570          CALL    28A7H
7F3A CD4900   00580          CALL    49H
7F3D 217E7F   00581          LD      HL,BUFF
7F40 11003C   00582          LD      DE,3C00H
7F43 010800   00583          LD      BC,8
7F46 EDB0     00584          LDIR
7F48 21867F   00590          LD      HL,TAB
7F4B 010A00   00600          LD      BC,10
7F4E EDB1     00610          CPIR
7F50 C0       00620          RET     NZ
7F51 010900   00630          LD      BC,9
7F54 09       00640          ADD     HL,BC
7F55 7E       00650          LD      A,(HL)
7F56 327A7F   00660          LD      (COUNT),A
7F59 2A7C7F   00670          LD      HL,(CURSOR)
7F5C 222040   00680          LD      (4020H),HL
7F5F AF       00685          XOR     A
7F60 CD647F   00690          CALL    DELAY
7F63 C9       00700          RET
7F64 F5       00710 DELAY    PUSH    AF
7F65 C5       00720          PUSH    BC
7F66 3A7A7F   00730          LD      A,(COUNT)
7F69 47       00740          LD      B,A
7F6A 0E01     00750          LD      C,01H
7F6C CD6000   00760          CALL    60H
7F6F C1       00770          POP     BC
7F70 F1       00780          POP     AF
7F71 C9       00790          RET
7F72 53       00800 MSG      DEFM    'SPEED ?'
7F79 00       00810          DEFB    00
7F7A          00820 COUNT    EQU     $
7F7A 00       00830          DEFB    00
7F7B          00840
7F7B 00       00850
7F7C          00860 CURSOR   EQU     $
7F7C 0000     00870          DEFW    0000
7F7E          00872 BUFF     EQU     $
0008          00874          DEFS    8
7F86 30       00880 TAB      DEFB    30H
7F87 31       00890          DEFB    31H
7F88 32       00900          DEFB    32H
7F89 33       00910          DEFB    33H
7F8A 34       00920          DEFB    34H
7F8B 35       00930          DEFB    35H
7F8C 36       00940          DEFB    36H
7F8D 37       00950          DEFB    37H
7F8E 38       00960          DEFB    38H
7F8F 39       00970          DEFB    39H
7F90 0100     00980          DEFW    0001
7F92 20       00990          DEFB    20H
7F93 30       01000          DEFB    30H
7F94 40       01010          DEFB    40H
7F95 50       01020          DEFB    50H
7F96 60       01030          DEFB    60H
7F97 70       01040          DEFB    70H
7F98 80       01050          DEFB    80H
7F99 90       01060          DEFB    90H
7F9A A0       01070          DEFB    0A0H
7EF5          01080          END     32501
00000 TOTAL ERRORS
```

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80 APPLICATIONS

by Dennis Kitsz

The first microcomputer users considered the advent of cassette storage a luxury, since programs hundreds of bytes long previously had to be entered by hand from switches and lights on a front panel. Then along came machines like the TRS-80, with cassette and a four-disk option as well. Finally, there is the Color Computer, with cassette and disk—and entire programs that plug into the side of the machine. This month the subject is those Color Computer ROM packs: what they are, and how to make your own.

First of all, ROM packs are easy and cheap. If they weren't, Radio Shack wouldn't sell them for 30 bucks each. If you pop one open you'll find a small printed circuit board with one or two integrated circuits on it. Maybe a pair of tiny capacitors. That's all. In fact, they are made up of exactly the same electronic components as Color Basic and Extended Color Basic, that is, read-only-memories (ROMs).

Last month's Applications covered quite a bit of computer jargon, so this time I'll make the dangerous assumption that you all read it, and jump right in with a description. The edge card of the Color Computer provides a complete bank of signals produced or used by the processor, plus a few specially created ones. Two of these special signals are essential for operating ROM packs: CTS* (cartridge select) and CART* (cartridge interrupt).

What is CTS* and what makes it important? If you leaf through computer magazines, you'll find a lot of talk about memory address decoding, which is the process of electronically assigning a group of memory locations to some specific device or a given block of random-access memory (RAM) or ROM. The Color Computer's memory map is broken into four such major blocks: 32K RAM including memory for Basic operation, video memory, and user memory from 0000 to 7FFF hex (0 to 32767 decimal); the two Basic ROMs from 8000 to BFFF hex (32768 to 49151); space for the external cartridge ROMs from C000 to FEFF (49152 to 65279); and internal locations for keyboard, cassette, serial input/output, and so on, from FF00 to FFFF (65280 to 65535).

Decoding the cartridge block might be complicated. It demands the selection (activation) of the external cartridge for all memory addresses starting at C000—a nice even number—but ending at FEFF, slightly less than the memory position at which a 16K block would normally end (at FFFF). This kind of irregular mapping,

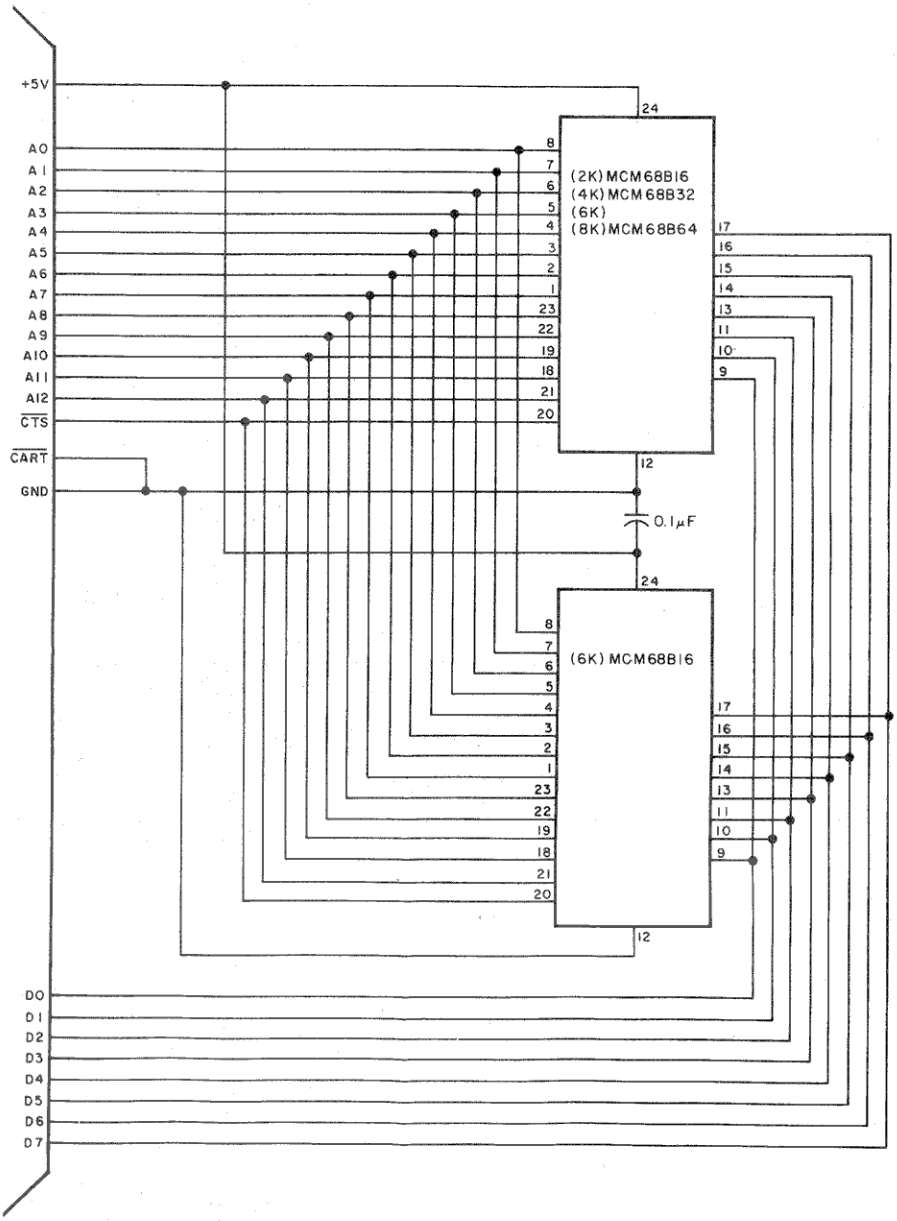

Fig. 1. Radio Shack arrangement for 2K, 4K, 6K, or 8K ROM cartridges. MCM68B series ROMs are fast factory-programmed memories manufactured by Motorola.

used for disk, printer, cassettes, and so forth on the Model I, was an electronic nightmare. But on the Color Computer, CTS* does that work. It is a signal output created by the computer which is active when the CPU wants any address from C000 up to FEFF (but not beyond).

The second cartridge signal is CART*; it is an input to the computer. When CART* is shorted to ground—which happens whenever a Radio Shack cartridge is inserted— the CPU is interrupted from its normal operation, and forced to jump to the address of the external cartridge and begin executing the program found there. It's a neat trick. Plug in a cartridge, power up the computer, and instantly you have something other than Basic—a game, another language, a monitor, an assembler, or just a simple utility program of some kind.

But there's a bonus. Recall, I mentioned that memory mapped addresses can be for ROM, peripheral devices, or RAM. Which means adding static RAM is as easy as adding a "ROM" pack. And almost as easy is adding an extra parallel input/output port or two.

One from Column A, Two from Column B

Several variations can be selected for adding memory in this cartridge area. Figure 1 shows how Radio Shack chose to do it. Using factory-programmed read-only-memories, they have connected these devices directly to the address and data lines coming from the central processing unit (CPU) in the computer. The sockets in the cartridge can accommodate two integrated circuits, which can be arranged in combinations of one MCM68B16 (2K) alone, one MCM68B32 (4K) alone, one MCM68B32 paired with one MCM68B16 in the second socket (6K), or one MCM68B64 (8K) alone. One or two capacitors keeps the electronic noise level down.

This method has the advantage of extreme simplicity—the use of only two electronic components lowers both cost and power demand. But the arrangement also has a disadvantage. Because no additional electronic logic was put in place, the full 16K addressing available from the CTS* signal is not used. 8K is the maximum memory space used. (Don't get me wrong; that's *lots* of space. After all, the entire Color Basic fits in 8K of ROM).

From the point of view of a Color Computer user attempting to create an extensive ROM cartridge add-on, however, Radio Shack's simple method is virtually impossible. That's because most home computer owners can't order the minimum 1,000 factory-programmed ROMs at a time. Instead, individual users must obtain memories that they can program at

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home, or which can be programmed in single quantities by mail order services. These are erasable, programmable, read-only-memories (EPROMs).

Figure 2 presents the simplest equivalent of the Radio Shack design. Four inexpensive 2716 EPROMs are hung onto the address and data lines, and selected in 2K increments by the 74LS138 demultiplexer. Whoa, you say, what's this demultiplexer and how did it get in the circuit?

As I mentioned, Radio Shack's ROM packs use different size ROMs for different program memory requirements. Although EPROM equivalents for these ROMs are available, they can be quite expensive—$20 or better for the 4K 2732 and $50 for the 8K 2764. At only $5 a pop, the 2K 2716 is well worth the trouble of adding an extra 50-cent integrated circuit like a 74LS138.

Next question: What does the demultiplexer do? Addresses 0 through 10 can select 2,048 (2K) different memory locations. Including address 11 increases the selection to 4K locations, adding address 12 increases it to 8K, and using address 13 increases the possibilities to 16K. In this design, the lower-numbered addresses 0 through 10 are used by the 2716 EPROM for actual memory location selection.

". . . most home computer owners can't order the minimum 1000 factory-programmed ROMs at a time."

That means addresses 11, 12 and 13 can be thought of as "block selection" tools rather than mere memory addresses—A11 selects two blocks containing A0 to A10; A12 selects two blocks of A11; and A13 selects two blocks of A12; for a total of 8 blocks.

The demultiplexer (Z1 in Fig. 2, type 74LS138) accepts three binary inputs and produces only one active signal for each unique combination. Therefore, since addresses A11, A12 and A13 are fed to its inputs, then eight individual block select signals are derived at its outputs. . .each one representing a single 2K block of memory—the size of a 2716 EPROM.

Watching Out for Overdrive

Notice, however, that four of the demultiplexed outputs from Z1 in Fig. 2 are marked "possible but not recommended." This is so because digital integrated circuits can only drive (feed reliable signals to) a limited number of other integrated circuits in the same family. This limitation is called a device's "fan-out" (one company prefers to call it "family rules of incest").

The CPU in the Color Computer is already pushing a couple of Basic ROMs and some other circuits, and because of its limited fan-out, it's unwise to ask it to drive more than two or three ICs. Four 2716 EPROMs are just about as much as can be added without the computer operation becoming unreliable. So if you use the design in Fig. 2, don't attempt to connect more than four 2716's.

However, there is a way to make all 16K of this cartridge address space available safely; it is shown in Fig. 3. In this design, the CPU is asked to drive only one set of extra integrated circuits. These are known as buffers, and their job here is to extend the fan-out of the CPU. They transmit the same signals to many more circuits than the CPU can do alone.

Two of the buffers (74LS244s, Z1 and Z2) are the one-way streets. That is, the address signals are always sent from the CPU to receiving devices. However, the data bus is different in that it is both read from and written to by the CPU— it is *bidirectional.* Z3 is a 74LS245 bidirectional bus transceiver (phew!), meaning it is able to receive signals from the left and send them out the right, or vice versa, depending on whether the send/receive (S/R) signal on pin 1 is high or low. This is how it is used here: By hooking up the computer's read/write (R/W) signal to the bus transceiver's send/receive (S/R) input, and by connecting the bus transceiver's chip-enable (CE) input to the computer's car-

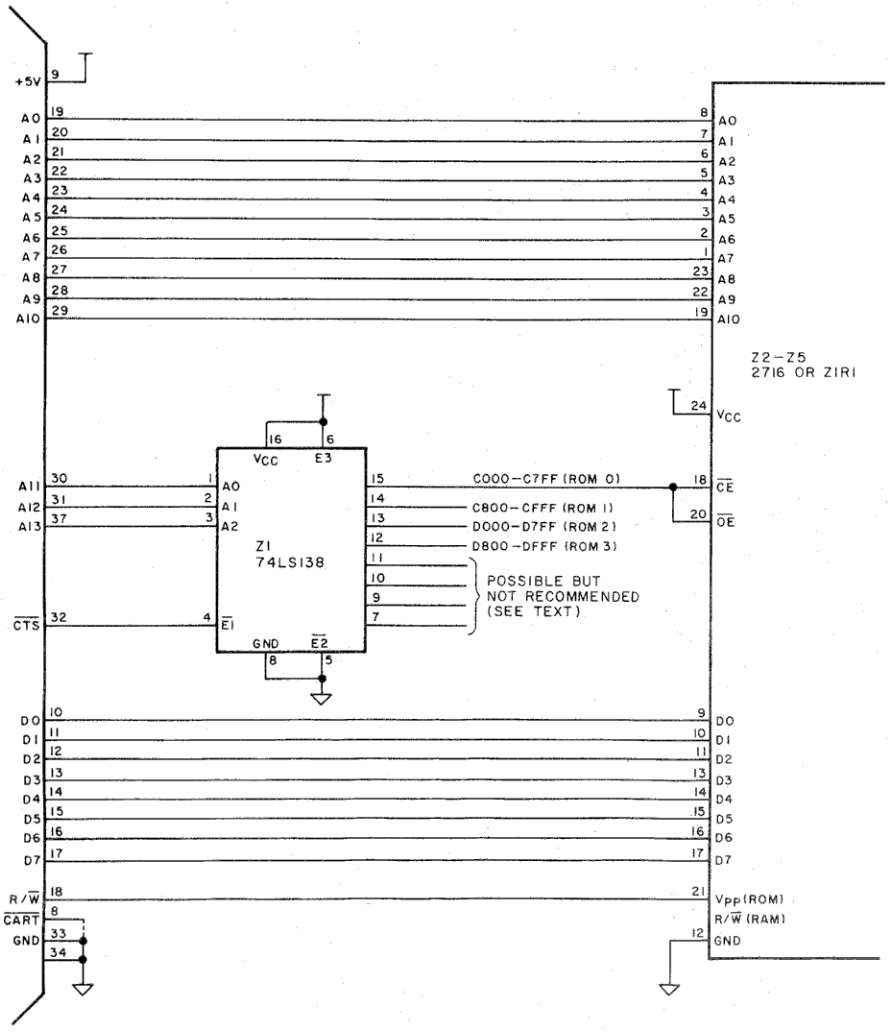

Fig. 2. ROM cartridge arrangement using four 2716 EPROMs. Although eight EPROMs can theoretically be connected, the load on the CPU would be too high.

tridge select (CTS*) signal, the 74LS245 will transmit data from the ROMs to the computer only when the computer issues a "read from cartridge," and will transmit data from the computer to the ROMs only when the computer issues a "write to cartridge."

The 74LS138 demultiplexer is used in exactly the same way as in Fig. 2, except that this time all eight 2716's can be hooked into its memory selection circuitry without problems. The power consumed is low (well under 200 mA) since only one 2716 is enabled at full power at a time.

Hidden Feature

There is an additional advantage to this circuitry not immediately obvious because I've been talking about "ROM" packs. The electronics industry has developed a 2K RAM which is pin-for-pin compatible with the 2716 EPROM. These RAMs (known variously as 21R1, 6116, or 2118) can be interchanged with the ROMs in this circuit merely by putting them into the same sockets. The circuitry in either Fig. 2 or Fig. 3 can be used without alteration, since pin 21 is used as a programming pin for the ROMs, and as a memory read/write pin for the RAMs. In fact, using November's 32K dynamic RAM piggyback together with a ROM pack filled with RAMs, you can have a Color Computer with Extended Basic and 48K memory.

". . . But if all that RAM isn't your style, you still have two other approaches. . ."

But if all that RAM isn't your style, you still have two other approaches to ease the wiring complexity in putting together Color Computer ROM packs. By the time you read this, the price of 4K 2732 integrated circuits may have dropped considerably, making them practical to use in home-built ROM packs. Figure 4 shows the changes necessary to use 2732 EPROMs. Pin 21 is now address line 11, and a 74LS139 demultiplexer is used in conjunction with addresses 12 and 13 to produce four 4K block memory select signals. Since pin-compatible RAMs do not exist, the RD/WR* line from the computer (pin 18) is routed to Z3 and to the ROMs pin 18 (chip enable).

Finally, simplest of all is Fig. 5, again using four 2732 EPROMs. Since the CPU can push four devices without too much overexertion, the buffers and bus

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FMT—Arranges data into a string variable as with PRINT USING.
PDAT/UDAT$—Permits user to do arithmetic on dates.
PK$/UPK$—Compresses strings to save disk space.
ETIM$—Shows the difference between two times.
CLEAR—Specifies the number of file blocks to be allocated when you specify high memory and string space.
DELETE—Allows you to dynamically remove portions of a BASIC program.

In addition to these, there are functions unique to Model II and to Model III. The exclusives to Model II are long error messages and PEEK/POKE. The exclusives to Model III are:

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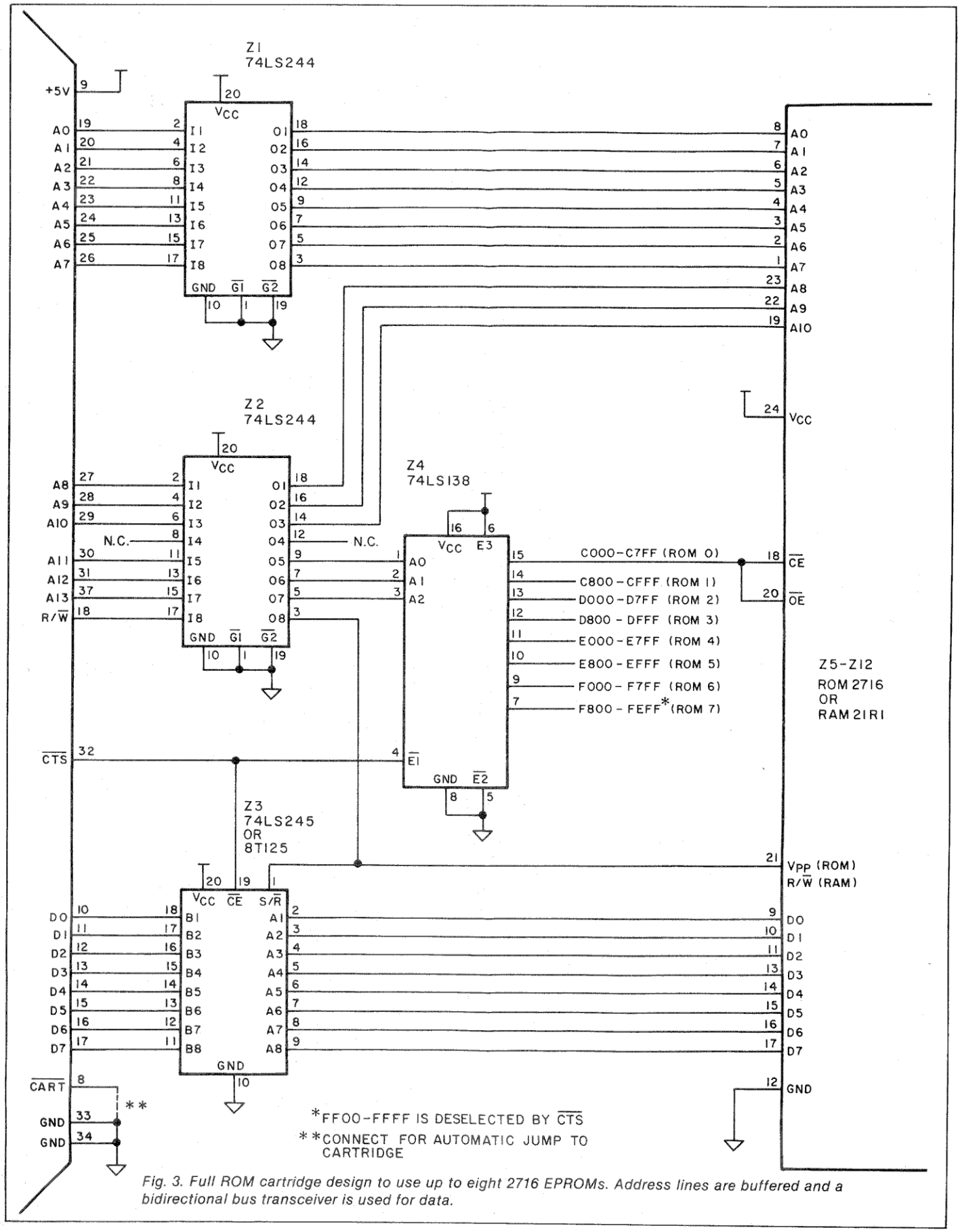
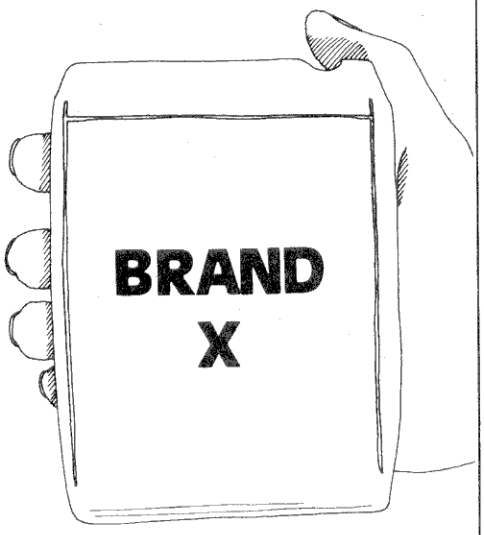


Fig. 3. Full ROM cartridge design to use up to eight 2716 EPROMs. Address lines are buffered and a bidirectional bus transceiver is used for data.

transceivers are eliminated, leaving only the 74LS139 demultiplexer and the ROMs themselves.

Construction Notes

Building the ROM packs is straightforward; be sure to use 350 nS 2716's (type 2716-1 or 27A16) for greatest reliability. Point-to-point wiring or wire-wrapping can



Start with an inexpensive 8-track cartridge...

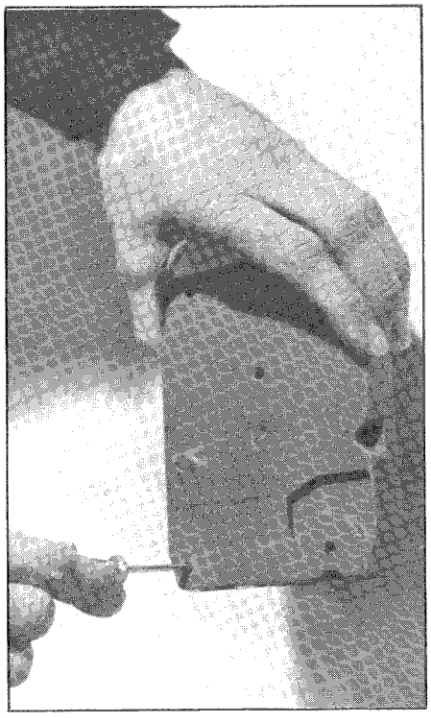


Photo 1....jam a small screwdriver into the four or five holes on the bottom to push back the locking posts...

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SCOTT ADAMS - PRES. OF ADVENTURE INTL.

When working with direct files or creating a formatted screen, Autofile and Automap are indispensible aids.

Autofile is designed to automate for the BASIC programmer the task of moving data elements to and from a direct file. Previously, this was a time consuming chore because the FIELDed variables may not be directly referenced by user logic. The FIELD statement was eliminated, thereby relieving you of the guessing game as to where the FIELDed variable is. In addition, the LSET and the CVx functions are performed automatically. The software, when installed, becomes part of your BASIC interpreter providing the enhancements without additional memory.

Automap is designed to automate for the BASIC programmer the task of presenting information on the video display and accepting information from the keyboard operator. The software consists of two main components: the OFF-LINE COMPONENT used to describe to the system the screen formats and the ON-LINE COMPONENT from within your BASIC program to initialize a screen, send data to the video display and receive data from the keyboard operator. This facility when installed, becomes part of your BASIC interpreter.

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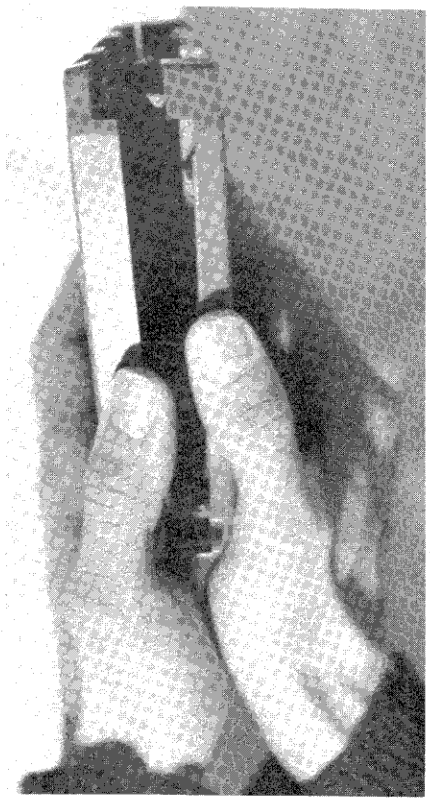

Photo 2. . . . carefully separate the top and bottom halves of the shell. . .

be used successfully, and overpriced edge connector cables can be obtained from Exatron (181 Commercial Street, Sunnyvale, CA 94086) or Alpha Products (85-71 79th Street, Woodhaven, NY 11421). The noise level is low enough that simple 0.1-mF bypass capacitors connected from +5 volts to ground near each EPROM will be satisfactory. All interconnections are quite parallel, and are visually easy to make. No matter what method you employ, use sockets for the EPROMs.

and EPROM programming are available from MSB electronics (Drawer 766, Barre, VT 05641). The layouts, by the way, are based on the public-domain PC artwork published in "Application of Intel's 5V EPROM Family of Microprocessor Systems," Application Note AP-72, available from Intel Corporation, 3065 Bowers Avenue, Santa Clara, CA 95051. So if you want to go ahead with your own design, get a copy of this publication note to ease the way.

" 'Gold Plug 80' is a terrific cure for most Model I edge connector problems."

I suggest that you follow Radio Shack's ingenious lead, and shorten or tape partly over the 5-volt power pin (pin 9) so that, in case you insert the ROM pack with the power on, all the proper connections are made *before* power hits the EPROMs. Kudos to the Shack for that idea.

Double-sided printed circuit layouts for the 4-ROM 2716 version will be published next month for those who can wait. For those who can't, cartridge packs, kits, cases, integrated circuits, blank EPROMs,

If the interest is high enough, I'll also publish plans for a Color Computer EPROM programmer, and a dynamic RAM addition for the cartridge area. Drop a post card—no letters on this one, please.

Cartridges

When you complete the project, you'll probably want a housing for it—and what better kind than a real cartridge? Although Radio Shack's ROM packs

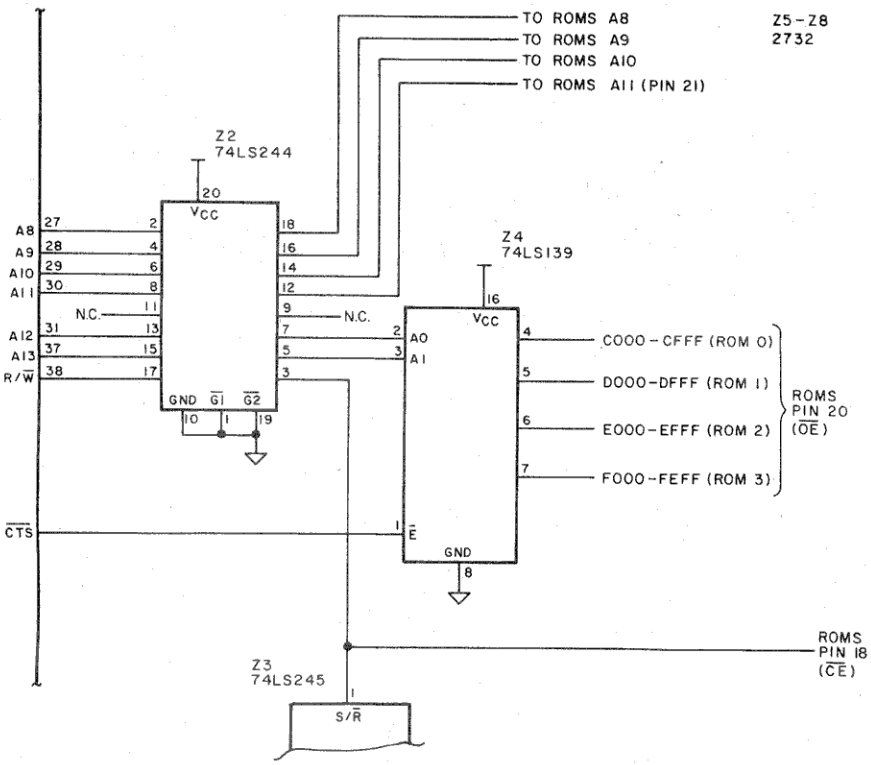

Fig. 4. Changes necessary to employ the ROM cartridge design presented in Fig. 3 with 2732 EPROMs. Four 2732s are used in this scheme.

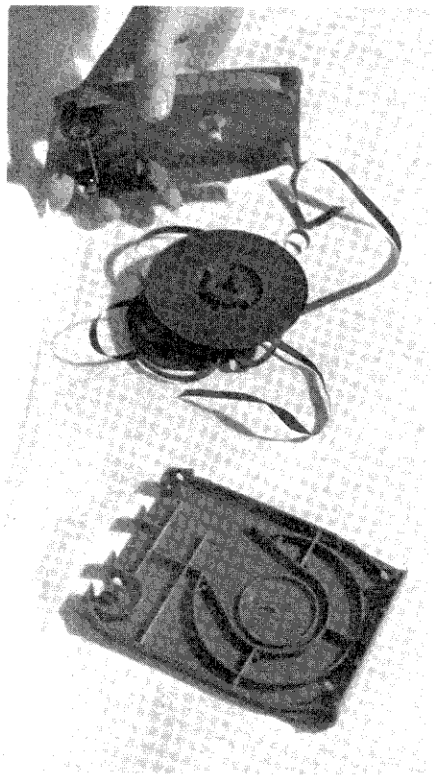

Photo 3. . . . carelessly dump out the innards. . .

come in stubby little cartridges, an actual 8-track cartridge with the tape removed and plastic parts clipped out makes a fine housing, preventing shorts, and (with a little imagination) providing a professional ROM-pack look. Press-on lettering for your program's name (and the author's name— yours) plus a good eye for design can certainly be impressive. Fool everybody! (Speaking of which, can you guess what next month is. . . ?)

Photos 1-5 show the first steps in converting a cheap 8-track cartridge to your own ROM pack. Actual mounting of the printed circuit board, plus cares and cautions, will be covered, together with the double-sided PC board itself, next time.

Updates

I ran into an interesting dilemma while using the Color Computer—a very regular random number sequence appeared, repeating every nth number, where n was the operand in RND(N). NEW, CLEAR and editing the program had no effect. Power-down did, naturally, but it has occasionally recurred. I couldn't find any solution in the technical information, nor from Fort Worth (yes, I too am just one of thousands to them). Can readers suggest a *simple* way to reseed the random number function?

It's-about-time department: "Gold Plug 80" is a terrific cure for most edge connector problems in the Model I. This completely new gold edge connector solders directly to the old one. Two problems, though. First, the little grey door won't go back on (big deal). The second is a trifle more serious: The Gold Plug 80 is a Kel/Am brand connector which will not mate successfully with AP Products con-

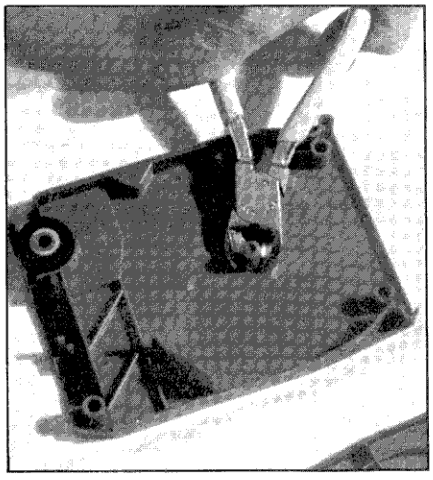

Photo 4. . . . snip off all the plastic protrusions except the four locking posts (see Photo 1). . .

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The Snappware College Educated Garbage Collector (SNAPP-VI) is an intelligent processing function which greatly improves performance of typical BASIC applications. And here's why.

Microsoft uses a 'variable length string' in the BASIC interpreter. Each time the string is assigned a new value, it is relocated in a string pool. Periodically the string pool must be reorganized and condensed into a single contiguous area. Performing this string space reclamation is time consuming and inefficient because this approach evaluates and collects each string individually. The time required is roughly proportional to the square of the number of active strings in the resident program. During reclamation the system seems to 'lock-up' and does not respond to the operator until the process is completed.

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nectors. However, it will work with the T&B Ansley brand sold by Radio Shack. So replace any edge connectors that won't fit with Radio Shack connectors, but definitely get the Gold Plug 80 ($19 a pair, also available singly for any connectors, including RS-232, printer, disk, and so on) from EAP Co., P.O. Box 14, Keller, TX 76248, (817) 498-4242. If you can solder, you can install it in a half-hour.

Another interesting item is sold by ABS Suppliers, P.O. Box 8297, 3352 Chelsea Circle, Ann Arbor, MI 48104, (313) 971-1404. If you've ever fought with scissors and rulers trying to turn your single-sided disks into double-sided ones, ABS has a plastic template which aligns the holes properly so you can mark them for punching. It's $5 for a few square inches of plastic and a sheet of documentation, but it costs about the same as a disk—meaning it pays for itself the first time you use it successfully. As a registered cheapskate, I'll recommend this item even though disk manufacturers wag their fingers, saying only disks specifically manufactured for double-sided use should be used that way.

"I wonder if 80 Microcomputing *authors and readers ever believed they were contributing to a weakening of U.S. international power?"*

Quick note to manufacturers and readers: If I use it or install it and like it, I'll recommend it here. If I passively don't like it, I'll ignore it. If I actively don't like it, I'll say so. Criteria explained.

Recent news: In an address to the American Association for the Advancement of Science, a leading military advisor to the CIA and the administration announced that the CIA hopes, in the interest of national security, to examine and prevent publication of technical articles it feels will be of assistance to nations considered enemies of the United States. He stated that advances in computer science in the Soviet Union are of particular danger, and can be traced directly to the free flow of information in U.S. technical publications. Furthermore, no reasons would be given for removing articles from publication, because such explanations would be security risks in themselves. I wonder if *80 Microcomputing* authors and readers ever believed they were contributing to a weakening of U.S. international power? ■

Next month: conclusion of Color Computer ROM packs, plus a special on babble memory.

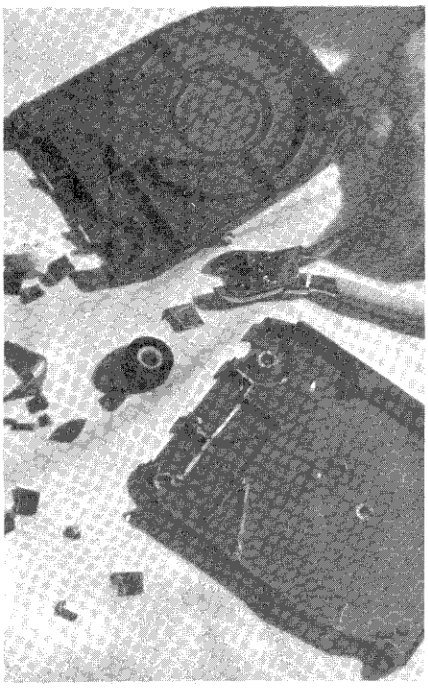

Photo 5. . . . and you've got an empty shell for your ROM pack all ready for a professional-looking label!

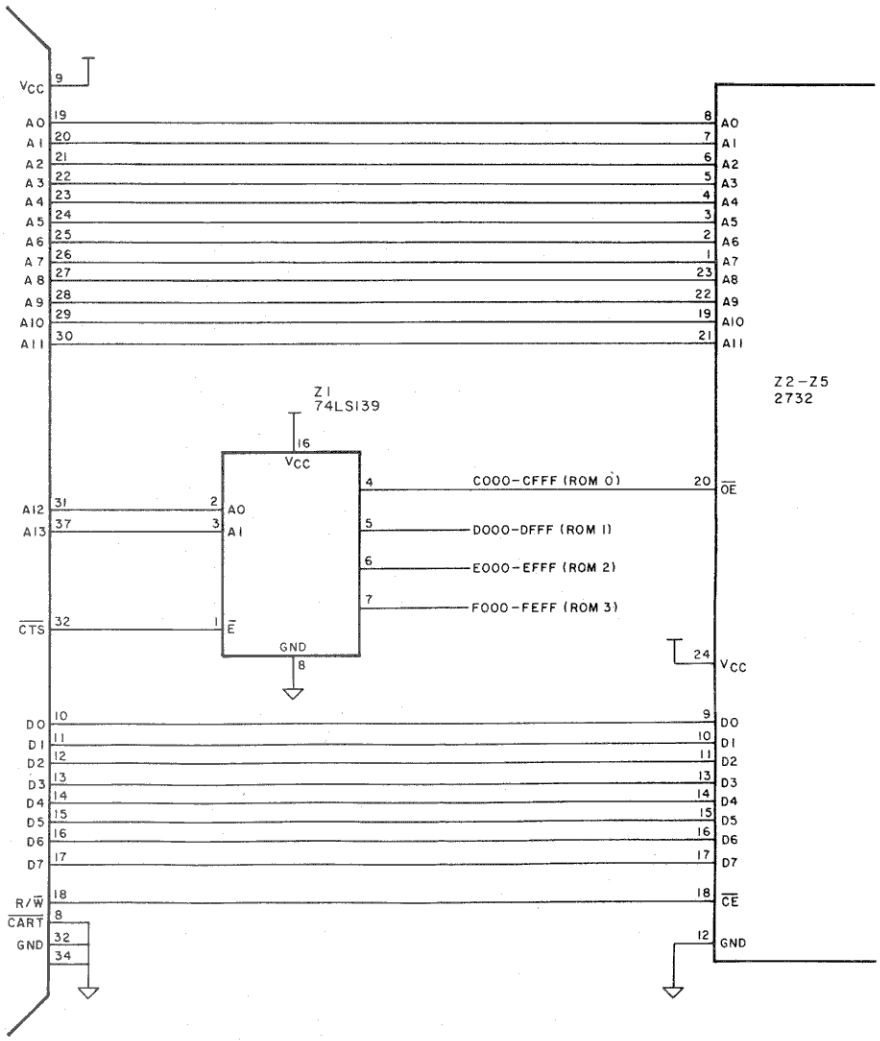

Fig. 5. Alternate method of using four 2732 EPROMs. It is similar to Fig. 2 in that buffering can be eliminated since only four additional devices will be connected to the CPU.

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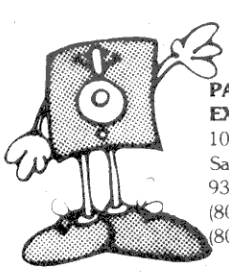

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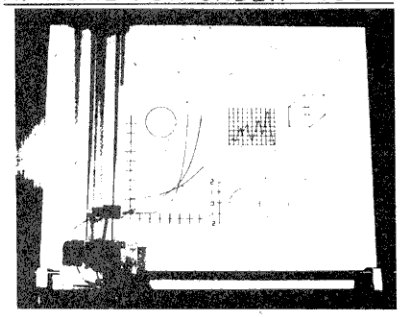

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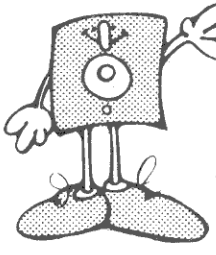

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MONEY DOS

an operating system for financial survival

by J.M. Keynes

Your two year CD (Certificate of Deposit) just came due. Now what will you do with the money? If you are like most investors you will likely reinvest in another CD. And you will probably be throwing money away. It is tragic that you work so hard for your money and then neglect it so when the time comes to invest it. Actually, it's not all your fault. Like a computer we are creatures of habit which rely on our data bank instructions. I have compelling evidence for purging the mental program which says, "Roll over that CD or Treasury Bond."

People tend to judge investments on the gross return. Twenty percent sounds great, but is no longer available. Even if one could get 20 percent, it may be an unwise choice. This point is crucial to investment decisions: The gross return of an investment is immaterial. You cannot spend gross unless you are in a zero tax bracket. Most of you are in a 20-50 percent bracket, so you must deal with the real world in which you pay income tax. Examine the following carefully and you will see that for many investors a 4-1/8 percent current return is superior to a 13.5 percent current return because I shall deal with the only criteria one should apply to investment evaluation (assuming the risk is the same)... what you can spend, net returns after taxes.

There is an investment quality bond which matures in 15 months which is quoted at 80 currently. (You pay $800 for each bond that returns $1000 at maturity.) The coupon rate is a niggardly 4-1/8 percent. It pays only $41.25 per year in interest. If one examines only the gross return at maturity (18 months), it is of little interest. At maturity you will have received only $61.87 in interest and $200 in a long term capital gain (you paid $800 and will receive $1000 at maturity). Total gross return for the bond equals $61.87 plus $200 or $261.87 while your $800 investment in the CD would return a gross of $162. Were it not for the special treatment of long term capital gains (holding period one year or more), the CD would be a better deal. Let's take advantage of what has been called 'a loophole for the rich' and put more after tax dollars in your pocket—which you will then spend on computer toys.

If one compares this bond with the current 15 month rate of 13.5 percent the results are dramatic, showing an advantage in favor of those in the 20 percent bracket. The bond's advantage increases geometrically with your tax bracket.

Run the Program in Listing 1 and get a true picture of this investment alternative; $10,000 invested in the above bonds by one in the 50 percent bracket will return, at maturity, $1374.22 more after taxes than a 15 month 13.5 percent CD. That is enough to buy a disk system. All for free—no more risk, just more money.

Few investors are aware of this strategy. Your banker will never suggest it. That would be counterproductive for him. One must buy these bonds through a stockbroker. The commission on a 10 bond lot should not exceed $50. The broker who handles your order will get about 30 percent of it—big deal—not for him but for you. This is not exactly "big ticket" merchandise for the broker, but they will handle the transaction if you ask. There are a number of similar bonds available that mature in one to five years. Look in the *Wall Street Journal* or your local paper on the bond page: They will be quoted as follows:

ISSUER'S NAME	COUPON	MATURITY YEAR
AT&T	3.5	1983

Look for the short term maturities and plug the numbers into the Listing.

Some of my clients have asked, "Why are these bonds available at such advantageous prices?" They always will be available because they benefit those in higher tax brackets most. Billions of dollars from "no tax" entities like pension funds, retirement plans and so on are not bidding against you as with CDs, commercial paper, and other short term high yield investments. Should you invest in these

```
5 REM  WRITTEN BY J. MAYNARD KEYNES FOR 80 MICROCOMPUTING
10 CLEAR:  CLEAR1000:  CLS
20 A$="$$####.##"
3000 PRINT: PRINT"AFTER TAX COMPARISION OF DISCOUNT BONDS WITH CERTIFICATE
3010 PRINT"OF DEPOSIT OR T-BOND FOR THE SAME PERIOD.
3020 PRINT: INPUT"TOTAL DOLLARS INVESTED";DI: IF DI<100,DI=10000
3030 INPUT "BOND PRICE IN DOLLARS (EG. 79=790)";BP
3040 INPUT"MONTHS LEFT TO MATURITY";MA:  ML=MA/12
3050 CG=1000-BP
3060 XX=DI/BP
3070 INPUT"COUPON RATE";CC:  CP=CC*10*ML
3080 INPUT"TAXPAYERS BRACKET";TP:  TB=(100-TP)/100
3090 INPUT"RISK FREE CD INTEREST RATE";IJ:  II=(IJ/100)*ML:  PRINTII
3100 CLS:  PRINT"RESULTS OF A";CC;"% BOND PURCHASED AT";:
PRINTUSINGA$;BP;: PRINT" DUE IN";MA;"MO.
3110 PRINT"FOR A TAXPAYER IN THE ";TP;"% BRACKET VS A CD AT ";IJ;"%
3120 PRINT:  PRINT"","GROSS RETURN","AFTER TAX RETURN"
3130 AT=CP*TB:  PRINT"INTEREST";: PRINT@270,USINGA$;CP
3140 TP=TP/100
3150 PRINT@289,USINGA$;AT
3160 NN=CG*.4:  NM=NN*TP:  NG=CG-NM
3170 A$="$$####.##"
3180 PRINT"CAP. GAIN";: PRINT@334,USINGA$;CG
3190 PRINT@353,USINGA$;NG
3200 TN=NG+AT
3210 PRINT"TOTAL NET";: PRINT@417,USINGA$;TN
3220 R1=BP*II:  R2=R1*TB
3230 PRINT
3240 PRINT"CD AT ";IJ;"% RETURNS ";: PRINTUSINGA$;R1;:
PRINT" GROSS OR ";: PRINTUSINGA$;R2;: PRINT" NET!
3250 DA=TN-R2:  PR=(DA/R2)*100
3260 PRINT:  PRINT"EACH BOND WILL PROVIDE AN ADVANTAGE OF ";:
PRINTUSINGA$;DA;: PRINT" OVER THE CD.":
 PRINT"OR ";PR;"% GREATER RETURN
3270 IFDI>1THENDX=DA*XX:
 PRINT"$";DI;" INVESTED IN BONDS YIELDS";:
PRINTUSINGA$;DX;: PRINT"  MORE AFTER TAXES.":  PRINT
3280 INPUT"TO EXAMINE ANOTHER BOND PRESS 'ENTER'";L4: GOTO3000
```

Program Listing

bonds, you are not locked in. They are traded daily on the New York Stock Exchange and are liquid. The bond I refer to must be considered safe as it is issued by AT&T.

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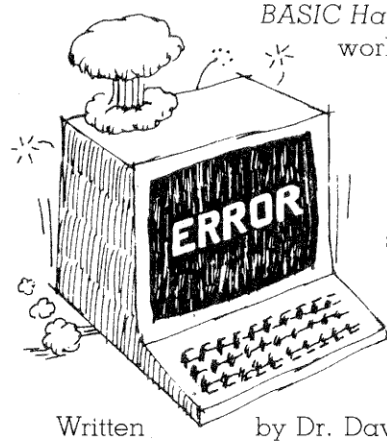

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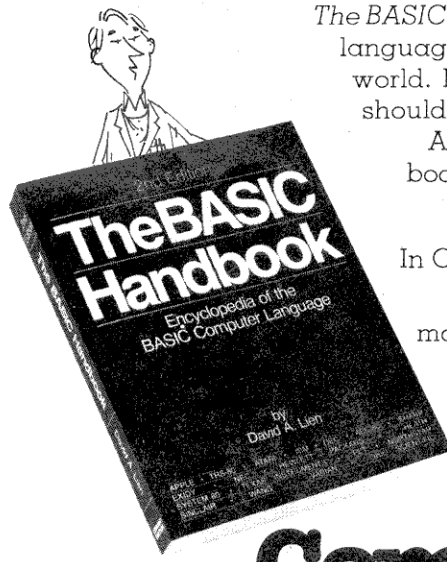

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80 Medical Opinion

by Philip R. Mills, M.D.

"Well over half our patients favor computer histories. . ."

Those of you who are old timers (two or more computer years old) know how slow sophisticated medical software has been in coming for the TRS-80 computer family. Fortunately the trend appears to be changing. There are now many available programs for the medical clinic including patient billing, patient scheduling, automated patient histories, drug interactions, life-expectancy predictions and personalized diet and menu suggestions.

This month begins a new feature in *80 Microcomputing*—a review of software and hardware of particular interest to the medical community.

This column is written particularly for two groups of Radio Shack computer users:

- Physicians, dentists or administrators of small medical clinics;
- Medical software programmers.

Any suggestions and comments will be welcomed.

Since the basis of medical diagnosis is the medical history, we will review two automated patient history packages this month. For non-physician readers a brief description of a minimal patient history may be helpful. A history usually contains three separate sections (see Fig. 1): History of Present Illness (HPI), Past Medical History (PMHx), and Review of Systems (RoS).

The History of Present Illness is the most individualized and complex portion of the history. It does not lend itself well to "standard" questions and yes/no responses. At the present time, I do not believe it is realistic to expect a 64K microcomputer with eight-inch drives to possess the capacity to take a meaningful HPI.

The Past Medical History is less complex, and routine questions can be asked with yes/no responses. but even here some typing by the patient (or office assistant) may be necessary for a complete listing of such things as prior surgical procedures and allergies.

The Review of Systems is ideal for a microcomputer program. It uses a repetitious set of "standard" questions for every new patient. Microcomputers may prove helpful here in many clinics. We use the computer to assist us in some hospital admission workups. Of course the ill and the illiterate are unable to use the program without assistance. We estimate that about 30 percent of our elective hospital admissions are appropriate candidates for the computer. Patient acceptance is mixed. Most are very impressed, while a few refuse to cooperate. Well over half our patients favor computer histories, however.

HPI: 23 y.o. right handed white male with his first episode of right elbow pain. It began two weeks ago after a non-traumatic but vigorous tennis match. The pain is aggravated by resisted wrist extension and supination. It is pain free at rest. The patient denies joint pain, swelling, or redness. He denies any other joint involvement.

PMHx: No prior hospitalizations or surgeries.
No known medical allergies.

RoS: No pertinent neurologic, cardiovascular, or genito-urinary complaints.

Fig. 1. Sample Medical History.

A FEW INSTRUCTIONS AND THEN WE'LL BEGIN.
USE THE KEYBOARD TO TYPE IN YOUR ANSWERS JUST AS YOU WOULD A TYPEWRITER KEYBOARD.
DO NOT USE THE 'SHIFT KEY', EVERYTHING IS AUTOMATICALLY ENTERED IN UPPERCASE.
IF YOU MAKE A MISTAKE, USE THE 'BACK ARROW' KEY (JUST ABOVE THE 'ENTER' TO BACKSPACE.)
IF YOU ACCIDENTALLY HIT THE 'BREAK' KEY, JUST TYPE 'CONT' AND PRESS 'ENTER'.
PRESS THE WHITE 'ENTER' BUTTON AFTER EACH ANSWER ONCE YOU ARE SURE IT IS CORRECT.

Fig. 2. Instructions for the user.

Computer-Assisted Patient History

One simple and inexpensive program is available from Medsoft, Box 7049, Tahoe City, CA 95730, (916) 583-3097. The price is $49. Written in Basic by a physician, Dr. Mark Spohr, it runs without modification on any Model I, II, or III computer under TRSDOS. It also runs perfectly on my Model I NEWDOS/80 and I expect it will run under any other TRSDOS like DOS. It requires a 48K memory, one disk drive, and an 80-column line printer. Although I tested a preliminary version for this review, no bugs were uncovered. It is not protected and is listable.

The program begins with instructions to the patient. For most of our users the instructions were too long. (A partial listing of the instructions is shown in Fig. 2). In our clinic we rewrote the instructions, deleting the reference to the Break key (no one remembers it anyway), then broke the directions into smaller segments.

The first portion of the history concerns patient identification and requires some typing. The patient's name, clinic number, birthdate, age, and so on are all entered. We found it best to rearrange the program and have our office assistant enter this information at the start. Then if desired the instructions are given so that patient can use the program without further assistance.

The remainder of the program requires little assistance. Most responses are yes/no and are not difficult for the average patient to understand. Instructions are continuously available on the top of the screen for reference (see Fig. 3).

A defect in the program is the absence of provisions for a response other than yes/no. Occasionally a patient is unsure of an answer and a help response should be an available option. No provisions are

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available for error correction. One psychiatric question needs reworking: "Do you find your life—Generally unsatisfactory?" is followed shortly by "Do you find your life satisfactory?" Branching could have eliminated this second question when a "no" answer was given to the first question.

"The Review of Systems is ideal for a microcomputer program."

The main menu provides three options: Take Patient History, Store Patient History on Disk, Print Patient History.

The print routine is very simple. A sample is shown in Fig. 4. It would benefit from enhancements to provide page numbering and pause between pages. A complete printout including negatives should also be available.

Since all history-type programs need modifications to fit the end user the listings are well annotated and modification is easily accomplished. I suggest that all rearrangements and changes be made and saved; then the program compressed.

The six-page documentation is adequate. It could have been improved by including suggestions for introducing this program to the patient by the office assistant.

Automated Patient History

A second program was written by Werner Slack, M.D., in 1979. It is marketed by Cybernetics, Inc., 8041 Newman Ave., #208, Huntington Beach, CA 92647, (714) 848-1922. It requires CP/M with CBasic, a Model II, and an 80-column line printer. This program costs $175. It is much more sophisticated than the Basic program discussed above.

This program has an interesting history. The questions were originally written in the early 70s for a mainframe computer. It was first made available for micros in 1979. Since its introduction it has not only been used in English, but one English-speaking physician in France rewrote the questions in French, leaving the printout in English! Currently a revision is in progress to provide more extensive error trapping and other enhancements.

It begins nicely with a short tutorial, instructing the patient on how to use the computer (see Fig. 5). An extensive and well thought out patient identification, social history, family history, allergy history, surgical history, and review of systems follows. Several questions were worded so well that I have incorporated them into my own personal review of systems. Four responses are available for every question and are continuously shown on the screen: Yes, No, Don't Know, and Don't Understand.

The questions were broken up by humor or a health education point. Even so, this is a long history and takes the typical patient 35 to 40 minutes to complete. We found only one mistake, which was a minor spelling error.

Documentation is adequate and includes instructions for question modification. This program accepts up to 1,000 questions and can be used for diet and other histories. The documentation which I received was for an older version of the progam which is no longer available. It would have been interesting if the documentation had included actual clinic experiences with this program. I wrote to Cybernetics asking to contact physicians using the program, but at the time of this writing have received no reply.

Some branching questions are used by this program for convenience and speed. For example the following question is asked: "Have any of your blood relatives had cancer, rheumatic fever, kidney disease, bleeding problems, or anemia?" If the answer is "no," no further questions are asked of these diseases. However if a "yes" response is given the program asks about each disease separately. This made the patients feel that the computer was repeating its questions. One question concerning whether the patient is male or female is asked twice. This seems unnecessary. Occasionally further branching would have decreased redundancy—for example, if the patient denies ever having had penicillin it seems useless to ask him if he is allergic to this antibiotic. Occasionally asking questions in a slightly different order would also reduce the appearance of redundancy for the patients. Of course, repeating the questions may decrease errors.

An interesting conclusion to the questions was an evaluation of how the patient

```
PLEASE TYPE Y FOR YES OR N FOR NO THEN
PRESS ENTER.

DO YOU HAVE ANY OF THE FOLLOWING
COMPLAINTS?
CHEST, HEART, LUNG

CHEST PAIN

Y OR N?
```

Fig. 3. Sample Screen.

```
CURRENT SYMPTOMS.....................................
FAMILY HISTORY.......................................
CANCER                          HEART TROUBLE
HIGH BLOOD PRESSURE             ASTHMA
ALLERGIES                       MIGRAINE HEADACHES
STOMACH OR DUODENAL ULCER
PAST MEDICAL HISTORY.................................
MEASLES                         MUMPS
CHICKEN POX                     WHOOPING COUGH
INFLUENZA                       HAYFEVER
HIVES OR ECZEMA
ALLERGIES............................................
SPRING GRASSES                  FALL POLLENS
SURGERY..............................................
TONSILLECTOMY
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** REVIEW OF SYSTEMS **
GENERAL..............................................
SKIN.................................................
HEAD, EYES, EARS, NOSE, THROAT
NECK.................................................
CHEST, HEART, LUNGS..................................
GASTROINTESTINAL.....................................
```

Fig. 4. Partial Printout.

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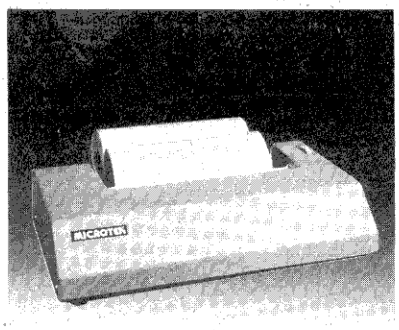

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*Data Source: Epson MX-80 Operation Manual

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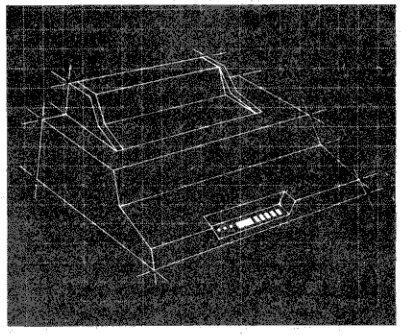

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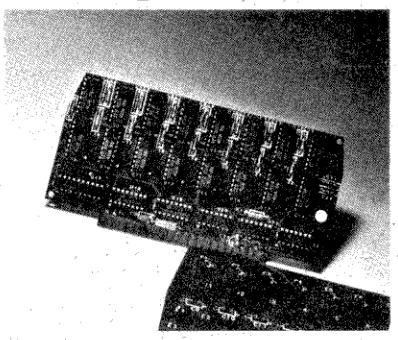

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80 Medical Opinion

liked or disliked the program. Responses were generally positive in our clinic, although many older patients felt the questioning took too long. From these responses we shortened our program and it was more acceptable.

The printout could be improved in several areas. For example, you are first asked if you have had a chest x-ray in the past year. If your reply is "no" you are then asked if you have ever had a chest x-ray. This is then printed out without any change in order as illustrated below:

```
RESPIRATORY.

  NO TB SKIN TEST
  TB SKIN TEST NEGATIVE
  TB VACCINE INJECTIONS RECEIVED
  NO CHEST X-RAY WITHIN THE PAST YEAR
  NEVER HAD ONE
```

Clearly this is inconsistent. An enhanced printout would note all inconsistencies and report them in an improved order.

The greatest flaw in the program is its lack of provision to return to a question and make corrections once a response is entered. Another flaw is the inability for an operator to save the program to disk for later printing. It also is impossible to skip the instructions and go right to the questions. If a mistake is made by the operator and the program terminated, there are no provisions to resume the questions at the point of termination. It is necessary to begin again. No special screen features of the Model II such as reverse video are provided.

The printout would benefit from enhancements to provide headings, page number and the option to pause between pages. The printout is all in uppercase. The printout did not provide an option to include all negative responses.

We have found these programs to be of great value when we are running behind schedule, the waiting room is full, and everyone is becoming impatient. At that time we can get a patient busy at the computer and decrease everyone's anxiety level.

Next month we will evaluate CP/M hardware and eight-inch disk drives for the Model I/III as well as a patient billing system for these computers. ■

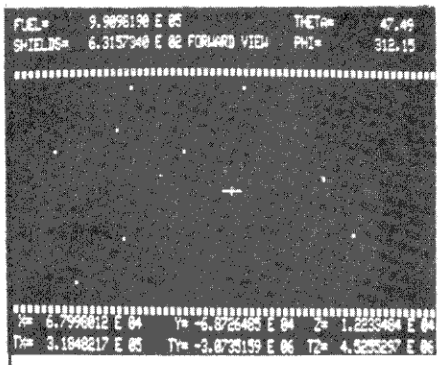
```
HELLO THERE!!!

BEFORE CONTINUING, I WILL
SHOW YOU HOW TO OPERATE THIS COMPUTER.
FIRST, FIND THE KEY MARKED "ENTER"
ON THE KEYBOARD AND PRESS IT.
If correctly done the second screen display appears:
---VERY GOOD---
YOU CAN ANSWER "YES" TO A QUESTION
BY PRESSING KEY NUMBER "1" AND
THEN THE "ENTER" KEY.
...TRY IT.
```

Fig. 5. First Screen Display

```
I.   TITLE...GENERAL MEDICAL HISTORY.......
                FOR
           Doe, John E.
     THIS HISTORY INCLUDES ITEMS COVERED IN A COMPLETE GENERAL MEDICAL HISTORY.
     THERE IS SLIGHT QUALIFICATION OF ABNORMALITIES AND ONLY POSITIVES ARE INCLUD-
     ED IN THIS REPORT.
II.  CHIEF COMPLAINT.
     ON February 1, 1982, THE PATIENT TOOK A SELF-ADMINISTERED COMPUTER HISTORY. PA-
     TIENT IS A 47 YEAR OLD MALE WHO STATES HIS REASON FOR THE VISIT AS: "Annual
     Physical".
III. PERSONAL AND SOCIAL HISTORY.
     A. MARRIAGE.
          NO DIVORCE OR SEPARATION.
          HAS BEEN SEPARATED
          HAS BEEN DIVORCED.
          2 CHILDREN.
          PRESENTLY MARRIED & LIVING WITH SPOUSE.
          SPOUSE IN GOOD HEALTH.
          SPOUSE DOESN'T HAVE PAYING JOB.
     B. OCCUPATION-Computer programmer.
VII. REVIEW OF SYSTEMS.
     A. ALLERGY (POSITIVES ELICITED BY HISTORY).
          PENICILLIN RECEIVED-NO ADVERSE REACTIONS.
          NO ADVERSE REACTIONS AFTER ASPIRIN.
                         NOT CHARACTERIZED.
          NO ADVERSE REACTION TO TETANUS SHOTS.
          NO ADVERSE REACTIONS TO OTHER DRUGS.
     I. GASTROINTESTINAL.
          GALLBLADDER DISEASE, PHYSICIAN DIAGNOSED.
          FREQUENT BELCHING.
          HEMORRHOIDS.
```

Fig. 6. Partial Printout.



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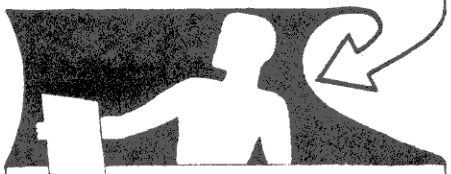

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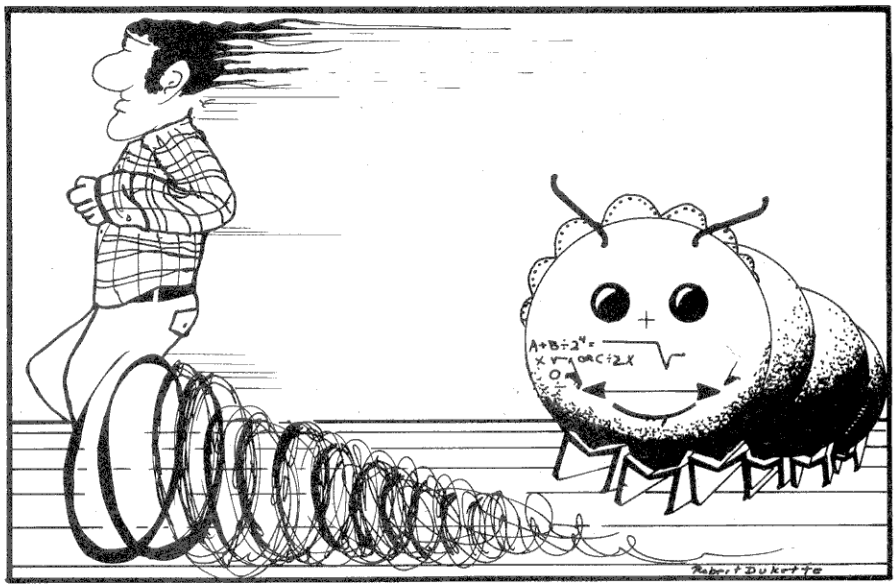
Copernica Mathematica

by Bruce Douglass

". . . algebra is the quantitative language of how things are, or how they will be, given a static set of conditions."

One of the most astonishing things I have seen is people afraid of a little calculus—a little cute, baby calculus, as if it had claws and fangs! A calculus is actually a very friendly creature. The fact is, almost everyone uses calculus in daily life.



Algebra

Algebra, which has been around for at least 2000 years, evolved to help humans deal with the world.

Suppose you are a sheepherder for 100 sheep. Each little darling eats grass from 10 square meters per day; you need some idea of how much space all your sheep need. You must solve the problem for an unknown using the symbolic manipulative techniques of mathematics that go by the name of algebra.

Specifically, algebra is the quantitative language of how things *are*, or how they will be, given a static (i.e. unchanging) set of conditions.

Calculus is analogous. It was invented around 1750 independently by two mathematicians, Newton and Leibniz. A crucial extension of the language we call algebra, calculus deals with how things *change*.

Take it to the Limit

A function's limit is the value that function approaches as its independent variable approaches another value. For example, take f(x) = 1/x. What is the limit of f(x) as x approaches infinity? That is, what value does f(x) approach when x gets larger and larger without limit? If you take a few trial values, you can easily see that f(x) approaches zero as x approaches infinity. How about the limit of f(x) as x gets close to 0? This is a more interesting question, since we all know the computer does not like to divide by 0. Take a few trial values, such as 1/2, 1/10, 1/100 and 1/400. What is f(x) doing all this time? That's right, f(x) approaches infinity as x gets close to zero.

So, the limit of a function is the value it approaches as the independent variable (in our example, x) approaches some value. How does this help us understand differential calculus?

Derive a Derivative

Figure 1 is a graph of some function. The derivative (also known as the differential) is the slope of the line tangent to the function at some point. How can we get a tangent line? If we draw a line between two points on the curve we have a secant line. Say we want to know the derivative at f(c) (the value of f(x) when x equals c).

The obvious approach is to take a secant line with the value x equals c somewhere between the two x values. If they are close enough, this secant line is a good approximation to the derivative of f(x) at x. If they are not close enough we can take two different values for x closer

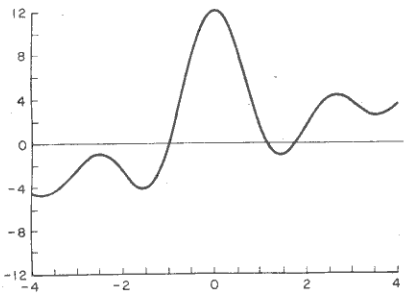


Fig. 1. y = f(x).

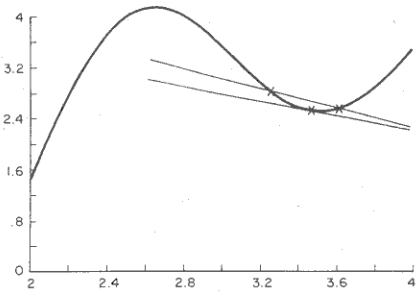


Fig. 2. Tangent line.

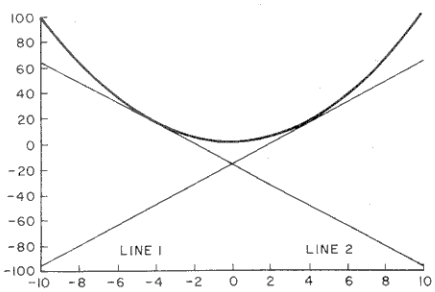


Fig. 3. y = x↑2.

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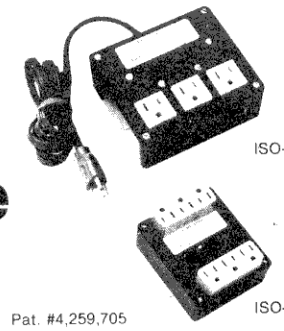

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to x equals c, and still have x equals c between them. In fact, we can take the limit of the difference of these two points' Y values (i.e. f(a) and f(b)) divided by the difference (b – a). As the two points come closer and closer together, the value of the function evaluated at those points will come closer and closer to f(c). We can come infinitesimally close; when that is so, the slope of the line is the derivative.

If you look at Fig. 2, you will see the tangent line to our function at x equals 3.5. Directly above the tangent is a line almost parallel to it, intersecting the curve at two points. This line is the secant. As we take the two points of intersection closer and closer to the single point of intersection of the tangent line, the secant line becomes a better approximation of the tangent. If the first point is f(x), then the second point is f(x + h). What is the slope of the line between f(x) and f(x + h)? Remember the rule from geometry: slope equals rise/run. The rise is f(x + h) – f(x) and the run is (x + h) – x, or simply h. Therefore the slope is (f(x + h) – f(x))/h for any increment h, however small. As we make h smaller and smaller, the slope approaches the derivative. Therefore:

$$\lim_{h \to 0} \frac{(f(x+h) - f(x))}{h} = \frac{df}{dx} = f'(x)$$

The expression df/dx is *not* a fraction. It means the derivative of f(x) with respect to x, or more simply, how much f(x) changes when x changes.

Several rules ease finding derivatives, but they can always be found (if they exist) by the limit method. Unless you express an interest in the analytical approach (i.e. the method when performing operations by hand), I will stick with how they are done on the computer.

Now, how do you find derivatives on a computer? Simple! You must define a few things in your program first:

- The function
- The value at which you wish to know the derivative
- The increment value, h

The short program below does this (see Listings 1-2). If you have Disk Basic, use the DEF FN capability. If you are a Level II user you must use a subroutine.

You are asked for the value of x; h is defined as .001 times x. This makes sure that h is small compared to x. If, however, this causes an underflow (or the value of x is zero), then we define h to be 0.000001. The function is evaluated twice (with h added and with h subtracted) and these are subtracted. The difference is divided by 2*h.

This method is foolproof provided the function exists at x + h and x – h, and the derivative exists and is non-infinite at f(x).

Quiz: What would it mean geometrically if the derivative were infinite? That's right, the tangent line would be vertical, and therefore its slope would be infinite.

Higher Order Derivatives

Higher order derivatives are simply derivatives of derivatives. We know the first derivative is the rate of change of f(x) with respect to a change in x. The second derivative is the rate of change of the first derivative with respect to x. Let's examine what this means.

Since the first derivative is the slope of the tangent line, the derivative of a line would simply be the slope of that line. That is, if f(x) = a*x + b, then df/dx = a. We will shift our notation slightly and refer to df/dx as f'(x). The second derivative (f''(x)) is the rate of change of the derivative. Since the slope of a straight line is, by definition, a constant, the second derivative *must* be zero. That is, the rate of change of f(x) with respect to x never changes as x changes. All other functions have a non-zero second derivative if they have one at all.

As an example of a second derivative, let's repeat an experiment made by Galileo. We climb to the top of a tower and drop an object to the ground. The position of the object is a function of time. How fast it is moving at a given time is called its speed. Recall that this is the first derivative of the position function with respect to time; that is, it is an answer to the question "How much does the position of the object change with a change in time?"

Now, remember that gravity is an accelerating force. The longer something is allowed to be pulled down by gravity (disregarding air currents), the greater its speed. That means that the object's speed is not a constant, but depends upon the length of time the object has been falling. So, we can find the second derivative by taking the derivative of the speed with respect to time. To put it another way, we can see how much the speed changes with a change in time. This change is called acceleration.

The parabola f(x) = x↑2 has the first derivative f'(x) = 2*x. The slope of the tangent line is itself a linear function of x. Look at Fig. 3: I have drawn two different tangent lines, and as you can see, their slopes vary as x varies. The second derivative turns out to be, in the case of the parabola, two. The third derivative is zero.

Many functions have infinitely many non-zero derivatives (for example, the trigonometric functions SIN(X) and COS(X)). But leaving that aside for now, how on earth do we calculate a second derivative of a function?

The same way we got the first derivative! F(x) is some function of x. If f'(x) exists, then it is also a function of x. Therefore, apply our limit definition to f'(x) to produce f''(x). Simple? We can do this as often as we need or want to, provided the derivatives exist. I will show some examples later that fail at some values of x.

```
5000 REM      DERIVATIVE OF FUNCTION  PROGRAM A
5005 REM      FOR LEVEL II BASIC WITHOUT THE DEF FN
5010 CLS:PRINT TAB(16);"DERIVATIZER"
5020 PRINT"THE FUNCTION SHOULD BE DEFINED IN LINE 5110"
5030 INPUT"ENTER THE VALUE AT WHICH YOU WANT THE DERIVATIVE";X1
5040 H=.001*X1 : IF H=0 THEN H=1E-5
5050 X=X1+H:GOSUB 5100:Y1=Y
5060 X=X1-H:GOSUB5100
5070 D=(Y1-Y)/2/H
5080 PRINT"THE DERIVATIVE OF THE FUNCTION AT ";X1;" IS ";D
5090 END
5100 Y=SIN(X)        'SAMPLE FUNCTION
5110 RETURN
```

Program Listing 1.

```
5000 REM      DERIVATIVE OF FUNCTION  PROGRAM A
5010 REM      FOR DISK BASIC WITH THE DEF FN CAPABILITY
5020 DEF FNY(X)=COS(X)          'SAMPLE FUNCTION
5030 DEF FND(X,H)=(FNY(X+H)-FNY(X-H))/2/H  'DERIVATIVE FUNCTION
5040 CLS:PRINT TAB(16);"DERIVATIZER"
5050 PRINT"THE FUNCTION SHOULD BE DEFINED IN LINE 5020"
5060 INPUT"ENTER THE VALUE AT WHICH YOU WANT THE DERIVATIVE";X
5070 H=.001*X : IF H=0 THEN H=1E-5
5090 PRINT"THE DERIVATIVE OF THE FUNCTION AT ";X;" IS ";FND(X,H)
5100 END
```

Program Listing 2.

There is a problem of accumulating errors in the derivatives using this finite difference method. Each time we approximate a derivative, any error is carried to any calculation that uses it, including finding a higher-order derivative. Error propagates and accumulates.

In the calculations, remember that $f'(x) = (f(x+h) - f(x))/h$. If we use another small increment k, we can derive the second derivative of f(x) as follows:

$$f''(x) = \frac{f'(x+k) - f'(x)}{k} = \frac{\frac{f(x+h+k) - f(x+k)}{h} - \frac{f(x+h) - f(x)}{h}}{k}$$

Since h and k are arbitrarily small increments, we can set h equal to k and deduce the following:

$$f''(x) = \frac{f(x+2 \cdot h) - 2 \cdot f(x+h) + f(x)}{h\uparrow 2}$$

A similar process produces the third and higher order derivatives. Note that we get a Pascal's triangle for the coefficients with alternating signs.

```
10 REM      NEWTON'S ITERATION METHOD
20 REM      FOR LEVEL II BASIC WITHOUT THE DEF FN CAPABILITY
30 DEFINT M,I:GOTO 100
40 REM      FUNCTION AND DERIVATIVE SUBROUTINE
50 Y=COS(X)          'SAMPLE FUNCTION
60 RETURN
70 X=X1+H:GOSUB50:Y1=Y:X=X1-H:GOSUB50:Y2=Y
80 D=(Y1-Y2)/2/H      'NUMERICAL DERIVATIVE FUNCTION
90 RETURN
100 CLS:PRINT"THIS PROGRAM ASSUMES THAT THE FUNCTION IS DEFINED
AT LINE 50.  IT USES NUMERICAL DERIVATIVES, AS DEFINED
IN LINE 80"
110 PRINT:INPUT"ENTER INITIAL GUESS OF ROOT";X1
120 C=1E-5:INPUT"ENTER CONVERGENCE CRITERION";C
130 M=20:INPUT"ENTER MAXIMUM NUMBER OF ITERATIONS";M
140 REM      START LOOP
150 FOR I=1 TO M
160     H=.001*X1:IF H=0 THEN H=1E-5
170     X=X1:GOSUB 50:IF ABS(Y)<C THEN GOTO230
180     GOSUB 70
190     IF D=0 THEN D=1E-5
200     X1=X1-Y/D
210 NEXT I
220 IF ABS(Y)>C THEN PRINT"CONVERGENCE NOT ACHIEVED"
230 PRINT"NUMBER OF ITERATIONS IS ";I-1
240 PRINT"COVERGED TO ";X1
250 PRINT"VARIANCE IS ";Y
260 PRINT"DERIVATIVE AT THE ROOT IS ";D
270 PRINT"(1)  TRY AGAIN WITH A NEW X OR (2) END"
280 A$=INKEY$:IF A$="" THEN 280 ELSE A=VAL(A$):IF A<1 OR A>2 THEN 280
290 IF A=1 THEN 100 ELSE END
```

Program Listing 3.

```
10 REM      NEWTON'S ITERATION METHOD #2
20 REM      FOR LEVEL II BASIC WITHOUT THE DEF FN CAPABILITY
30 DEFINT M,I:GOTO 90
40 REM      FUNCTION AND DERIVATIVE SUBROUTINE
50 Y=COS(X)[2        'SAMPLE FUNCTION
60 REM      ANALYTICAL DERIVATIVES HERE
70 D=-2*COS(X)*SIN(X)     'ANALYTICAL DERIVATIVE FUNCTION
80 RETURN
90 CLS:PRINT"THIS PROGRAM ASSUMES THAT THE FUNCTION IS DEFINED
AT LINE 50.  IT USES NUMERICAL DERIVATIVES, AS DEFINED
IN LINE 70"
100 PRINT:INPUT"ENTER INITIAL GUESS OF ROOT";X
110 C=1E-4:INPUT"ENTER CONVERGENCE CRITERION";C
120 M=20:INPUT"ENTER MAXIMUM NUMBER OF ITERATIONS";M
130 REM      START LOOP
140 FOR I=1 TO M
150     GOSUB 50:IF ABS(Y)<C THEN GOTO200
160     IF D=0 THEN D=1E-5
170     X=X-Y/D     'X(N)=X(N-1)-F(X(N-1))/F'(X(N-1))
180 NEXT I
190 IF ABS(Y)>C THEN PRINT"CONVERGENCE NOT ACHIEVED"
200 PRINT:PRINT"NUMBER OF ITERATIONS IS ";I-1
210 PRINT"COVERGED TO ";X
220 PRINT"VARIANCE IS ";Y
230 PRINT"DERIVATIVE AT THE ROOT IS ";D
240 PRINT"(1)  TRY AGAIN WITH A NEW X OR (2) END"
250 A$=INKEY$:IF A$="" THEN 250 ELSE A=VAL(A$):IF A<1 OR A>2 THEN 250
260 IF A=1 THEN 90 ELSE END
```

Program Listing 4.

Problem Functions

Take the function $f(x) = 1/x$, and try to find the derivative at x equals 0. You cannot, since the function itself doesn't exist. Try the derivative of SQR(x). SQR(0) is perfectly legitimate, but the derivative of this function does not exist at x equals 0. Go ahead and try it.

Now For a Use

"Well," you might say, "So what?"

"Well," I might reply, "we can use this derivative to construct a better equation solver!" The method is called the Newton (or Newton-Raphson) iteration method. This procedure converges much more rapidly than others such as the bisect method (provided you are sufficiently close to the solution). Called a quadratic method because the value of the error term decreases by a square with each iteration, it adds almost two digits of accuracy with each iteration. In fact, if this method does not converge within 20 iterations, it probably won't converge at all.

Figures 4-5 show the outline of the method. In Fig. 4, we see a function graphed. We want to know the zero or root of the function (the value of x that makes f(x) zero, or where it crosses the x-axis is called the "zero"). Notice that all points on the curve have the coordinates (x,f(x)). Near the tangent line to the curve at some point X0, the tangent line is a good approximation to the curve itself, although outside of this vicinity, it is a rather poor approximation. The linear function $M(x) = f'(x)(x - x0) + f(x0)$ is close to what f(x) is around the x value X0. In fact, at X0, $M(x) = f(x)$. Since these functions are approximately the same, the zeros of these functions must also be approximately the same. We can use the zero of M(x) to approximate the zero of f(x). If we let x1 be the zero of M(x), then $x1 = x0 - f(x0)/f'(x0)$. This is the value of x1 on Fig. 5. In our particular example, the initial guess was $x0 = 4$. The next approximation is the x value where the tangent line crosses the x-axis. Repeating the method using x1 instead of x0 gives us x2. We repeat the procedure until close enough to the solution, as defined by our convergence criterion.

The type of function with which you can find as many derivatives as you like around some value X0, is called *analytic*

at X0. All functions that do not allow it at some point X0 are called *non-analytic* at X0. Note that a function may be analytic everywhere but a single point (in the case of SQR, it is non-analytic at x equals 0), or a finite set of points, or everywhere. Most functions that we deal with on a daily basis are analytic, but watch out for singularities (points at which a function is undefined or is infinite).

Since x0 is approximately correct, we must be somewhere close to the zero of f(x), and x1 should be a better estimate than x0 was. Note that we use the same approach—we have our line M(x) equal f'(x1)(x − x1) + f(x1), and find its zero, x2 = x1 − f(x1)/f'(x1), and so on for x3 and x4. X2 is a better approximation to the actual zero than x1, and x3 is a better approximation than x2.

The Newton method, one of the simplest for solving equations around, has one of the fastest convergence rates. It is sometimes difficult to satisfy the requirement of being sufficiently close; it may be necessary to resort to another method. An example of this type of function is shown in Fig. 6, f(x) = ARCTAN(x). X1 (−25.6, which is off the scale of the figure) is so far away from the actual zero (0.00) that when you repeat the procedure, you actually diverge rapidly from the zero. This is because the trial point chosen was too far away. Set a ceiling on the number of iterations, or check to see if the distance between sucessive terms is, indeed, becoming less.

The following short program allows you to solve for the zeros of equations. Four versions are included; you may easily configure it to your system (see Program Listings 3-6). Versions 1 and 3 allow you to put in the analytical (as distinct from numerically calculated) derivatives, either as a DEF FN FP (DEFine FuNction FP) or as a short subroutine. Versions 2 and 4 allow you to numerically calculate them. If you have muMATH (the microsoft TRS-80 learning tool), use it to solve for derivatives and then put them into the

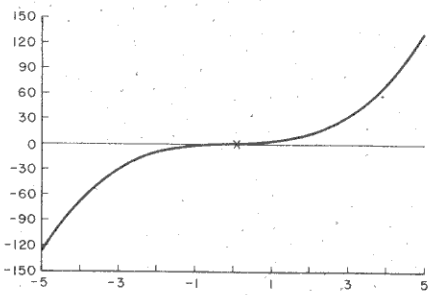

Fig. 4. y = x↑3 + x.

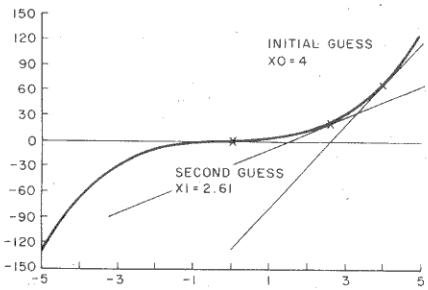

Fig. 5. Newton Method.

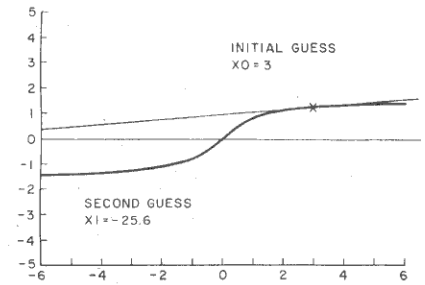

Fig. 6. y = Arctran (x).

```
10 REM      NEWTON'S ITERATION METHOD PROGRAM #3
20 REM      FOR DISK BASIC WITH DEF FN CAPABILITY
30 DEFINT M,I
40 DEF FNY(X)=COS(X)          'SAMPLE FUNCTION
50 DEF FND(X,H)=(FNY(X+H)-FNY(X-H))/2/H   'DERIVATIVE FUNCTION
60 CLS:PRINT"THIS PROGRAM ASSUMES THAT THE FUNCTION IS DEFINED
AT LINE 30.  IT USES NUMERICAL DERIVATIVES, AS DEFINED
IN LINE 40"
70 PRINT:INPUT"ENTER INITIAL GUESS OF ROOT";X
80 C=1E-5:INPUT"ENTER CONVERGENCE CRITERION";C
90 M=20:INPUT"ENTER MAXIMUM NUMBER OF ITERATIONS";M
100 REM     START LOOP
110 FOR I=1 TO M
120     H=.001*X:IF H=0 THEN H=1E-5
130     IF ABS(FNY(X))<C THEN GOTO170
140     X=X-FNY(X)/FND(X,H)
150 NEXT I
160 IF ABS(FNY(X))>C THEN PRINT"CONVERGENCE NOT ACHIEVED"
170 PRINT"NUMBER OF ITERATIONS IS ";I-1
180 PRINT"COVERGED TO ";X
190 PRINT"VARIANCE IS ";FNY(X)
200 PRINT"DERIVATIVE AT THE ROOT IS ";FND(X,H)
210 PRINT"(1)  TRY AGAIN WITH A NEW X OR (2) END"
220 A$=INKEY$:IF A$="" THEN 220 ELSE A=VAL(A$):IF A<1 OR A>2 THEN 220
230 IF A=1 THEN 60 ELSE END
```

Program Listing 5.

```
10 REM      NEWTON'S ITERATION METHOD #4
20 REM      FOR DISK BASIC WITH DEF FN CAPABILITY
30 REM      AND ANALYTIC DERIVATIVES
40 DEFINT M,I
50 DEF FNY(X)=COS(X)[2       'SAMPLE FUNCTION
60 DEF FND(X)=-2*COS(X)*SIN(X)    'ANALYTICAL DERIVATIVE FUNCTION
70 CLS:PRINT"THIS PROGRAM ASSUMES THAT THE FUNCTION IS DEFINED
AT LINE 30.  IT USES NUMERICAL DERIVATIVES, AS DEFINED
IN LINE 40"
80 PRINT:INPUT"ENTER INITIAL GUESS OF ROOT";X
90 C=1E-5:INPUT"ENTER CONVERGENCE CRITERION";C
100 M=20:INPUT"ENTER MAXIMUM NUMBER OF ITERATIONS";M
110 REM      START LOOP
120 FOR I=1 TO M
130     DE=FND(X): IF DE=0 THEN DE=1E-5
140     IF ABS(FNY(X))<C THEN 170
150     X=X-FNY(X)/DE
160 NEXT I
165 IF ABS(FNY(X))>C THEN PRINT"CONVERGENCE NOT ACHEIVED"
170 PRINT"NUMBER OF ITERATIONS IS ";I-1
180 PRINT"COVERGED TO ";X
190 PRINT"VARIANCE IS ";FNY(X)
195 PRINT"THE DERIVATIVE AT THE ROOT IS ";FND(X)
200 PRINT"(1)  TRY AGAIN WITH A NEW X OR (2) END"
210 A$=INKEY$:IF A$="" THEN 210 ELSE A=VAL(A$):IF A<1 OR A>2 THEN 210
220 IF A=1 THEN 70 ELSE END
```

Program Listing 6.

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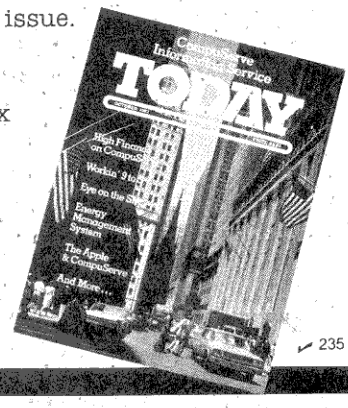

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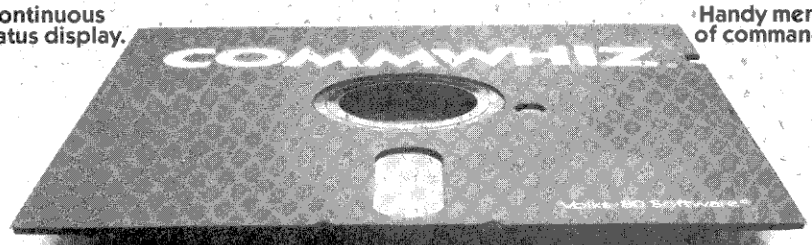

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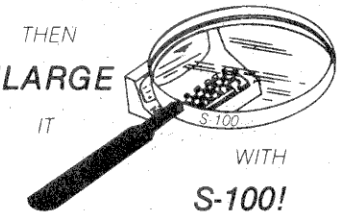

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Basic program manually.

Polynomials

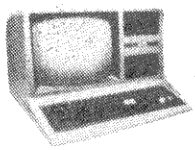
We now have routines and programs to solve for a root of some general equations. We have not addressed the problem of finding *all* roots of an equation. In general, this is very difficult. An arbitrary function may behave erratically; our methods have a hard time zeroing in on all the zeros. But a special class of non-linear functions have fairly accessible zeros; these are the *Polynomials.*

A polynomial is denoted P(N,X), where N is the order and X is the independent variable. P(N,X) is a sum of terms of the form An*X↑N + . . . + A1*X + A0. It is a sum of constant coefficients (the Ai's) times decreasing powers of X, where the highest power is N and the coefficient An is non-zero. An example of a second order polynomial is P(2,X) = 3*X↑2-1.

P(N,X) has N roots, some of which may be repeated. The polynomial P(2,X) = X↑2 + 2*X + 1 has the repeated root X = − 1. The algorithm I describe below is Horner's algorithm; we will use it in a program with

```
10 REM      POLYSOLVER  BY BRUCE POWEL DOUGLASS
20 REM      SOLVES FOR ALL REAL ROOTS OF A POLYNOMIAL
30 REM      BY NEWTON'S ITERATION AND HORNER'S METHOD
40 REM      AND REDUCES THE ORDER OF THE EQUATION BY
50 REM      SYNTHETIC DIVISION
60 REM
70 CLEAR 100:CLS:PRINT TAB(16);"POLYSOLVER"
80 PRINT TAB(10);"BY BRUCE POWEL DOUGLASS"
90 DEFINT I-N
100 INPUT"ENTER THE ORDER OF THE EQUATION";N
110 N1=N
120 DIM A(N),B(N),C(N),X(N),D(N)
130 REM
140 FOR I=N TO 1 STEP -1
150    PRINT"ENTER THE COEFFICIENT OF X[";I;:INPUT A(I)
160 NEXTI:INPUT"ENTER THE CONSTANT TERM VALUE";A(0)
170 FOR I=0 TO N:D(I)=A(I):NEXT I 'SAVE ORIGINAL COEFF
180 PRINT:PRINT:PRINT
190 PRINTTAB(10);"POLYNOMIAL TO BE SOLVED IS:"
200 PRINT STRING$(63,"-")
210 PRINT "F(X)=";:FOR I=N TO 1 STEP -1:PRINT A(I);"X[";I;" + ";:NEXT I:PRI
NT A(0)
220 PRINT:PRINT
230 GOTO 310
240 B(N)=A(N):FOR I=N-1 TO 0 STEP -1   'EVALUATE FUNCTION
250    B(I)=A(I)+B(I+1)*X
260 NEXT I       'NOW GET DERIVATIVES
270 C(N)=B(N):FOR I=N-1 TO 1 STEP -1
280    C(I)=B(I)+C(I+1)*X
290 NEXT I
300 RETURN
310 FOR J=1 TO N1:K=0
320    PRINT"ENTER INITIAL VALUE OF ROOT #";J;:INPUT X
330    GOSUB 240:IF ABS(B(0))<1E-6 THEN 370
340    IF C(1)=0 THEN C(1)=1E-4
350    IF K>30 THEN 570 ELSE K=K+1  'MAX # OF ITERATIONS=30
360   X=X-B(0)/C(1):GOTO 330
370   X(J)=X
380   FOR I=1 TO N
390      A(I-1)=B(I)
400   NEXT I:N=N-1  'REDUCE ORDER OF EQUATION
410   PRINT"ROOT #";J;"=";X
420   PRINT"REQUIRED ";K;" ITERATIONS"
430 NEXT J
440 REM  NOW CORRECT FOR ROUNDOFF ERROR BY USING EACH OF
450 REM  THE COMPUTED ROOTS AS AN APPROXIMATION AND RESOLVING
460 REM  THE ORIGINAL EQUATION
470 CLS:N=N1:FOR I=0 TO N: A(I)=D(I):NEXTI
480 FOR J=1 TO N:X=X(J)      'GET COMPUTED ROOTS
490    GOSUB 240
500    IF ABS(B(0))<1E-6 THEN 530
510    IF C(1)=0 THEN C(1)=1E-4
520    X=X-B(0)/C(1): GOTO 490
530    X(J)=X
540    PRINT"ADJUSTED ROOT #";J;"= ";X
550 NEXT J
560 END
570 PRINT"ROOT DID NOT CONVERGE  AFTER ";K;" ITERATIONS"
580 PRINT"CONVERGED TO ";B(0)
590 PRINT"RESIDUAL VARIANCE IS ";B(0)
600 PRINT"IF THE ANSWER IS ACCEPATBLE, PRESS 'Y' ELSE PRESS 'N'"
610 A$=INKEY$:IF A$=""THEN 610 ELSE IF A$="Y" THEN 370 ELSE IF A$="N" THEN
K=0:GOTO 320
620 GOTO 610
```

Program Listing 7. Polysolver.



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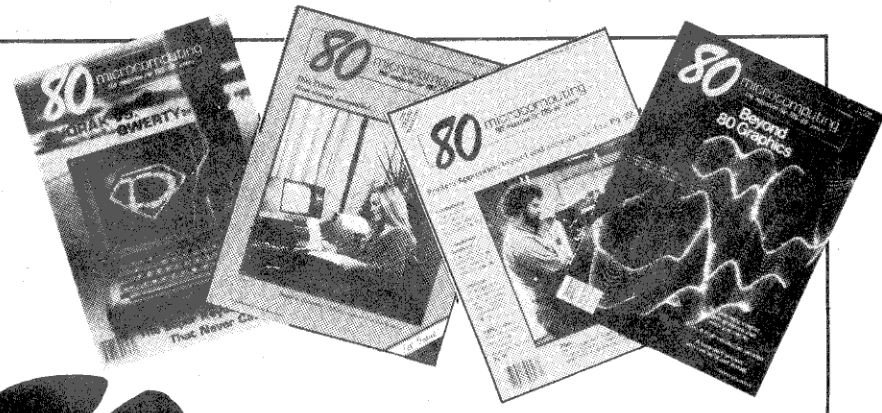

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the Newton-Raphson iteration procedure to solve for all real roots of a polynomial. Note the reference to "real" roots. Complex roots or unstable roots may cause the program to fail to converge, so in the program below (Polysolver) I have set iteration maximums.

Zeroing In

In terms of the number of computations, and in reference to accuracy of computation and run-speed of programs, it is always advisable to nest parentheses when evaluating polynomials. For example, you could compute the value of P(3,X) = 2*X↑3 – 3*X↑2 + X – 2 by substituting the value for X in each term, raising it to the given value, and then multiplying it by the constant. Finally, add all the terms for the answer. An alternative approach is to nest the equation to minimize the number of multiplications and arithmetic operations. This reduces roundoff error and greatly improves speed. The example, nested, would be:

P(3,X) = – 2 + X•(1 + X•(2 + X•(– 3 + 2•X)))

Multiply this; you will find the number of multiplications fewer than with the more obvious approach. This is especially important on the TRS-80 where powers and exponents are only single precision. This approach enables you to work in double precision if you need greater accuracy.

Nesting multiplications is called Horner's algorithm. In Polysolver, this is done by the program with the array elements. Polysolver uses the A array to hold the coefficients of the polynomial being evaluated. The B array elements are defined by the relation B(K) = A(K) + B(K + 1)*X, as K goes from N to zero. B(0) contains the value of the polynomial as a whole when the loop is iterated through from N to zero (step – 1). That is, for a given value of X, running through the defining relation of the B elements is identical to evaluating the polynomial using Horner's algorithm.

Once we have used the Newton-Raphson iteration to find one root (R1), we can define a new polynomial of degree N-1 by factoring out (X-R1) from P(N,X). Since R1 is a root, (X-R1) factors out evenly, and all roots of the reduced polynomial are also factors of the original polynomial. We repeat the procedure until we have N roots.

"Complex roots or unstable roots may cause the program to fail to converge. . ."

This gives a polynomial of degree N-1, Q(N-1,X)*(X-R) = P(N,X). The method used is called synthetic division.

Another elegant part of this algorithm is that the reduced polynomial Q(N-1,X) = P(N,X)/(X – R) is equal to the derivative of P(N,X) (called P'(N,X)) at the point of evaluation. This equality, not generally true, holds for the point of evaluation and a small area around the point of evaluation. This is actually a faster method of computing the derivative than that given previously. Since we need it for the Newton-Raphson iteration, this is a quick way to find the derivative. This is the C array in the program Polysolver: C(1) is the element actually containing the derivative of P(N,X) at the point. It is not C(0) since Q is a polynomial of order N-1.

This procedure is sensitive to unstable roots. That is, some equations have roots that are "almost" complex rather than real; the accumulated roundoff error is enough that the program cannot find the second or third root. Round-off error figures noticeably during the factoring. Even if you find N roots, they are less and less accurate the later you find them. Polysolver avoids this problem: It finds all roots and, with these roots as close guesses, resolves the original polynomial. Thus, while the error may be fairly large for the Nth root, it is made much more accurate by using the roots found in first iterations as an approximation to the real roots. The original polynomial and the Newton-Raphson iteration zero in on the real roots with greater precision.

Polysolver (Program Listing 7) looks for N roots. If some roots are complex it will oscillate, unable to find them. After 50 iterations, it will give the value it did find, the number of iterations, and the option of accepting the faulty value or inputting a new trial value. If it did not find the root because of instability, it will still often approach the root; the discrepancy may be eliminated during the last part of the program that adjusts the roots. If the roots are clearly complex or you are too far from any other real roots to find them, it allows you to choose another estimate.

Use the program to solve the cubic equation: X↑3 + 6*X↑2 + 11*X + 6. You should find roots – 1, – 2, and – 3. As an example of an unstable equation, find all roots of X↑4 – 3.1*X↑3 – 1.53*X↑2 + 12.427*X – 9.826. All roots are real, but accumulated roundoff error won't let you find them using an iterative procedure. If you input 0 as the trial value for X, the program converges to 1.6999. If you input 0 again, it converges to – 2. There are two more real roots—can you find them? ■

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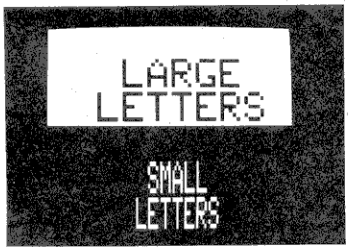

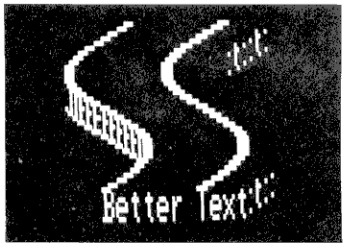

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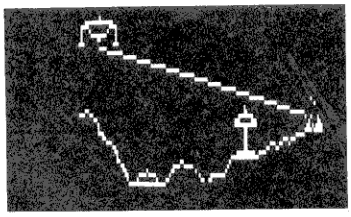

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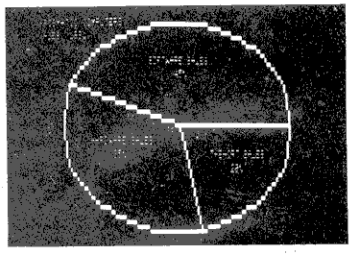

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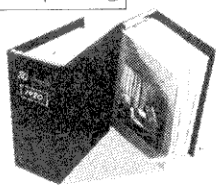

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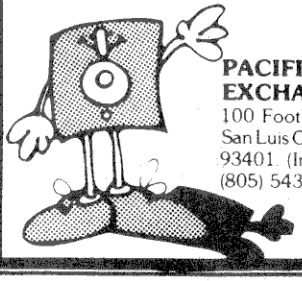

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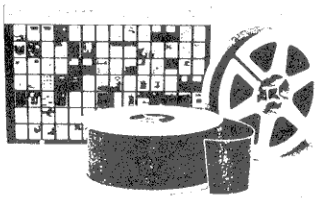

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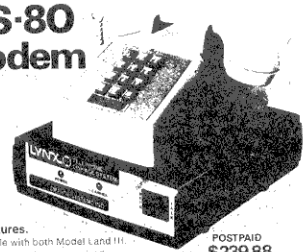

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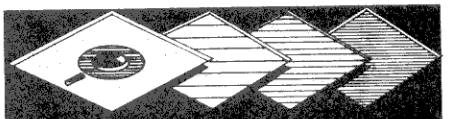

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EDUCATION 80

by Earl R. Savage

"You will lose the time of day, but that is seldom needed."

School computer facilities vary from individual classrooms to libraries to full-blown laboratories and most of them have accumulated a game or two. The upshot is that game-playing can get out of hand. Teachers need a method to put limits on this recreation.

The "time-limiting" methods outlined here are rather simple but give you immediate control. They also serve as points of departure for developing more advanced techniques. Keep in mind, these methods can be applied to all instructional programs when time is a factor. This column deals with programs written in Basic. However, these techniques are readily adaptable to programs in other languages.

When writing programs you can incorporate these time-limiting procedures. With equal ease, you can insert time-limiting into programs currently in use.

Time's Up!

The simplest approach is to set up a counter/checker operation. First, locate a portion of the program through which execution must pass repeatedly as the game is played. Then, insert the following statement: ST = ST + 1:IFST = xxPRINT "SORRY, TIME IS UP!":END. Replace xx with an appropriate number. It may be large or small depending upon how frequently the statement is executed and how long you wish to allow the game to be played. When the counter (ST) reaches xx, the program ends.

So far, so good. The game ends at the selected time. There is nothing, however, to prevent the student from rerunning the program immediately. Here you can get a bit sneaky. Change the previous statement to read: . . . IS UP!:POKEyy,222:END. At the beginning of the program, insert:

```
IFPEEK(yy) = 222PRINT
"NOT AGAIN!":END
```

Now 222 is POKEd into a memory location just before the program stops. When the student tries to run the program again, it checks that same location for 222. If 222 is found, the program ends before the game gets started. The unsophisticated student will be stymied.

In this example, yy represents an arbitrary location near the top of memory. You might use 32700, minus 3 or whatever is appropriate for your machine. Note, the POKEd number, 222, is also arbitrary. You may use any number unlikely to be there accidentally (avoid 0 and 255).

While this method will work in any program, there is another you can use if your computer has a real-time clock. You will lose the time of day but that is seldom needed. Consider the following Model III statements:

```
4 POKE 16921, 5 : POKE 16920, 0
.
.
.
162 IF PEEK (16920) >8PRINT
"SORRY, TIME IS UP!": END
.
.
.
```

When line 4 is executed, the real-time clock is reset to the hour of five and the minute of zero. Line 162 (which should be in a frequently executed portion of the program) checks the time and, if it is over eight minutes, ends the program.

That action terminates the game at the time you choose, but what prevents a rerun? Well, did you wonder why the clock was set to the unlikely hour of 5 am in line 4? Consider this line:

```
3 IF PEEK (16921) = 5 PRINT "NOT AGAIN!"
  : END
```

Any student attempting to rerun the program within an hour is thwarted.

Note, both of these techniques prevent the student from running other programs containing the same statements. If this is not your wish, simply vary the 222 (or its memory location) or the 5 am from program to program.

These techniques may be effective for your students depending upon their level of programming proficiency. You can be less obvious by spreading the parts around in the program and using a few GOTO's and GOSUB's to connect them.

If you have a favorite method of limiting game-playing, write me about it. We'll try to share them all with other readers.

TRSDOS

I suppose that TRSDOS is used in more TRS-80's than any other disk operating system. TRSDOS does a great job. However, there is one annoying problem on Model III TRSDOS 1.2 and 1.3. The trouble arises when you call up the directory of a disk with more than 11 programs on it. Later versions of Model I TRSDOS display the directory a page at a time. On the Model III, the directory goes on to the end, scrolling the first programs right off the screen.

There is no published patch (so far) to cause a slower or page-by-page display of the directory. Until there is one, here are a couple of ways around the problem.

First, you can flip on the printer and make a printout of the entire directory. This overcomes the problem but uses a lot of paper for those occasions when all you want is to check on the spelling of a filename or find a program in a pile of disks. You can also enter Basic and call the directory (CMD"D:0).

The remaining solution is to develop your reflexes: Press Break just before the directory begins to scroll. In this way, you can examine eight to 12 entries.

These stop-gap measures are inconvenient, to say the least. If you have developed a patch, let us spread the word and make a lot of folks happier.

"Will it Sell?"

Everyone who has learned to program has had at least one fantasy about striking it rich with the fruit of his labor. Our more proficient students often ask "Do you think this program would sell?" It is sometimes difficult to arrive at a realistic answer. Here are a few factors you should ponder.

The prime consideration should be whether the program does something that others do not do, or if it does its job better than others like it. Familiarity with the marketplace enables you to pass this hur-

dle and can come from reading ads to keep track of what is available.

Objective and accurate estimation of the commercial potential of a program is a tough job. Yet, this must be done to avoid losing an opportunity or an investment. The situation is the same whether you plan to place the program with a software house or to produce and market it independently. (Now, that's an interesting decision, too.)

There is a lot of work involved in preparing a program for commercial consideration. First and foremost, your program must be absolutely bug-free. Not only must it run with any reasonable user input, but it must not crash with unreasonable input. This means extensive and effective error-trapping.

The program must execute quickly and efficiently. This is determined, within any given language, by the design and organization of the program statements. Efficiency does count.

Another area is often overlooked or given only perfunctory attention by amateurs. Every program submitted to a publisher should be accompanied by two documentations.

The first set is written for the publisher considering your submission. Program documentation ordinarily includes a listing, a variables list and an outline of the program organization if this is not clear from remarks in the listing.

The second set of documentation is written for the user. It includes a statement of what the program does, suggestions for its use, and any information the buyer needs to use it effectively. Emulate good documentation in programs you have purchased.

There are sources of more detailed information on the preparation and submission of programs to software publishing houses. One such is a free package from the Submission Department, Instant Software, Inc., Peterborough, NH 03458.

In addition, a new monthly publication shows promise. *Programmer* (Box 3210, Manchester, NH 03105) covers such topics as what types of programs various companies are seeking, and how to make submissions.

There is one caveat: This field, like all others, contains its share of crooks. When choosing your potential publishers, stick with respected, established houses—stay off side streets.

If you and your students come up with a really good program, don't hide your light under a bushel. Check into the marketing possibilities. You may make a buck to help pay expenses! ■

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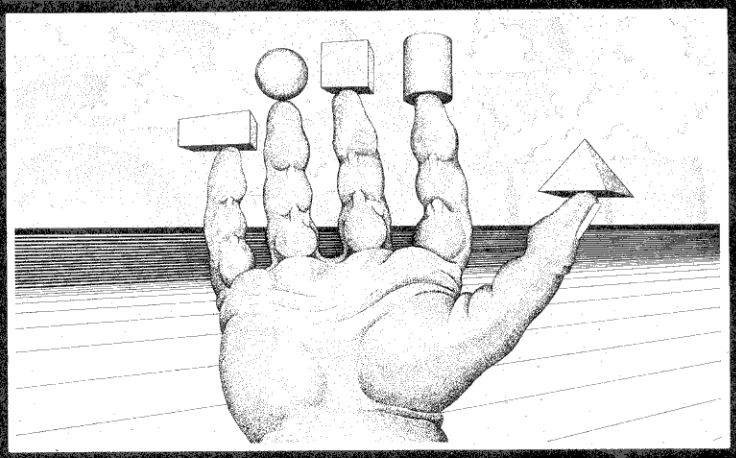

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80 NEWS

edited by John P. Mello Jr.

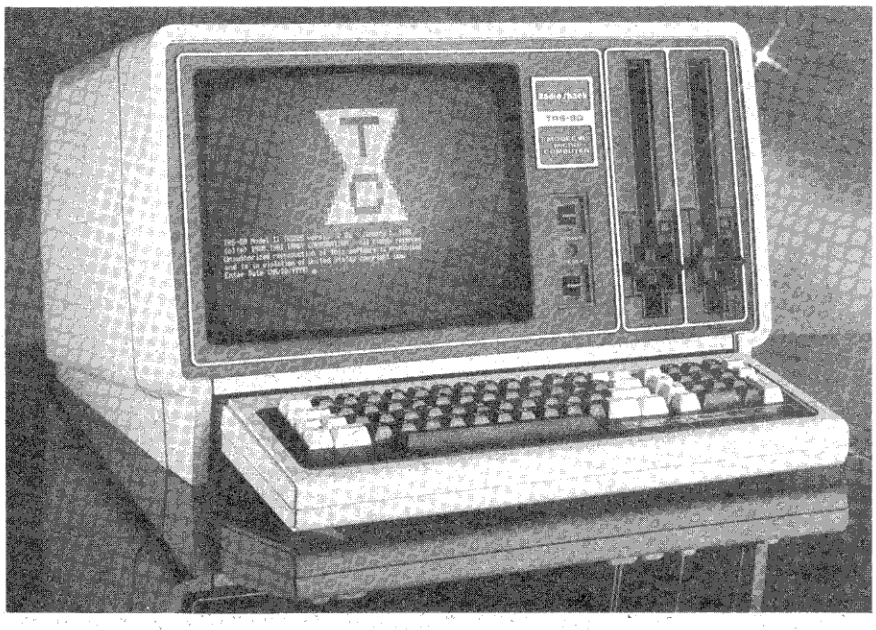
Wraps off Tandy's 16-bit micro

New Pocket Computer and graphics package also unveiled

by G. Michael Vose
80 Micro Technical Editor

Obviously undeterred by the entry o IBM into the personal computer derby, Radio Shack announced its own 16-bit computer January 19 at a press conference held at One Tandy Center in Fort Worth. The new computer, called the TRS-80 Model 16, is aimed at the burgeoning business computer market and, with a price tag of $4,999, offers minicomputer power at a microcomputer price.

At the same press conference, the company also announced a new TRS-80 Pocket Computer, a Model III-like computer terminal, a high resolution graphics package for the Model II, and an upgrade kit that turns the Model II into a Model 16.



The New Model 16

Radio Shack's new machine is based on the Motorola MC68000 16-bit microprocessor. The MC68000 addresses either one of two memory configurations—in a standard 128K, or an optional 512K. In addition, the machine contains a Z80 microprocessor with its own 64K of memory. The Z80 handles all input/output operations for the MC68000 and will also be available for running existing Model II software.

The Model 16's white cabinet is similar to that of the existing Model II. The detachable keyboard features black and white keys in contrast to the Model II's black and grey keyboard. Also featured is a green phosphor screen housing two trim-line, double-sided, double-density eight-inch disk drives. Additional drives can be accommodated including the Radio Shack 8.4 megabyte hard-disk unit.

The Model 16 operating system looks like, and is upwardly compatible with, the current Model II TRSDOS. A single command signals the computer to function in either the 68000 or the Z80 mode. The operating system, still unnamed as of late January, features Editor/Assembler, Debug, Cross referencer and linking loader programs. RS Cobol will be available within weeks of the April availability date of the Model 16, and compiler and interpreter versions of Basic plus compiled Fortran will be available within the year.

Multitasking will be available in June according to Radio Shack. The Model 16 can then be operated by three users simultaneously, two using the new $699 Model III-like terminals. The new terminal will be called the Radio Shack DT-1.

Model II owners will be able to upgrade their computers to the Model 16 configuration for $1,499. The upgrade must be performed at an authorized Radio Shack service center and will be subject to the following restrictions: the white on black screen will be retained; the on-board disk drive will be retained; and the memory will be restricted to 256K.

The Model 16 operating system is included as part of the upgrade package.

The TRS-80 Pocket Computer II

The new Pocket Computer debuting in April features a true 8-bit processor in contrast to the current PC's piggy-backed four-bit processors. Selling for $279, the PC-II is made, like its predecessor, by the Japanese OEM Sharp. Radio Shack plans an RS-232 interface for the PC-II later in the year leaving open the possibility that the PC-II will be able to communicate with other TRS-80 computers.

Model II Graphics

To enhance the graphic capability of the Model II, Radio Shack has also announced a $499 high-resolution graphics package. Details on this package and some of the other new products were sketchy as *80 Micro* went to press. Look for more details in an upcoming issue. ■

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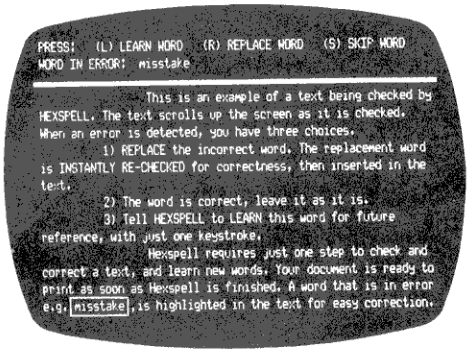

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By Cleo Hughes
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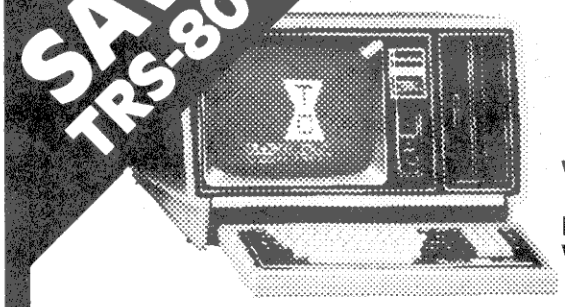

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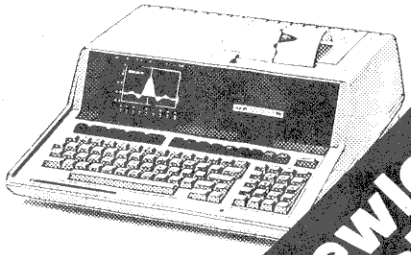

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Meters trashed for game change

by John P. Mello Jr.
80 Micro News Editor

A recent rash of petty thefts linked to the lure of electronic games in a major New England city appears to be an aberration rather than a rule on the national scene.

During the last four months of 1981 more than 50 juveniles were arrested in Providence, RI, for jimmying parking meters to get change to play electronic games. But an informal survey of big city police departments conducted by *80 Micro* revealed Providence's bane was not shared by other major U.S. cities.

James Higgins, a lieutenant with the Providence Police Department's Juvenile Division, explained in a telephone interview the epidemic of parking meter robberies piqued the curiosity of police. They began questioning juveniles on why they broke into the meters, and the answer became repetitious: to get change to feed their electronic "jones."

Although several juvenile gangs were involved in the thefts, Higgins said, "there were a lot of individual efforts, too."

In neighboring Cranston, RI, homes have been burglarized by teenagers seeking money for the games. "We have had several instances where juveniles have told investigators that's what they'd done with the money," Police Chief Anthony Moretti said in a telephone interview.

But in Chicago, Los Angeles, Houston, New York, Detroit, Boston, Miami, and New Orleans, police said juvenile crimes linked to electronic games was not a significant problem in their cities.

"We really haven't compiled any statistics that crimes are taking place specifically for that purpose (playing electronic games)," a spokesperson for the Chicago Police Department's Youth Division said.

He added game rooms were kept to a minimum in the Windy City. "You have to have a special license to have a game room," he noted. "They are not easy to obtain in the city of Chicago."

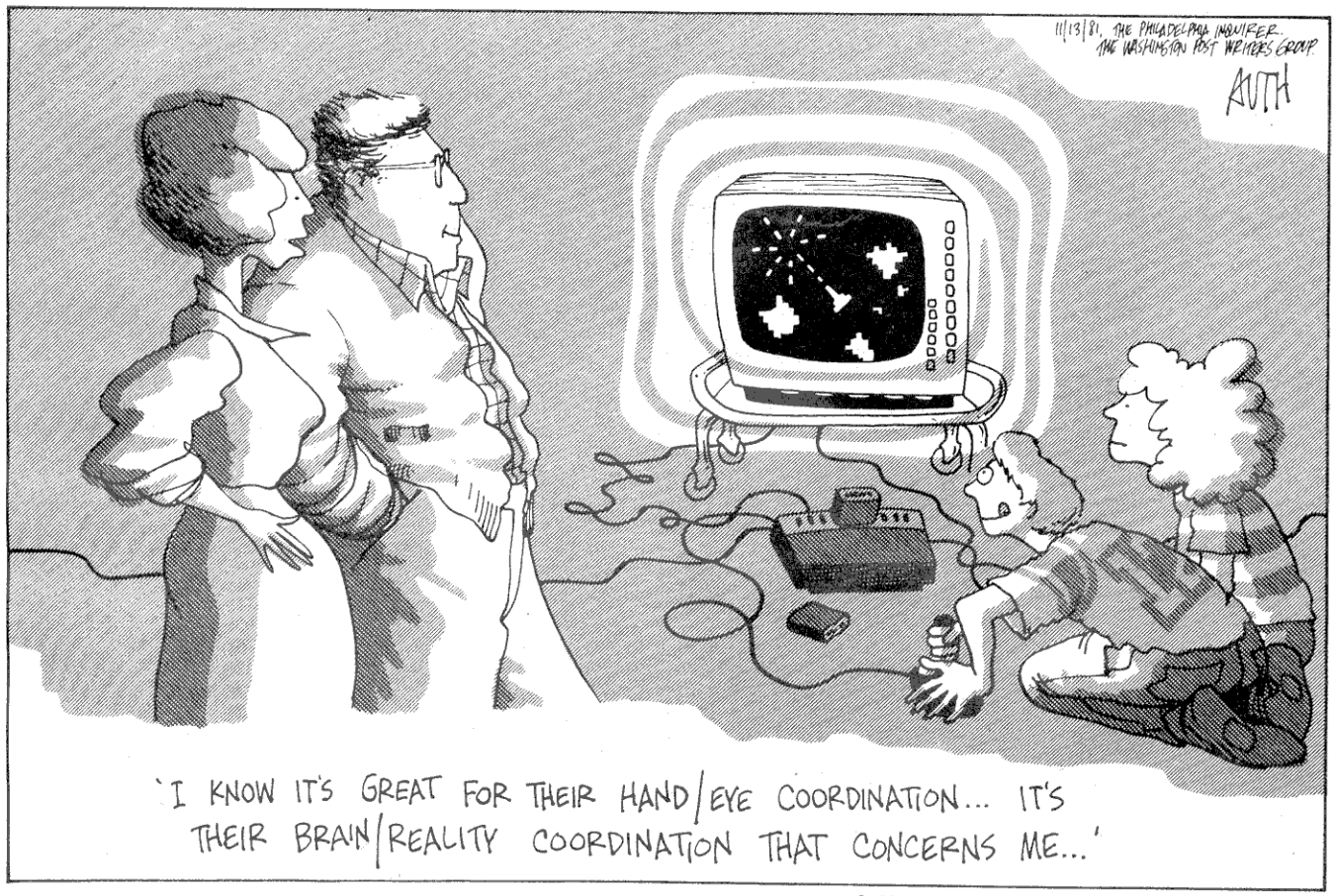
"We don't have any research, to my knowledge, of kids committing thefts to play the games," observed Patricia Ann Adams, a detective with the Juvenile Division of the Los Angeles Police Department.

"However," she said, "in our experience, where there are a lot of electronic game arcades and pinball arcades, since they do attract juveniles, other crimes related to kids occur there. For instance, narcotics sales to children and adults picking up children for sexual purposes."

She added, "The same thing would be true of parks and other amusement areas —places where children congregate. It certainly has nothing to do with the electronic games per se."

"Nothing of significance has come to our attention," said Paul Michna, a captain with the Juvenile Division of the Houston Police Department.

Continued



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He said a juvenile narcotics squad has been assigned to keep an eye on the arcades "because in those game rooms we find marijuana and crystal and speed."

"We just can't blame the game rooms for being a problem area," he maintained. "It's just a place where juveniles congregate. We've got others that congregate on shopping center parking lots and the Dairy Queen parking lot."

"I know these coin-operated games have become an obsession with a lot of these kids," he noted. "We find a lot of them in the game rooms around the high schools and junior highs. Instead of being in school, they're playing these games. These are the kids who will look for any excuse to skip school. If it wasn't the games it would be something else."

A school official in Providence was also concerned with the games distracting children from school. Josephine DiRuzzo, chairman of the Providence School Committee, has proposed a bill in the Rhode Island legislature making it illegal to operate the electronic games near schools.

An ordinance adopted by Oakland, CA, last December included provisions making it unlawful for an electronic game to be placed within 1,000 feet of a street entrance or exit to a school or playground.

Oakland Deputy City Manager George A. Dini said the new ordinance was recommended by a group of citizens in one of the city's residential areas. "They were disturbed by an empty store where someone moved in a bunch of video games," he explained. "They had a bunch of teenagers hanging out there at night and I guess disturbing the neighborhood."

He said some people also felt the youngsters were "squandering their lunch money" on the games, a concern also voiced by school committee members in Cranston, according to Chief Moretti.

Dini added, "It's not the games themselves. They just attracted youngsters who stayed there late in the evening."

Jeffrey Young, a graduate student at the Center for Applied Social Science in the Psychology Department of Claremont Graduate School in California, has been studying game player's behavior since September and expects to release his research results this summer. He contended electronic games are not necessarily addictive, but technology has made them more attractive to game players than mechanical games were to them. He also noted, "The kids we see in the arcades don't seem to be hoods." ■

Tandy tries hand at videotext

Videotext will be put to a real test in Texas this year when the Tandy Corporation tries to find out if people are willing to pay for the service.

"This is a commercial application of present-day computer technology that allows for the electronic transmission of information to a subscriber's home or office," Tandy President and Chief Executive Officer John V. Roach said in a statement released by Radio Shack.

The computer newspaper *Infoworld* quoted Radio Shack Senior Vice President Charles A. Phillips as saying of the experiment: "This is an entry-level effort in electronic journalism." He added, "If there's any real test here, it is this: Can we sell the general public on buying a Videotex terminal?"

At press time, Phillips told *80 Micro* Tandy expected the project to begin February 15, "a couple of weeks later than we were hoping for."

He said in the telephone interview Tandy had lined up one information provider for the project, the Fort Worth *Star-Telegram,* and was "talking with two or three" other providers.

"We're maintaining a certain responsibility to bring in certain service providers," he observed. "The newspaper will be the bulk of the information with its news, weather, sports—you name it."

Roach said Tandy intended to invite providers with specialized data bases to join the project. The providers, he said, could include newspapers, financial institutions, and airlines.

At press time, Tandy had yet to set the fees for subscribers, but Phillips said they would be "less than $10."

Asked if there would be any charges in addition to subscription fees, he responded, "Right now we haven't identified any, but I don't want to exclude the possibility."

He said the newspaper would make most of the decisions on additional charges: "What they're printing in the paper today—the copyrighted and syndicated stuff—they may want to affix a charge to or negotiate a charge with the supplier, if they decide to put it in the service."

Asked how many subscribers Radio Shack expected the Fort Worth-Tarrant County project to garner, Phillips said the projections were "in house" and not for release to the public.

Before Tandy announced its videotext experiment, it and Datapoint Corp. joined the Texas Newspaper Publishers Association in a lawsuit to block an Austin, TX, experiment in electronic delivery of information by the American Telephone and Telegraph Co.

"It's an interesting development that they would oppose our doing it but go ahead and conduct one themselves," said Pic Wagner, a Washington spokesperson for AT&T. "It's not surprising. I suspect there will be a number of firms conducting experiments."

Phillips explained: "We filed to uphold the injunction won by the association. Then we had to go back to court to give testimony as to why we thought AT&T didn't belong in this business in this state. But AT&T picked up their marbles and went home and didn't want to go to court over it."

"If there's any real test here, it is this: Can we sell the public on videotext?"

"The main purpose of that experiment," Wagner maintained, "was to determine if there is a market for these types of services and what the customers want and how much they're willing to pay."

"It had become apparent to us," Wagner continued, "that the proposed experiment was going to be tied up in litigation before the Texas Public Service Commission and perhaps elsewhere for a long time. Because of our ability to obtain some of the information elsewhere it just seemed a wise course to drop the experiment."

"Information is not our business; hardware is," Phillips declared. "We just don't like competing with a company who's funded with regulated funds rather than open-market, free-enterprise funds.

"We'll compete with anyone in the free-enterprise system, but not with anyone who's fighting with regulated funds. They can just dip down and there's no such thing as losing money." ■

Grid crowns garnered with micro

As coaches sift through the shards of last season and prepare for spring football, some of them are fantasizing about the mythical walk-on with all the tools to turn things around. A pair of coaches in Minnesota have found such a walk-on. However, he's not made of blood and bone but silicon and he's helped the duo compile an impressive high school won-loss record.

The walk-on is called Champs, a football scouting program for TRS-80s now being sold by Radio Shack. Since it was developed in 1976 by coaches J. Richard Dewey and Mathew L. Rauh, Jr., squads with access to the program have been the champion of their eight-team conference.

Rauh and Dewey don't claim their program will make a team another Dallas Cowboys, but they do say it can make gridiron field generals more effective coaches.

"It didn't affect our style of coaching," said Dewey, who developed the program with Rauh at Apple Valley High School, "but it made us more effective coaches. From the information we were able to gather and the efficiency with which we were able to gather it, we were able to spend more time coaching the kids."

He explained in a telephone interview with *80 Micro* the program was designed to save time: "We were gathering quite a bit of the information by hand. It was taking us 30 to 35 hours to do it. With the computer, we did 20 minutes work and the computer did the rest."

"Now that we're spending only 20 minutes doing the work instead of 30 hours," he continued, "we're able to spend more time coaching the players and consequently we're going to get better performance out of the players."

The program also enabled Apple Valley, with some 1800 students, and Dewey's and Rauh's current school, Rosemount, to get better performance out of their teams. Dewey maintained, "The information we're getting is going to help us put a player in the right spot more often and when you put players in the right spot more often, you have more success."

During the four years they used Champs at Apple Valley, Dewey and Rauh

teams were 37-6, won the conference championship every year, and earned two state runner-up trophies. At Rosemount, the one year the pair used Champs their team won the conference championship.

Asked if opposing coaches tried to counter the duo's computer by adding new wrinkles to their game plan, Dewey explained, "That's difficult to do. Football coaches tend to be stereotypical in general. They tend to go back to what they've done well in the past."

"Generally speaking," he said, "on the high school level, during the first two weeks of practice, we get into the basics for our whole season."

By trying to add new wrinkles to your game, Dewey explained, you reach a point of diminishing returns "because you have to start retraining people. You're not going to get the same results if you have to retrain people every week."

Dewey and Rauh had their scouts—volunteers like parents, former players or coaches—survey an opponent three times, although the program will work with less information. "It's not required to go out and see a team three times to have a successful report," Dewey noted. "You can get to the point where you have too much information. Computer generation can cause information overload."

Dewey, who has a bachelor's degree in math and a Ph.D in management information, said the pair have other athletic programs in the works, including a defensive tendency program, athletic department administration and recruiting. ■

What Champs does

Champs analyzes an opponent's offensive tendencies, although Dewey said he and Rauh are preparing another package, to be released this year, to analyze defensive tendencies.

When Champs is loaded into a TRS-80, a main menu listing eight options appears on the screen. The add and change functions allow a user to add or change information on an opponent. The list function will list to a printer all the information on an opponent; automatic will allow a user to print reports in up to 10 pre-designed formats.

The more info option lets the user define a field situation and find out what plays a team ran in that situation in the past. With the percent option, the user can define a situation—what does a team do between its 41 and an opponent's 35 yard line?—and find out relevant percentages—run: 78 percent, pass: 20 percent and kick: 2 percent.

The sort option will sort all information of a specified type. For instance, a down and distance sort will reveal which plays were run on first and 10, first and more than 10, first and less than 10, second and long and so forth.

The Model III Champs program disk stores complete descriptions of 5500 plays and the Model I program 700 plays.

Coach Dewey said the program will sell for $149.95—"a real steal." ■

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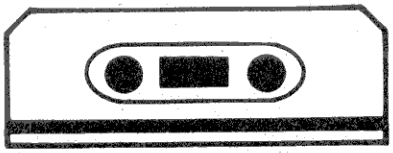

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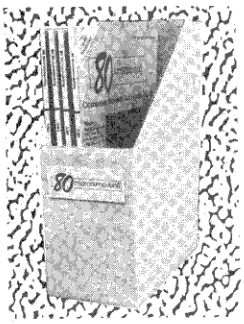

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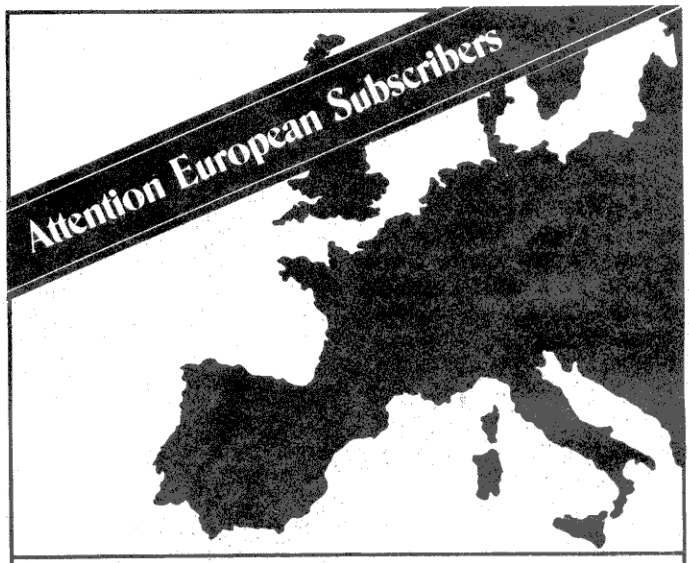

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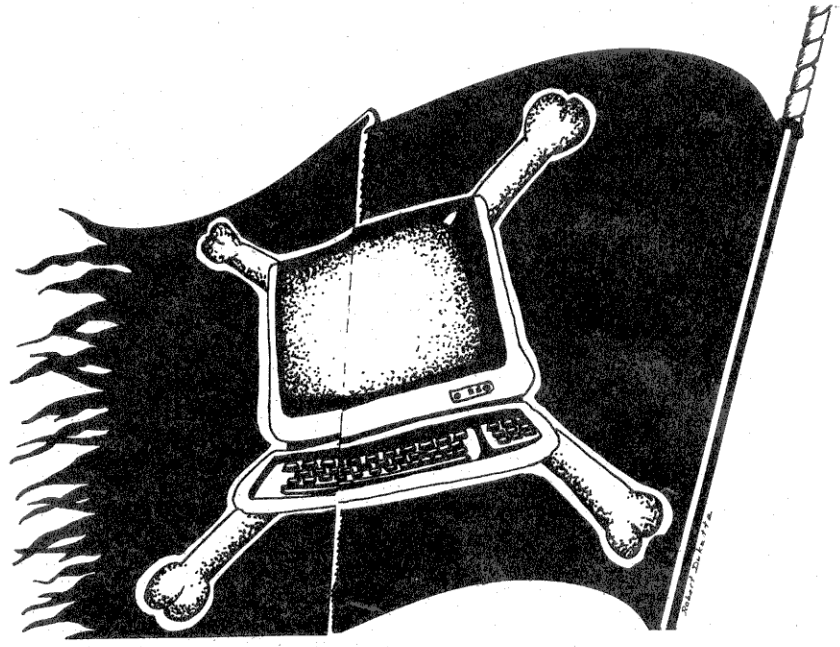
Wordstar pirate hit with lawsuit

by Kerry Leichtman
80 Micro staff



Micropro International and Digital Research have filed what is believed to be the first-ever software copyright infringement lawsuit against Data Equipment Inc. of Sunnyvale, CA and its parent company Dataforce International.

The suit claims Dataforce made and sold unauthorized copies of Micropro's Wordstar, Datastar, Wordmaster, MailMerge and Digital Research's CP/M software packages. In their suit the plaintiffs demand: an injunction preventing the defendants from copying or marketing counterfeit copies of the plaintiffs' software; impoundment of all counterfeit copies of plaintiffs' software and the equipment used to make such copies; an accounting of profits generated by the illegal copying and marketing of such software; punitive and exemplary damages of $1 million; treble damages for trademark infringement; and $50,000 for each copyright infringement.

Allegedly, Dataforce acted as original equipment manufacturers. The software was distributed as part of system packages. The system hardware was most commonly manufactured by Altos. These hardware and software packaged systems were sold to law firms, accounting offices and other service professionals. Most of the systems were sold in California, although some were sold to firms in other parts of the northwestern United States. There is no evidence the hardware was obtained by illegitimate means.

The alleged scam unfolded when unsuspecting users began calling Micropro and Digital Research requesting modifications or program enhancements. When it was discovered that these callers were not registered users, the firms became suspicious and figured out the rest.

The suit was filed in U.S. District Court in San Francisco in November, 1981. The process has moved to a procedure called discovery. Once the suit is filed, representatives from Micropro and Digital Research have the right to meet with and interrogate the defendants under oath. The representatives also have the right to go through the defendants' files. The charge for not cooperating is perjury. That is, if you can find the defendants.

Ronald S. Laurie, copyright, trademark and patent counsel for both Micropro and Digital Research said: "This is not the usual situation. Usually the discovery process is anywhere from one to three to four years, depending on how complicated the law suit is. But we seem to be having trouble getting any kind of a response out of the defendants.

"They have not filed an answer to the complaint. It seems like everyone has disappeared. We can get a default judgement, but then the question is who do you collect against if no one is around?"

Both Data Equipment and Dataforce International are, or were, located in Sunnyvale, CA. When *80 Micro* attempted to reach the defendants for comment it received the same response as Micropro and Digital Research's lawyers: "The number you have reached is not in service at this time and there is no referral. Thank you. This has been a recording." ■

Atari targets software pirates

The Atari Corporation has begun in earnest to crack down on software pirates and copy cats.

It has hung the hairshirt on a swashbuckler known as "B.B. Roberts"; gone to court against two software manufacturers; and settled with a third.

The Sunnyvale, CA company hired a private detective to nail Roberts after he sent a letter—bearing on the masthead a one-eyed pirate—to interested parties offering several well-known computer software packages at discount prices.

Atari did not prosecute Roberts because "he never cashed a check and he never produced any software," an Atari spokesperson told the computer newspaper *Infoworld*. However, Atari did wring a repentant essay from Roberts and is using it to discourage pirating.

In federal district court in Fresno, CA, Atari obtained a temporary restraining order against On-Line Systems, producers of "Gobbler" and "Jawbreaker." The order prohibits On-Line from manufacturing or selling the games. Atari claims the games infringe on the firm's rights to the home computer version of Pac Man.

On-Line has filed a lawsuit against Atari claiming it is attempting to restrain trade by monopolizing the rights to any game with a maze and dots.

Atari did not fare as well in Chicago. A federal district court judge there denied Atari's and arcade manufacturer Midway's motion that a preliminary injunction be issued against Magnavox Corp. to stop it from producing its home-video game K.C. Munchken.

Atari and Activision, of Santa Clara, CA, settled their differences out of court. Activision makes plug-in game cartridges for Atari computers. It was started several years ago by former Atari employees. The firms refused to make the terms of the settlement public. ■

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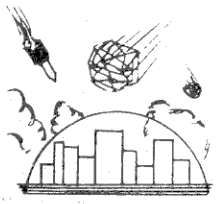

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Group formed to fight software bucs

by Kerry Leichtman
80 Micro staff

The call to arms has been sounded and the war against software piracy has begun in earnest. Ms. Robin Robinson has created the Association for Software Protection. Robinson previously spent over two years as Software Protection Director for Mini-Computer Business Applications before starting up the organization.

"One individual trying to protect his product from both the ignorant and the devious is a time-consuming job," said Robinson. The association, she added, will attempt to assist software developers by coordinating efforts to eliminate the ever-increasing piracy problems facing the industry.

For the organized concept to work, Robinson said she needs the cooperation of the software industry. To enlist this support, she distributed a questionnaire and established the association's guidelines through the industry's responses to it. With the results compiled, Robinson has now announced her membership drive.

Benefits to members will come in many forms: A bi-monthly newsletter will be distributed containing case histories, legislative updates, responses to members' questions and news; an information library established to house information on international software laws and to maintain a compilation of software protection problems within the industry along with solutions so far developed; ongoing research pertaining to current piracy problems; conferences and an educational campaign directed toward the user unfamiliar with software copyright restrictions; providing "starter packs" as assistance for both software developers and software users.

The starter packs, to be placed in software packages, "will not only educate, but will serve as an endorsement of our members," said Robinson.

Response to Robinson's efforts have been favorable, she said, and requests for applications and information have steadily arrived at the association's offices. For application and additional information contact: Ms. Robin Robinson, The Association for Software Protection, 10143 Leona Avenue, Tujunga, CA 91042.■

Videotext journalism

Reporting of the future taught in Florida

They're readying themselves for the journalism of the future at the University of Florida in Gainesville. The school has established an Electronic Text Center and aims to have a curriculum in videotext editing and programming by 1983.

"People who are training to become editors will have an option of moving into this area," said Ralph Lowenstein, dean of the College of Journalism and Communications.

He told *80 Micro* in a telephone interview, "There may well be a curriculum in place by the fall of 1983."

Lowenstein said by this summer, the college expects to have "rotatext"—non-interactive videotext continually rolling over a viewer's tube.

The school hopes to use channel 11 of the local Cox Cable tv affiliate to broadcast its rotatext from 12 midnight to 9 am. The cable company has also reserved a "superband" channel for teletext—a type of videotext that is interactive.

In July, the college will hold a two-week course on videotext for up to 25 journalism professionals.

But the cornerstone of the new curriculum, a survey course on videotext, began in January.

"We will try to give students some experience they can use editing on videotext," said Dr. Kurt Kent, who is teaching the survey course. It will consist of lectures and labs, he explained, and includes material on microcomputers, mainframes, information systems and computer graphics.

Asked the difference between newspaper and videotext editing, Kent, who knows Fortran, Basic, PL1, Compass and Assembly Language, responded: "The space constraints are the first major difference. You have so little space that you've got to treat your stories differently."

Kent, a graduate of the Universities of Iowa and Minnesota, said story "jumps" present another problem to videotext editors:

"In videotext, you have to pay more attention to getting a complete part of the story on the screen for each screenful, so people don't have to go to the next screen to understand the screen they're looking at."

"The feeling is," Kent observed, "few people will take the time to look through the whole story start to finish. There might be quite a few people looking at page one, but the fallout after that is going to be pretty big."

Dean Lowenstein said the 1,350-student college of journalism has one of the largest newspaper editing labs in the country. Housed in its new $6.3 million building, the school has 19 VDTs—two of them feeding into the Gainesville *Sun*, a newspaper owned by the New York Times Company.

The college also has a Public Broadcasting System tv station and three radio stations.■

CP/M arrival stalled at IBM

by G. Michael Vose
80 Micro Technical Editor

Two months after its arrival on the microcomputer scene, the IBM Personal Computer is still waiting for a version of the CP/M operating system. The software has been adapted for the Personal Computer by its originators, Digital Research, but IBM is still testing it.

Full marketing rights for the Personal Computer version of CP/M-86, the operating system written for the 16-bit 8088 and 8086 Intel microprocessors, have been acquired by IBM. Tom O'Niel of Digital Research's Marketing arm expects IBM to release the software "in late February or early March." O'Niel did not know what IBM planned to charge for the system.

The Personal Computer Marketing Division, through its spokesperson Jeannette Maher, could not offer at press time a release date for CP/M-86 or speculate on its eventual price. Apparently only authorized IBM retail outlets will sell CP/M-86 for the Personal Computer.

The operating system currently available for the Personal Computer, called IBM DOS, is necessary to run the applications software currently available for the machine. This includes VisiCalc, Easy Writer, accounting and game packages. The IBM DOS costs $40.■

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★ **Written by an experienced gamer** in fantasy role-playing, based on the game Dungeons & Dragons.

Objective: Your character begins on the first of a three level dungeon, searching for magical "stones" which permit you to descend to the next lower level.

The Adventure: There are numerous traps, and over a dozen hostile monsters that come in various sizes, shapes and degrees of nastiness. It has various treasures and magic items (weapons, elixers, cloaks, scrolls, etc.) You can become a fighter, a theif or a magic-user. Each time you play you get a totally different and exciting game.

This short description only begins to tell you of the many adventures and some of the features of this exciting game.
This will be your favorite adventure game!

Complete documentation included.
You must specify Model I or Model III. Available on:

Tape, 16K..... **$19.95** Diskette, 32K..... **$24.95**

New!

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CHECKING ACCOUNT Mod. I or III, 48k disk $39.00
Excellent check writing program for small business. Prints checks on printer, sorts into 32 catagories for bookeeper and IRS.

BILLING SYSTEM Mod. I or III, 48k disk..... $39.00
Excellent system for the small business man. It is fast and easy to use. Prints out invoice and monthly bills. Adds interest etc.

Special buy both programs checking and billing..... $65.00

FAMILY TREE ..... **Tape$32.00 Disk** **$39.00**
Excellent Family Genelogy program works on both Model I and III. Excellent program for beginning Family Tree. Complete directions for research and program use.

Scarfman ..... $14.95/$23.95

LASER DEFENSE $14.95/17.95

SUPER DIRECTORY

This will be the standard of which all other Directories are judged. It will read any normal type of diskette Mod I or III, Multi Dos, Ldos, Dos Plus, Tri Dos, New Dos, Double Density, Single Density, 35, 40 or 80 track drive's.

It is easy to use but at the same time has all the features you will ever need. Display to screen or to printer. Displays by program, or disk, or subject.

You can even add a line to help tell what the program is about Example:
TRACEPRT/CMD 146U PRINT TRACE OF MACHINE LANGUAGE RUN.
Traceprt/cmd is file name on disk ● 146 is disk number ● U is for utility ● PRINT TRACE OF MACHINE LAGUAGE is descriptor file.

Special Introductory offer with each directory ordered before June 1st we will include 4 blank Wabash double density Disks for a dime or you can get a box of ten disks for only $19.90.
Please specify operating system.

Super Directory . . . $39.90 With 4 Wabash Disks. . . $40.00
With 10 Wabash Disks $59.80

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✓See List of Advertisers on page 402

Now micros can talk mainframe

by G. Michael Vose
80 Micro Technical Editor

The 1982 Radio Shack Computer Catalog (RSC-6) debuted software to allow TRS-80 Model II microcomputers to converse with the IBM family of mini- and mainframe computers. The three software packages (ReformaTTer, Binary Synchronous Communications 3270, and IBM/DEC Compatible Binary Synchronous Communications 3780) are priced from $249 to $995. These packages enable the Model II to transfer files between TRSDOS and IBM formatted disks (IBM 3741 single density format) and communicate with IBM Systems 360/370 machines or with DEC PDP-11 or VAX-11 minicomputers (or any device equipped with bisynchronous communications ability).

Without the use of this kind of sophisticated communications software, however, there has been no method of using the data files generated by one computer on a different system. This problem has surfaced as more microcomputer systems have been pressed into service in the nation's places of business. Many managers are anxious to extract data from their company computer for use on their office microcomputer system. In other situations, companies are being stymied by an inability to use a word processor data file generated by the computer at the home office on their own dedicated system.

Growing micro use created demand for sophisticated software to make mainframe a micro second language

Since floppy disk storage is the most efficient method now available for data storage, INSTOR Corporation of Menlo Park, CA has devised a solution to the computer incompatibility problem. The company has built an intelligent floppy disk storage system allowing data exchange between different computer systems.

INSTOR/80 and 801

The devices, called the INSTOR/80 and INSTOR/801, interface to the host computer via its RS-232 communications port. The INSTOR/80 then converts output from the host computer to the IBM 3741 format and makes all necessary ASCII/EBCDIC conversions. Any computer using the IBM format can use these disks. With the proper software, over 25 different computers including the IBM Personal Computer and HP3000, PRIME, Data General and DEC minicomputers can then read these IBM formatted disks. Once the information is transferred to an INSTOR/80 disk, it can be read off that disk from the same or another INSTOR/80 into a different computer. The INSTOR/80 can also be used with OCR page readers, scanners, bar code readers and other data collection devices.

The INSTOR/80 will retail for $3,000 while the INSTOR/801, made specifically for the IBM Personal Computer, will retail for $2,000. Both models use eight-inch disks.

The INSTOR/80 can be a significant time-saver over communications software methods of transferring data from computer to computer. The INSTOR/80 transfers data at the rate of 9600 bits per second. Importantly, the two computers do not have to be tied up at the same time if data is transferred using disks rather than communications links.

For more information, contact INSTOR Corporation at 175 Jefferson Drive in Menlo Park. ■

Computer Week created in Granite State

Declaring that, "Whereas it is generally agreed that all students should become computer literate in order to function effectively in today's environment," a proclamation will be signed this spring by Gov. Hugh J. Gallen making the first week in May Educational Computer Week in New Hampshire.

Sponsored by the University of New Hampshire Department of Computer Services, the highlight of the week will be an all day Educational Computer Fair. The fair will be staged at the UNH Memorial Union Building on Tuesday, May 4. It will provide educators, students and the general public the opportunity to view currently available educational microcomputer software and to obtain information about the educational uses of microcomputers (see *80 Micro*, February 1980.)

The fair will feature simultaneous presentations by educators and vendors concerning the use of computers in education. Educators and industry representatives will discuss trends in educational computing, the value of learning computer programming as a methodology for training young minds and other innovative ideas. Exhibitors will be charged $100 for a 12-by-12 foot booth. Space is limited.

The coordinator for the fair is Anne Knight, the Educational Coordinator for the UNH Department of Computer Services. Knight, who is also chairperson of the New Hampshire Association for Computer Education Statewide (NHACES), told *80 Micro*, "Educators are becoming more interested in computers and computer literacy." Her department at the university is acquiring information about educational software for dissemination to New Hampshire school districts. The department owns a TRS-80 Model I and some educational software in spite of an infinitesimal microcomputer budget.

By spotlighting computers and education for the entire week of May 3-7, Knight hopes to engage the imagination of students and their parents to the potential of educational computing. By involving the governor and the state news media through the proclamation of Educational Computer Week, she hopes to "make everyone at least aware that microcomputers are likely to be an exciting aspect of the educational experience."

The other formal activity planned for Educational Computer Week is an Information Swap to be held at the Ramada Inn in Concord, NH. Sponsored by the association, the swap will begin at 4 pm and will be followed by dinner and a guest speaker. In addition, the association is encouraging local school districts to organize meetings on their own to explore the educational uses of microcomputers. (For more information, call Anne Knight at (603) 862-3527.) ■

—G. Michael Vose

PULSE TRAIN

Congressman offers Email to constituents

Constituents of a Pennsylvania Congressman may give him their "two cents' worth" through an electronic mail service.

Democrat Jim Coyne developed the service with the U.S. House Information System and Dialcom, a national telephone-access computer firm.

Coyne, quoted by the computer newspaper *Infoworld*, said of Email, "As the public becomes more aware of it, it will be easier for them to give elected officials their two cents' worth—and that's about what it will cost them."

Free computers for French

Telematique, the French national program to advance electronic information technologies, has announced plans to offer as many as a million French citizens free computer terminals.

According to a report in the computer newspaper *Infoworld*, the computers would be part of a massive electronic telephone directory experiment that may eventually replace printed directories in all French households.

Currently the French are conducting an electronic telephone directory experiment in Western France. By the beginning of this year 270,000 homes and businesses were expected to be participating in that trial.

At Comdex the French announced plans to expand the experiment to Paris. A portion of those terminals will be aimed at the professional market and will be an open-ended tool for the businessman.

Roy Bright—managing director of Intelematique, the international marketing arm of Telematique—said the 300,000 to 600,000 terminals ordered by the French could lower the price of the devices in the United States to $300.

CompuServe-AP experiment extended

Eleven newspaper members of the Associated Press will continue their videotext experiment with a major data base through the middle of 1982. The experiment was slated to end in December 1981.

Some of the newspapers have been on-line with CompuServe Inc., of Columbus, OH, since July 1980, but others didn't plug into the system until last summer and fall.

Experimenters will take a close look a three aspects of the videotext test in its final months:

- A study of the experiment by RMH Research Inc. to pinpoint the wants of present and future videotext subscribers and measure the market potential of videopapers;
- Implementation of the first national electronic classified advertising data base provided by newspapers; and
- Installation of computer terminals in 100 homes across the United States for five months to get the reaction of a cross-section of videotext viewers.

Newspapers participating in the experiment are the Columbus (OH) *Dispatch*, Washington *Post*, Los Angeles *Times*, New York *Times*, St. Louis *Post-Dispatch*, Minneapolis *Star & Tribune*, Atlanta *Journal and Constitution*, Norfolk (VA) *Virginian-Pilot and Ledger Star*, San Francisco *Examiner* and *Chronicle*, and Middlesex (Framingham, MA) *News*.

The news is up to date at this mall

When shoppers at the Westmount Mall in London, Ontario, tire of consumerism, they can take a break at the Videopress booth, a "first of its kind" commercial videotext system using Telidon technology.

The Free Press Printing Company, which created the booth, sells commercial spots—displayed on four-foot tv screens—to stores in the mall, non-competing merchants outside the mall and national advertisers. A continuous stream of 10-second ads are recycled every six minutes. The messages can be changed or updated instantly and inexpensively, allowing advertisers to react almost instantly to market conditions.

Shoppers may access information at the booth through three interactive touch-screen terminals. The information includes news headlines, weather, road conditions, entertainment, local community events, winning lottery numbers, a mall guide and a mall gift guide.

First Epaper in Canada

Canada's first electronic newspaper has hit the tubes. Using Telidon—an information system developed by the Canadian government—*La Presse* of Montreal offers an electronic edition featuring national and international news 24 hours a day.

The Epaper involves 50 sequential screens repeated every 20 minutes. Nighthawks can catch the next day's news by tuning in at midnight.

Electronic *La Presse* is offered by the Videotron Group to 551,000 cable tv subscribers in greater Montreal, Trois-Rivieres, Quebec City, Sherbrooke, Victoriaville, Gatineau and Mont Laurier.

Soon at your local stationery store

Wilson Jones Company, which has sold commercial office supplies for more than 80 years, is entering the software business. The firm, a subsidiary of American Brands Inc., will be marketing six accounting software packages aimed at the more than 10 million small businesses in the United States. According to American Brands, formerly The American Tobbaco Company, the distribution channel opened by Wilson Jones has the potential of reaching more than 10,000 retailers.

Another communications bill unveiled

A bill to restructure the $75 billion communications industry was introduced by U.S. House telecommunications subcommittee chairman Tim Wirth, D-CO.

A restructuring bill has also been introduced in the U.S. Senate and another proposed by the Federal Communications Commission.

continued

PULSE TRAIN *continued*

Wirth's bill, aimed at fostering competition in the industry, would allow American Telephone & Telegraph Co. to set up a subsidiary to provide unregulated data-processing services and to sell phone equipment.

The subsidiary would be designed to minimize the possibility AT&T would use its revenue from monopoly services such as local phone service to subsidize competitive services provided by the new unit.

However, the chairman's bill would give AT&T two options for setting up the subsidiary.

If the new "Baby Bell" offered services the parent company provided, it would have to receive some of its initial capital and all of its subsequent capital from outside the Bell System.

If the subsidiary offered new services, the separation requirements between parent and subsidiary would be less stringent and only one-fourth of the capital would come from outside the Bell System.

A plan for setting up Baby Bell was submitted to the FCC by AT&T at the end of last year (see *80 Micro*, February 1981).

Hearings on Wirth's bill were scheduled for last month and a subcommittee vote on the proposal planned for this month.

More data bases

Computer users can tap at least 960 data bases, up from about 400 two years ago, according to Cuadra Associates, publisher of an industry directory. For every data base that's discontinued, about 25 new ones crop up, Cuadra said.

CompuServe to manage Comp-U-Card

A major computer information provider and the largest computerized shopping service in the nation have announced a five-year, $9.5 million resource management agreement.

Under the pact, CompuServe of Columbus, OH, has agreed to manage orders for Comp-U-Card of Stamford, CT.

In a statement released by CompuServe, an H&R Block company, it predicted it would have to dedicate entire mainframe computers to meet Comp-U-Card's needs.

Comp-U-Card will use CompuServe to allow the shopping service's some two million subscribers to buy brand name appliances, furniture, electronic goods, china and silver at prices as much as 40 percent below manufacturers' list prices. The service can be accessed through computers, the telephone and cable tv.

Button button

Seymour Rubinstein, president of Micro Pro International, manufacturer of WordStar, had this bit of advice for members of the Western Computer Dealer's Association at its recent meeting in San Mateo, CA: "Get to know the 'hot buttons' of the customer—what feature he or she needs—and push them."

$50,000 reward for info on semiconductor thieves

Monolithic Memories of Sunnyvale, CA, is offering $50,000 for information leading to the arrest and conviction of anyone responsible for robbing $2.7 million in semiconductor chips from the firm last Thanksgiving weekend. The theft is reportedly the largest ever of semiconductor devices.

Daisy wheel will roll over dot matrix

"I know this isn't a popular opinion, but I think you will see daisy wheels making a comeback and the growth rate of dot matrix printers slow."

That's the view of Peter Wright, vice president of Gatner Group Inc. Wright's remarks, reported by *Computer Business News*, were made at Comdex '81 held last November in Las Vegas.

Wright said the average price of daisy wheel printers will drop over the next 18 months to $1500. Currently the average is $3000.

Wright also predicted greater penetration by the Japanese into the daisy wheel market: "Two years ago Qume and Diablo each owned 40 percent of the market, but recently Japanese companies have seized the opportunities available in this market."

In a related matter, the Venture Development Corporation of Wellesley, MA, said in a study released late last year U.S. printer manufacturers are being challenged by foreign competitors.

The report added that some American small system manufacturers have already switched to Japanese daisy wheel printers, which are cheaper and faster than similar printers made in the states.

New York-Canadian synergy

The New York Times Information Service Inc. and Info Globe of Canada announced an agreement to market each other's data bases in their respective nations. The NYT Information Service data base includes the full text of the New York *Times*; AMI, a marketing and advertising data base; and MEDAB, a Middle East information service. Info Globe's data base includes the full text of *The Globe and Mail*, a national Canadian newspaper, and MARKET-SCAN, a stock quotation service.

Info Manager Barbara Hyland noted in a statement announcing the pact, "We believe that many positive benefits will flow from the synergy which will develop as a result of this agreement."

Flakey computer

If you live in a state beginning with "M," you may receive an unwanted surprise from New York City.

"We're having a little trouble on our computer with states beginning with the letter 'M,' " a spokesman for the city's parking violations bureau told the Boston *Globe*. "Thousands of violation notices have been sent erroneously."

The problem came to the *Globe's* attention when Natick, MA, was billed $120 for three $15 fines and the usual harsh penalties for late payment. The vehicle owned by the town and cited on the tickets was a half-ton air compressor—a trailer-like vehicle without an engine.■

RELOAD 80

Disk drive users are in luck—this month LOAD 80 branches out to include disks as well as cassettes. This column will cover the specifics of LOAD 80 on disk: loading and running programs on one or two-drive Model I or Model III systems.

Like the cassette, LOAD 80 on disk will be made up of the listings we publish monthly in *80 Microcomputing*. Because not everything will fit, we select those programs which are fairly long (more than a few screenfuls) and of general interest. In any case, the disks you receive will be brimful.

LOAD 80 will be produced on a single-density TRSDOS 2.3-formatted data disk, with no operating system. To increase the disk space and keep the price down, it will be produced on double-sided (flippy) disks. These disks have two sense holes and two write-protect holes, enabling users to read the disk one side at a time.

Using a flippy in this manner could result in short media life because the direction in which the disk spins relative to the read-write head is changed when the disk is flipped over. Therefore, *back-up this disk onto a single-sided disk immediately.*

Model III Users

Since the disks are in a single-density format, Model I users with more than one drive can simply place their operating system in Drive 0, place the LOAD 80 disk in another drive, press Reset, and begin. Model III users, however, have the problem of reading a single-density disk with a double-density operating system. Here is how to do it with Model III TRSDOS:

1. Place a back-up of your TRSDOS disk in Drive 0. Place your LOAD 80 disk in Drive 1, either side up.
2. PURGE files on Drive 0 until you have at least 134 free GRANS. (See your operating manual for details on the PURGE utility.)
3. Type CONVERT and <Enter>. Answer 1 to Source, 0 to Destination.
4. CONVERT will read each file in single-density format and then copy it in double-density format onto your TRSDOS disk.
5. Flip the LOAD 80 disk over and do steps 3–4 again.

Consult your manual if you have trouble. Remember that not all files will run correctly on the Model III. This is especially true of assembly language programs.

One-drive Users

Because LOAD 80 is produced without an operating system, one-drive users must own an operating system or utility which permits single-file, single-drive copying. Model III owners with only one drive encounter another problem because the data disk is single-density and the DOS disk is double-density.

We have prepared the following tables of a few popular operating systems, along with their single-file, single-drive copy capabilities. Table 1 is for the Model I; Table 2 is for the Model III. As with all software, read the manual thoroughly before you use the program, and follow on-screen prompts. You will find the correct file names listed in the LOAD 80 directory enclosed with the disk.

Please note that this information comes directly from the producers of the various operating systems; if a command doesn't work call them, not us.

Errata

Program 6 on side B of the December LOAD 80 (file name P1) is incomplete. Lines 100–3780 were inadvertently left off the tape, but were included in the magazine. The correct version will be included on the March LOAD 80. Use Floppy-Fixer on page 326 of the December 1981 *80 Microcomputing* as documentation.

Please address any questions to:

Art Huston
Technical Editor
80 Microcomputing
Pine St.
Peterborough, NH 03458
or call (603) 924-9471.■

	Versions	(Y/N)	Syntax
DOSPLUS	All	Y	COPYI filename
LDOS	5.0	Y	XFER filename
	5.1	Y	COPY filename (X)
MULTIDOS	All	Y	COPY :0 $filename
NEWDOS	All	Y	COPY :0 $filename TO filename
NEWDOS80	All	Y	COPY :0 $filename TO filename
TRSDOS	All	N	———
ULTRADOS	All	Y	COPY :0 $filename TO filename

Table 1. Model I single-file, single-drive copying.

	Versions	(Y/N)	Syntax
DOSPLUS	All	Y	COPYI filename
LDOS	All	Y	COPY filename (X)
MULTIDOS	All	Y	COPY :0 $filename
NEWDOS80	All	N	———
TRSDOS	All	N	———

Table 2. Model III single-file, single-drive copying, single to double density.

Program	Title	Page	Comments
1	THREEDEE	138	NONE
2	PRMSRCH	152	NONE
3	HUMANS	154	NONE
4	GRADES	184	NONE
5	SCRNPRNT	214	NONE
6	CENSOR	216	NONE
7	OTHLLO80	252	NONE
8	RGRAPHIC	294	NONE
9	BLTNBRD	314	NONE
10	FLPYFIXR	*	Needs EDTASM

*Page 326 of December 1981 *80 Microcomputing*.

80 CALENDAR

March

1-2 Michigan Association for Computer Users in Learning, Wayne, MI. **Sixth annual convention featuring sessions on facets of education uses of computers,** Western Michigan University, Kalamazoo, MI.

3-4 University of Washington Academic Computer Center, Seattle, WA. **Eighth Annual Computer Fair.**

3-7 Catalyst, Jersey City State College, Jersey City, NJ. **Microcomputer Week '82, "an international event of significance to educators,"** Jersey City State College, Jersey City, NJ.

9-10 The Yankee Group, Cambridge, MA. **Seminar on the Super Service Bureau,** New York City, NY.

12-13 Seattle Pacific University and National Council for Computers in Education. **Fifth Annual Computers in Education Conference,** Seattle Pacific University, Seattle, WA.

16-18 McGraw Hill International Training Systems, Edutronics Division, New York City **International Training Conference: Tools for Data Processing Training,** McGraw-Hill Building, New York City, NY.

18-20 Technical Education Research Centers, Cambridge, MA. **Workshop on microcomputers in education,** Mesa Community College, Phoenix, AZ.

22-25 The Interface Group, Framingham, MA. **INTERFACE '82—communications-information conference and exposition for sophisticated end users,** Dallas Convention Center, Dallas, TX.

24-26 Technical Education Research Centers, Cambridge, MA. **Workshop on Microcomputers in education,** Lewis and Clark College, Portland, OR.

26-28 The Interface Group, Framingham, MA. **Showcase Expo for small business proprietors, independent neighborhood professionals and mid-level corporate managers,** Georgia World Congress Center, Atlanta.

28 Greater Baltimore Hamboree and Computerfest. Timonium, MD. **Multi-interest small computer and electronics show,** Maryland State Fairgrounds Exhibition Complex, Timonium, MD.

7-9 American Management Association, New York City, NY. **Course on paperwork management,** New York City, NY.

April

1-3 Alaska Association for Computers in Education, Anchorage, AK. **Educational Computing—The Future is Now conference,** Anchorage, AK.

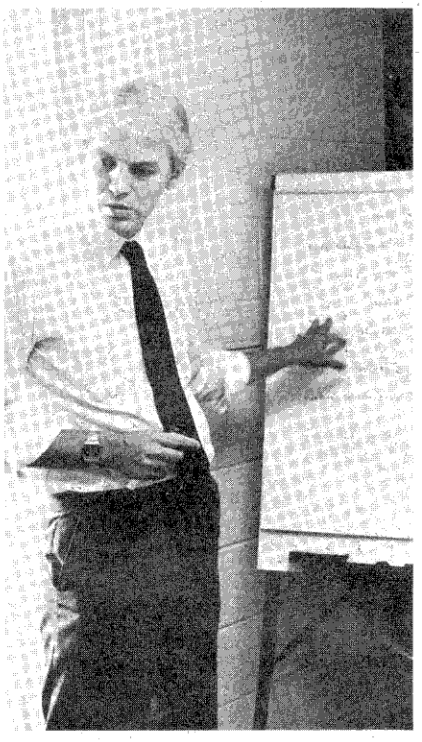
2-3 Montana Council of Teachers of Mathematics and Montana Office of Public Instruction. **Rocky Mountain Computer Conference for educators,** Ramada Inn, Billings, MT.

2-4 Kengore Corp., Franklin Park, NJ. **Eighty/Apple Computer Show—an exposition for products and services for Apple and TRS-80 computers,** NY Statler Hotel, New York, NY.

12-14 American Management Associations, New York, NY **Course on paperwork management,** Chicago, IL.

15-17 The Interface Group, Framingham, MA. **Showcase Expo for small business proprietors, independent neighborhood professionals and mid-level corporate managers.** A. J. Cervantes Hall, St. Louis.

15-18 National Computer Shows, Chestnut Hill, MA. **Southwest Computer Show and Office Equipment Exposition,** Market Hall, Dallas Market Center, Dallas, TX.



Ken Orr will be one of the featured speakers March 16-18 at the international training conference held in New York City by the Edutronics Division of McGraw-Hill.

16-18 Virginia Computer User's Conference, Association for Computing Machinery, and Virginia Polytechnic Institute and State University. **12th Annual Conference with topics on artificial intelligence, office automation and data-base management,** Marriot Hotel, Blacksburg, VA.

22-25 The National Computer Shows, Chestnut Hill, MA. **New York Computer Show and Office Equipment Exposition,** Nassau Coliseum,

Uniondale, Long Island, NY.

3-25 The Interface Group, Framingham, MA. **Showcase Expo for small business proprietors, independent neighborhood professionals and mid-level corporate managers,** Miami Expo Center, Miami, FA.

24 John Craig's Computer Swap, Palo Alto, CA. **Flea market for computer enthusiasts,** Santa Clara County Fairgrounds, San Jose, CA.

19 University of California Extension, Berkeley. **The Manager's Approach to 16-Bit Microprocessors,** (one-day intensive course), Mountain View, CA.

21-23 The Interface Group, Framingham, MA. **Showcase Expo for small business proprietors, independent neighborhood professionals and mid-level corporate managers.** Commonwealth Pier Exhibition Hall, Boston, MA.

May

4-8 University of California Extension, Berkeley. **16-Bit Microprocessor Workshop,** (6 week evening course), Mountain View, CA.

6-9 The National Computer Shows, Chestnut Hill, MA. **Southern California Computer Show and Office Equipment Exposition,** L.A. Convention Center, Los Angeles, CA.

7-9 The Interface Group, Framingham, MA. **Showcase Expo for small business proprietors, independent neighborhood professionals and mid-level corporate managers,** Anaheim Convention Center, Anaheim, CA.

11-12 The Yankee Group, Cambridge, MA. **The Next Generation of Consumer Electronics seminar,** Palo Alto, CA.

Coming Next Month

What's the ultimate utility? How about a utility to help you find utilities? That's what will be featured next month when *80 Micro* raises the curtain on its buyer's guide to utilities—editor/assemblers, disassemblers, monitors, terminal packages, Basic editors, and tape, file and speed-up utilities. Also in April. . . Gather around the chalk board as Jake Commander presents a tutorial on utilities; polish up your Skinner box for an exclusive *80 Micro* interview with the graduate student that got B.F. on the research road after a 20 year hiatus; and steel yourself for some April foolishness fashioned to feather your funny bone.

Proof Notes

Continued from page 10

tion of television camera and computer. This combination can be used to set up a feedback loop between program and camera, allowing the program to modify its own designs. The motion picture industry is already well into inventing and using these new ideas. As you can see, between typing in a short program and interfacing external hardware, computer graphics can be as simple or complicated as you want.

To push your video display to its greatest heights, however, some patience and perseverance will be required. Although we provide you with some programs to try out, if you're serious you should familiarize yourself thoroughly with computer graphics to get that all-important extra insight. It's interesting to see how many proficient programmers avoid graphics because of the extra efforts involved. If you have the determination to master both the arts of programming and graphics, your services are likely to be always in demand. To get started, you will need some reading with a little simple math thrown in. Unfortunately, there is a dearth of good beginners' books on the subject. Most that I've seen jump feet first into some awful-looking math which would scare off any neophyte. I hope we manage to provide some enlightenment, encouragement and inspiration in this issue.

Jake Commander
Technical Consultant

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We're looking for hot GAME programs:

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Then, sit back and collect your royalty checks. Write for our free Programmer's Kit today!

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Peterborough, NH 03458

No. 6 UNBELIEVABLE OPPORTUNITY!

If You've Written a Useful Program-- We'd Like to Publish It!

We want programs for INDUSTRIAL applications:

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JOB TRACKING
MACHINE SCHEDULING

Get published and earn royalties! Write for our free Programmer's Kit today.

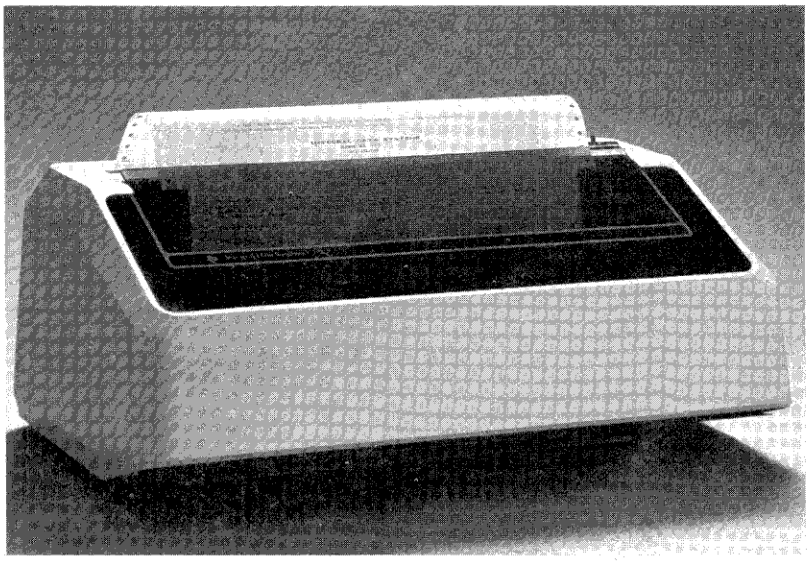
INSTANT SOFTWARE, INC.
Submissions Dept. ✓2
Peterborough, NH 03458

✓*See List of Advertisers on page 402*

NEW PRODUCTS

edited by Janet Fiderio

Featuring—The Prism Printer
Color Graphics and Printing for your TRS-80.



The Prism Printer.

The Prism Printer

The Prism Printer is a fully configured 132-column dot matrix, software selectable, eight color printer. A four band ribbon carries the process colors of cyan, magenta, yellow, and black. Additional ribbons are optional.

Prism features include: semi-automatic cut sheet feed, a high speed data mode, nine-wire ballistic-type print head incorporating two staggered rows of print needles to create vertically overlapping dots in a single pass (achieves correspondence quality print and true mixing of colors), proportional spacing, enhanced (bold) text printing, and standard print densities of 10, 12, or 16.7 characters per inch.

Selectable features include: automatic text justification, programmable horizontal and vertical tabbing, reverse paper feed, and fine positioning of characters. Microprocessor controlled, the printer has "logic seeking" look-ahead capability and high-speed slew for maximum output. It has both anRS-232C serial interface and a Centronics-compatible parallel interface.

Priced at $1995, this printer is available from Integral Data Systems Inc., Milford, NH 03055, (603) 673-9100.

Reader Service ✓550

Only the Shadow Knows

Macro Mon, dubbed "The Shadow," is a machine language program allowing disassembly and examination of program instructions from within the computer's memory. It disassembles each instruction as it is executed, and then optionally sends it, with all current register values, to the video screen or printer.

"The Shadow" may be located anywhere in RAM. Additional features include the ability to: single-step through ROM, set user-defined break points in RAM or ROM, find any string up to 16 bytes long in RAM or ROM, provide a visual display of tape Loads and Saves, and relocate any machine language program in RAM with all external calls and jumps changed to execute in their new location.

It is available for the Model I (cassette $54.95, disk $59.95) or for the Model III (disk $69.95) from Advanced Operating Systems, 450 St. Johns Road, Michigan City, IN 46360, (219) 879-4693.

Reader Service ✓551

Datapack A Data Communications Package

Datapack is a terminal package program for the Color Computer. It allows you to use the computer as a buffered computer terminal through a modem to a time sharing network, or as a direct-connect terminal to another computer system.

The program saves data stored in the buffer either to cassette tape, or outputs to the printer. The data output is automatically set to the maximum size of your system memory when entered, allowing maximum space for saving data. Also included are features to send control codes and to enable or disable keyboard echo. When the terminal mode is exited the contents of the buffer may be viewed on the screen or saved to tape for later loading.

For more detailed information contact Cer-Comp, 5566 Richochett Ave., Las Vegas, NV (702) 452-0632. Datapack is priced at $24.95.

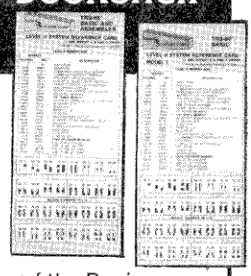
Reader Service ✓552

Wildcat, Disk Directory

Wildcat is an advanced disk directory catalog system which reads directories directly from the disks of all Basic, Scripsit, Pencil, and Edtasm type files. It also appends the first 50 characters of any data or other ASCII type file.

The catalog information contains the disk ID, name, date, free grans, filespec, and first line remark. Four versions are

80 microcomputing bookshelf



Nanos System REFERENCE CARDS

(for Model I and Model III)

At last! No more flipping through the pages of the Basic manual! No more working through the maze of machine language instructions! These cards completely summarize the Basic and Assembler manuals! FEATURES (on most cards):
memory map, eyeball graphics, math instructions, basic commands, store instructions, basic functions, load instructions, basic statements, move instructions, special keys, exchange instructions, print using examples, shift instructions, basic special characters, compare instructions, basic and assembler messages and codes, branch instructions, basic facts, data alteration instructions, reserved words, I/O instructions, ROM routines, complete character chart with graphics and space-compression codes, hex-dec chart, control code cross-reference, assembler instructions commands and operators, screen line layout, editor commands & subcommands, condition code easy access
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Designed as a fold-up, accordion-style card, fits in your pocket. Panels organized for optimum speed for reference.
Model I: BASIC only FC1001 $2.95
Model I: BASIC and Assembler FC1002 $4.95

NEW!

DOS RANDOM ACCESS & BASIC FILE HANDLING—By H.J. Muller. This book was written for the nonprogrammer. It is ideal for the businessman or professional who needs to solve and write special programs for in-house business problems, or the hobbyist who wants to go beyond the cassette recorder and into disk storage and file manipulation. It is written as a self-instruction tutorial and will provide anyone with some Level II experience with the ability to write special programs for inventories, mailing list, work scheduling, record keeping, research project data manipulation, etc. 150 pages. BK1236 $24.50

NEW! FOR THE MODEL III

MOD II ROM COMMENTED—Soft-Sector marketing, 1981. This book is not an instruction course on machine language, but rather an information source that you can use time and time again for writing your own program or patching old Mod I machine language programs. It contains an explanation of ROMs in the latest machine from Tandy, with must every location of the 14K ROMs listed, with comments. BK1235 $22.50.

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Nanos System Reference Card
(as described above)
Model III: BASIC FC1004 $3.95
Model III: BASIC and Assembler FC1003 $5.95

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April 2-4, 1982
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available for the Model I, 48K, with at least two five-inch disk drives.

Wildcat is priced at $39.95 and is available from Donald M. Fielding, 2207 NW 61 Place, Margate, FL 33063, (305) 972-6744.

Reader Service ✓553

Stiff Upper Lisp

An improved version of Lisp is now being marketed.

Stiff Upper Lisp offers an interactive computing environment with more than 120 compiled functions in less than 14K bytes. Lisp functions and data have the same form so that one function can analyze another.

Additional features include a library of functions written and callable as needed, symbolic debugging aids, an editor written in Lisp that can be customized, an online help facility, a printer formatter, and a spelling correction function.

For more information contact Lifeboat Associates, 1651 Third Ave., New York, NY 10028, (212) 860-0300.

Reader Service ✓554

Entire Game System

The Adventure System was designed to provide a standardized adventure format to replace those currently on the market and allow authors the capability to design original adventures limited only by their hardware. In addition, the Adventure System provides end users the criteria to evaluate new adventures as they appear.

The system consists of an adventure editor, a driver program to execute data bases created by the editor, and two complete adventures written by the author. It is available for the Model I and III disk system with 48K from The Alternate Source, 1806 Ada, Lansing, MI 48910, (517) 487-3358. The package is priced at $39.95.

Reader Service ✓555

Data Ace For the Model II

Data Ace combines a Data Base Management and Operating System, a conversational Data Definition Language (DDL), an Interactive Query Language (DIL), Block Structures programming language for easy development (DML), and a full screen text editor to create and maintain programs and procedures. The combination of these features enable the user to automate a business rapidly to the exact requirements needed.

This system runs on the Model II with 64K, an expansion box, at least one drive and a printer. The price of the system is $1350. The package includes a formatted disk, a demonstration disk, a two systems disk (for each use), and both volumes of the users guide.

For additional information contact The Aragon Group Inc., 1904 Wright Circle, Anaheim, CA 92806, (714) 634-9012.

Reader Service ✓556

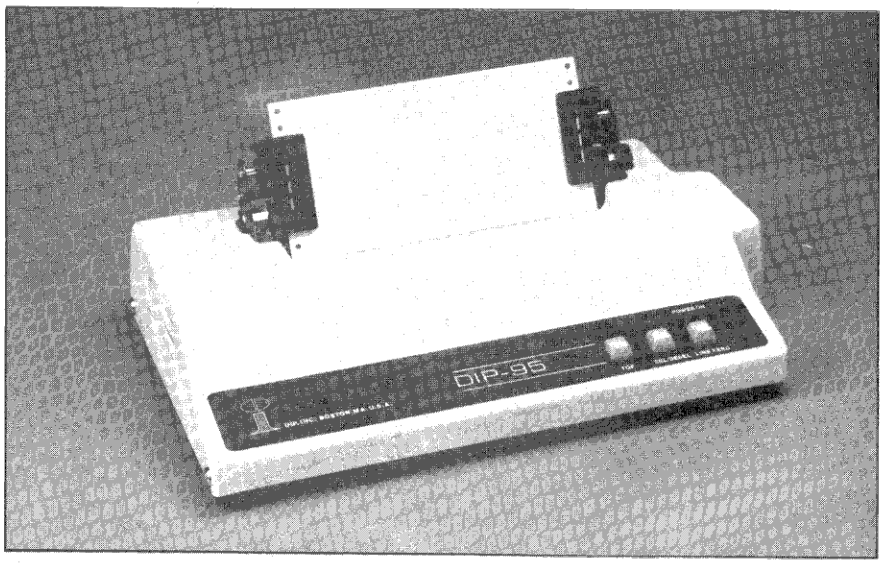
Data Ace

New Dip Printer

The Dip-95 is a nine-wire impact printer with switch-selectable, dual-mode capacity.

The data processing mode uses a nine by nine matrix font while the correspondence mode uses an 11 by nine font. Some of the features offered are: six different character sizes, one or two pass printing, bidirectional printing, tractor and friction feed, continuous loop ribbon cartridge, variable line density, continuous form length control, and telecommunications capabilities.

Its dot-addressable graphic capabilities can provide plotting, drawing illustra-



The Dip-95 Printer.

tions, printing CRT screen graphics, and special effect symbols.

The Dip-95 is priced at $929 from Dip Inc., 745 Atlantic Ave., Boston, MA 02111, (617) 482-4214.

Reader Service ✓557

Automated Electronic Mail System

The Automated Electronic Mail System, geared towards the commercial software user, allows point-to-point document communications. The system consists of two programs.

The first, an auto answer (data collection) system, features unattended reception of ASCII files with automated error handling and optional logging of files received.

The sending system features auto dial and spooled output of up to 64 files. The system allows the user to set the time one wishes the output to begin. Once set for output, the user can walk away. All error handling and output is done by the system.

The answering system can accept data from any computer equipped with a Bell 103 compatible modem. However, with an MSB unit, verification and re-send on error of data is accomplished at an effective baud rate of 275.

Available for the Model I and III, the receiving system is priced at $1300, including modem and connecting cable. Price of the sending system is $500. Options are available for an additional cost. For more detailed information contact MSB Consulting, 170-15 Highland Ave., Jamaica Estates, NY 11432, (212) 526-0825.

Agricultural Software

The Farm P&L Software package is designed for the commercial agricultural producer who uses a cash accounting system.

The system files and accumulates coded expenses and income. From this coded data a 10-page profit and loss statement/management report is generated.

Information included on this report is: detailed and total income and expenses for the month and to date, a breakdown of expenditures to date, detailed listing of all loans payable and all payments made to date, and much more.

This software is customized to the customer's operation and available for the Model I, II, III, and the Pocket Computer. Prices depend on the customizing. Contact Summerville Enterprises, Agri-Computer Services, 104 Broad St., S.E. Aliceville, AL 35442, (205) 373-6383.

Reader Service ✓558

Power Line Monitor

The Inmac Power Line Monitor is a device that monitors the power sent to computers and other sensitive equipment, using standard 120 Vac.

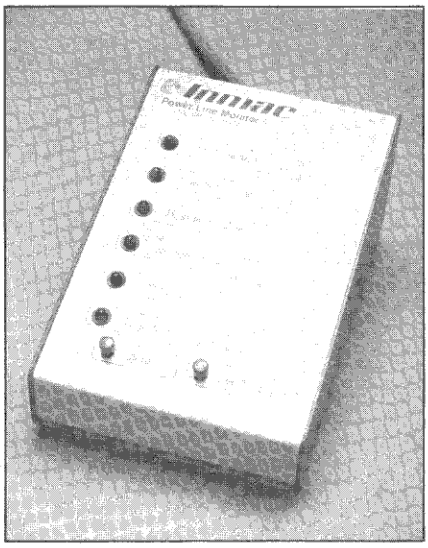
The Monitor differentiates six different types of problems: power failure, low or high line voltage, voltage spike or drop, and high frequency noise. The system enables the user to determine whether a shutdown is due to a faulty system or a power problem, and includes a troubleshooting guide to facilitate user repairs.

The cost of this product is $295. For information contact Inmac Corporation, 2465 Augustine Drive, Santa Clara, CA 95051.

Reader Service ✓559

Bad-Check Summary

The Automated Bad-Check Summary is a program designed for the Model I owner. It is a computer-managed business service package which lets you provide a bad-check service to the retail businesses in your area to make money.



The Inmac Power Line Monitor.

By gathering bad-check information from merchants, the user forms a cumulative list that is constantly revised. The bad-check summary generated by the program consists of the bank number, the person's account number, amount of check, date written, and the reporting subscribing merchant.

The summary is available on disk for $99.95 from ABS Suppliers, Box 8297, 3352 Chelsea Circle, Ann Arbor, MI 48104, (313) 971-1404.

Reader Service ✓560

E. E. Ladder

The Electrical Engineering Ladder Network Analysis Program, known as E. E. Ladder, is designed for the Electronics designer.

The program calculates either the transmission coefficient or the insertion loss magnitude, along with the phase angle of the user's design, allowing modification of the design to fit the response of the actual network. These functions are calculated over any desired frequency range and are plotted on the video display or line printer. The circuit reflection coefficients and driving point impedances are also calculated over the frequency range selected.

E. E. Ladder can be used in the design of matching networks, filters, terminators, crossover networks, and other passive element designs which are frequency dependent.

Disks can be purchased for $59.95, tapes for $54.95 for the Model I and III. Both are available from Advanced Operating Systems, 450 St. John Road, Michigan City, IN 46360, (219) 879-4693.

Reader Service ✓561

Search and Sort

Search and Sort (SNS) is a collection of fast machine language routines which may be called from Basic. The package sorts strings, integers, single and double precision numbers in either ascending or descending order. It also does a lightning quick search of an already sorted list of strings for a given string, and optionally inserts a string in the proper place to retain sorted order.

SNS is available on cassette for $11.95 or on disk for $13.95. Both disk and cassette include the 16K, 32K and 48K ver-

✓See List of Advertisers on page 402

sions as well as a Basic test program which demonstrates the use and features of the collection. For more information, write Micro Pro Systems, Route 2 Box 533, Cumming, GA 30130, (404) 887-6814.

Reader Service ✓562

Data Processing Directory

DP Directory, a new data processing reference magazine, publishes the tables of contents of over 100 Data Processing periodicals each month. The Directory covers many data processing magazines dealing with hardware, software, systems development, telecommunications, graphics, word processing and personal computing.

Twelve monthly issues are available for $48 from DP Directory, Box 562, Bloomfield, CT 06002.

Reader Service ✓563

Two New Word Games

Two new word games are available for the Model I and III; both emulate such popular games as Scrabble and Boggle.

Wordwiz pits two players against each other using the computer as a scorekeeper. The object of the game is to make as many legitimate words as possible from an array of 25 letters.

The object of the second game, Sentenceer, is to form as many sentences as possible from an array of 24 words. Again the computer acts as a record and scorekeeper.

Both games are priced at $9.95 and are available from Shirley Software, Box 417, Old Greenwich, CT 06870.

Reader Service ✓564

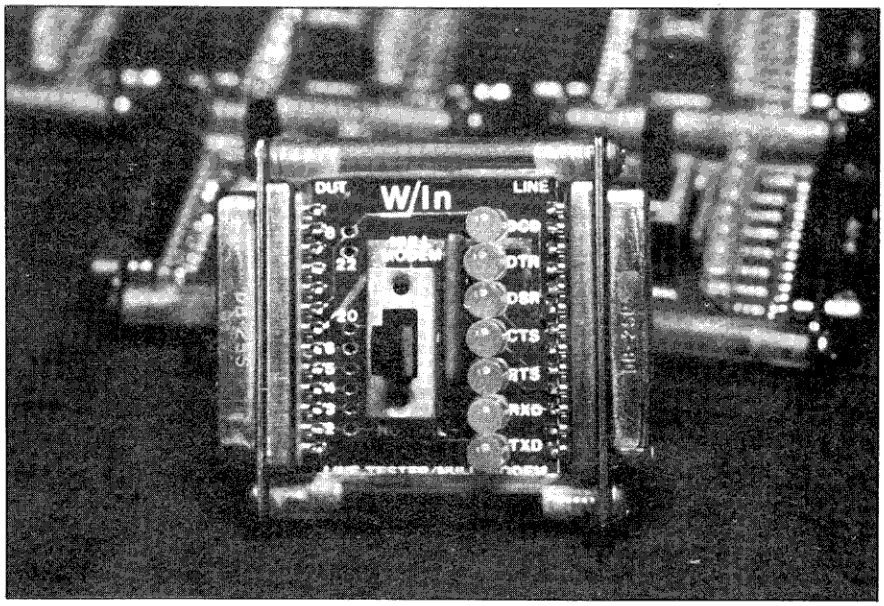
Abstract Strategy Game

Richochet is a game of strategy combining fast action and arcade-style graphics.

The player maneuvers blocks to set up a shot at the opponent's goal while protecting his own goal from attack. Each player has two launchers he can fire against one of four different computer opponents or a human.

Richochet is available for the Model I and Model III on disk and cassette from Automated Simulations, Box 4247, Mountain View, CA 94040, (415) 964-8021. It is priced at $19.95.

Reader Service ✓565



The W-DLT Data Line Tester.

Data Line Tester

The W-DLT, a portable data line test device, identifies the seven most-used RS232 data lines and shows likely causes of problems.

In addition, by the flip of a switch the W-DLT becomes a null modem used to interconnect terminals, modems, or computers without having to reconnect any cables. This lets standard devices communicate with each other with one standard cable.

This data line tester is available for $59.95 from Warren Instrotech LTD., Box 4500, Ogdensburg, NY 13669.

Reader Service ✓566

Estate Planning Software

Estax 81 is estate planning software for the Models I, II and III.

Written by an estate planning attorney for use in a law office, accountant's office, life insurance agency or bank trust department, "Estax 81" projects estate taxes for a husband and wife under the Economic Recovery Tax Act of 1981 for 8 different marital deduction arrangements, completing all computations in less than 60 seconds.

At least one disk drive, TRSDOS and 48-64K are required. Priced at $295, this software is available from Professional Data Corporation, 6449 Goldbranch Road, Columbia, SC 29206.

Reader Service ✓567

APL for the Model II

TIS-APL is now available in three versions for the Model II in kit form.

The kit consists of an APL interpreter on disk, APL keycaps, and an APL character generator. Version I, for educators ($295), contains all the primitive APL features. The second version, for software development ($495), includes all APL primitives plus all file handling and editing features. The third version, for full software support and development ($1195), contains the versions of the second with the added support of receiving future updates and enhancements at no added cost. The package includes complete access to Telecompute's user inquiry telephone number.

For further information contact Telecompute Integrated Systems Inc., 251 Spadina Ave., Toronto, Ontario. Canada M5T 2E2.

Reader Service ✓568

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For TRS-80® Model-I or III with 48K RAM and 2 Disk Drives. (3 Disk for Model-I) *"Native code"* driver (parallel and RS-232) for Autologic APS-5* & Micro-5 Phototypesetters. Full screen editing and 100, FDP compatible markup codes, allowing 200 User Defined, disk resident, Formats. Algorithmic Hyphenation with 500 word expandable *exception* dictionary and maintenance program assures correct word breaks. Optional line printer proofing for context, line-breaks, and hyphenation.

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✓361

COGNIVOX VIO-332. The affordable voice I/O peripheral for the TRS-80

See Review in December 81 issue of 80 MICROCOMPUTING

If you have a TRS-80 model I, level II with at least 16K of RAM, COGNIVOX VIO-332 will add a whole new dimension to your computer.

Imagine being able to use your voice for entry of commands and data and then listen to the computer talk back to you! This exciting possibility has now become a reality at a very affordable price.

COGNIVOX can be trained to recognize words or short phrases from a vocabulary of up to 32 entries of your choice. To train COGNIVOX to recognize a word, you simply repeat the word three times under the prompting of the system. The voice output vocabulary can have up to 32 entries chosen by the user.

COGNIVOX comes complete with microphone, power supply, built-in speaker/amplifier, cassette with software and extensive user manual. It plugs into the expansion port of the keyboard or in the expansion interface via a standard 40-pin flat cable with connectors on both ends (not included - $19 extra).

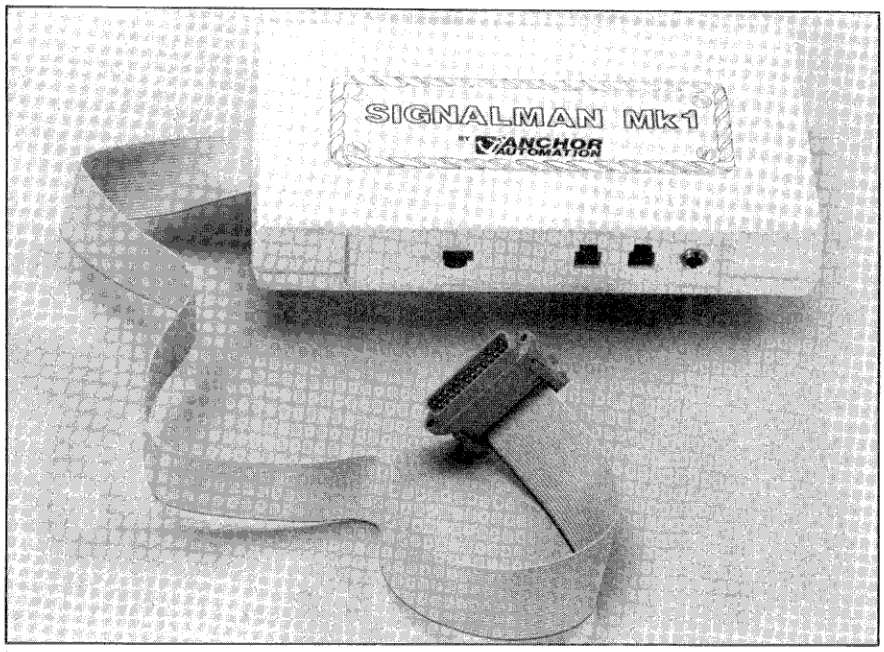
Software provided with the unit includes demonstration programs, two voice operated games and programs that play music. It is also very easy to add voice I/O to your own programs. A simple statement in BASIC is all that is needed to either recognize or say a word.

Use COGNIVOX for data entry when hands or eyes are busy, as an educational tool, a sound effects generator, an aid to the handicapped, or as a super toy. Use it with the Radio Shack power controller (#26-1182) to control by voice appliances and lights in your home. The list is endless.

COGNIVOX costs only $149 (plus $4.50 shipping in the US, foreign add $15 for air shipment, CA add 6% tax.) The 40-pin flat cable jumper is $19 extra. To order send a check by mail or call us at (805) 685-1854, 9AM to 5PM M-F and charge it to your VISA or MASTERCARD. COGNIVOX is backed by a 120-day warranty against manufacturing defects.

VOICETEK P.O. Box 388, Goleta, CA 93116

✓See List of Advertisers on page 402



The Signalman MK1 Modem

Compact, Low cost Modem

The Signalman MKI is a Bell 103 compatible, completely portable modem.

The Signalman interfaces to any RS-232 port with a built in RS-232C cable. Its small physical size allows users to mount it in out-of-the-way spots with its velcro fasteners. A tone-audible carrier detect circuit replaces flashing LEDs as confirmation of standard phone line connections for both voice and data.

Priced at $129, the modem also includes automatic mode selection (originate/answer) and a talk data switch. For more information contact Anchor Automation Inc., 16130 Valerio St., Van Nuys, CA 91406, (213) 997-6493.

Reader Service ✓569

The Formula

The Formula is a software package incorporating the characteristics of a data base manager, a word processor, and a compiler language along with a general accounting system. It is intended to be a flexible system generator for business and other applications.

The Formula permits complete application development through the process of defining what should go into files, steps the job-stream should take in processing, and report format. The system also provides a complete general accounting system including general ledger, accounts receivable, and accounts payable. Also included is a Basic full screen editor. Label printing and a professional time accounting system are options.

The cost of the Formula software is $595. For information contact Dynamic Microprocessor Associates Inc., 545 Fifth Ave., New York, NY 10017, (212) 687-7115. The Formula runs on CP/M.

Reader Service ✓570

Software Enhancements

A Software Enhancements/Documentation package is now available for Radio Shack's Disk Payroll System for Models I and III.

This software uses machine language sorts and features perfectly aligned vertical spacing and form tops on any 80-column, or wider, printer. It also allows you to make changes to employee data without reprinting the entire screen.

All changes to your Radio Shack disks are made under program control so programming skills are not needed. This Enhancement/Documentation package is priced at $39 and is available from Microcomputer Applications, 3485 Mock Orange Court South, Salem, OR 97302, (503) 364-1090.

Reader Service ✓571

Cave Hunting for Treasure

Cave Hunter is a game for the 16K Color Computer using high resolution graphics, color, and sound.

Your objective is to maneuver your way through a cave in search of the valuable treasures which lie there. As the passageways weave in all directions, angry cave creatures relentlessly pursue you.

Priced at $24.95, Cave Hunter is available from Mark Data Products, 23802 Barquilla, Mission Viejo, CA 92691, (714) 768-1551.

Reader Service ✓572

The Electronic Breadboard

A new computer-aided design program, the Electronic Breadboard, helps electronics technicians, engineers and experimenters to evaluate voltages, currents, impedence and frequency responses without a lot of guesswork.

The program simulates the effect of the addition or removal of components, calculates point impedance, analyzes the frequency response of a circuit, and allows circuit designs to be saved on tape or disk.

Available for the Model I, Level II, 16K and Model III, 16K for $49.95. Contact Instant Software Inc., Peterborough, NH 03458, (603) 924-9471 for more information.

Reader Service ✓573

Cassette Business Package

CBP is a cassette business package for the Model I and III with 16K. It consists of the following programs: a cassette data base manager, a word processor, an inventory control system, a stock management program, a check balancing program, a label printer, a deposit calculator, a statistics program, a sort utility, and a key access utility.

CBP is priced at $59 and is available from The Micro Architect Inc., 96 Dothan St., Arlington, MA 02174, (617) 643-4713.

Reader Service ✓574

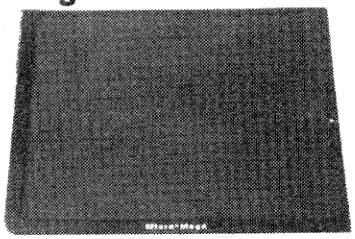
Enhanced Hexspell

Hexspell 2 is a spelling checker for the Models I or III with two disk drives and 48K.

It features one step error detection and

for the TRS-80 from Micro-Mega

The Original GREEN-SCREEN



The eye-pleasing Green-Screen fits over the front of your TRS-80 Video Display and gives you improved contrast with reduced glare. You get bright luminous green characters and graphics like those featured by more expensive CRT units.

Don't confuse the Original Green-Screen with a piece of thin film stuck to the face of your video tube, such as that advertised by others. The Original Green-Screen is mounted in a full frame perfectly matched to the color and texture of the TRS-80 Video Display. It is attached with adhesive strips which do not mar your unit in any way.

The full frame design of the Original Green-Screen "squares off" the face of your video display and greatly improves the overall appearance of your system.

(Specify whether for Model I or Model III)

THE GREEN-SCREEN.....*$13.95*

Add $1.50 for postage and handling.

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A vastly improved version of the original TOUT horse race handicapper. Now, thousands of races are simulated in seconds to give you each horse's probability of winning and identify overlays. Horses are screened using factors derived from an operations research study. This handicapper outperforms programs and calculators selling for much more.

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Jacks or better to open with a joker that can be used as an ace or in straights or flushes (Gardenia CA rules). You play against six computer-controlled opponents. This program has true artificial intelligence capabilities. DRAW5 was developed originally by Real World Simulations. After three years of refining, it's now available for the TRS-80. It will provide hours of fun, challenge and education. Now 30% faster.

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TOUT3 and DRAW5 supplied on 500 baud cassette. Add $4.00 for Model I or III diskette. All programs available on 8" disk for Model II at $6.00 additional. PA residents add 6% sales tax. North Star diskette version of DRAW5 can be obtained from Real World Simulations, Box 4107, Torrance, CA 90510.

TRS-80 is a Tandy Corporation trademark.

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- Accounts Payable 400 accts, 1000 transactions/month, and 99 department codes. $199.95
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Model II
- Available for floppy or hard disk. Capacitites below are for 2 floppy drive systems.
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- Accounts Payable 2000 accts, 5000 transactions/month, and 99 departmental codes $499.00
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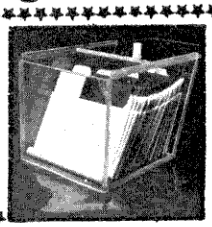

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correction. Erroneous words are highlighted in full context when detected, and can be immediately replaced. The replacement word itself is immediately checked for correctness.

In addition to dictionary words, Hexspell 2 checks complete texts including codes, formulae and numbers common in many commercial and technical documents.

For more detailed information contact Hexagon Systems, Box 397, Station A, Vancouver, BC. Canada V6C 2N2, (604) 682-7646. It is priced at $99.

Reader Service ✓582

Software For Physicians

MOS-2 Software gives Physicians in groups of up to ten the ability to organize information on 15,000 patients by name and procedure and to file transactions on both daily and monthly bases.

Among the features available are insurance form processing, recall capability, morbidity indexing, diagnosis and procedure statistics, aged receivables and patient account status. Options include a referral file to keep track of referring doctors, and word processing to send customized letters.

The system is designed for the Model II. A demonstration disk is available for $99. The full system is priced at $499. Contact Windham Software Inc., 29-31 Ivanhill St., Willamantic, CT 06226.

Reader Service ✓592

Winchester Disk Storage Subsystem

The MSC 9700 Subsystem combines the Seagate Technology ST-506 5.25-inch Winchester disk drive, the Xebec S1410 controller, and a 115V/230V power supply.

Its features include: 22-bit error detection, 11-bit error correction, a full sector data buffer, and single command disk initialization. A one or two-drive version of the subsystem is available for either five or 10-megabytes of on-line storage capacity.

Through the use of interchangeable host adapter personality cards, the subsystem can be compatible with a variety of microcomputer systems.

The MSC 9700 is priced at under $3000, the Host adapters for under $200, from Microcomputer Systems Corporation, 432 Lakeside Drive, Sunnyvale, CA 94086, (408) 733-4200.

Reader Service ✓583

Expands Color Computer Memory

The 16 Plus Board expands the Color Computer's Memory from 16K to 32K.

The board does not require soldering, plugs in easily, and fits neatly under the RF shield cover. Its design allows the graphics display to reside anywhere within the 32K memory. No modifications are required for existing software.

The board costs $84.95 from Computerware, Box 668, 1472 Encinitas Blvd., Encinitas, CA 92024, (714) 436-3512.

Reader Service ✓584

Cookbook on a Disk

Dinner on a Disk, a completely automated cookbook, contains over 100 full screen "pages" of proven recipes.

Published directly on a five-inch disk, this cookbook requires no technical training or knowledge.

The disk is available for TRS-80 Models for $14.95 from The Computerized Shopper, 683 Towles, Palo Alto, CA 94306 (415) 856-7467

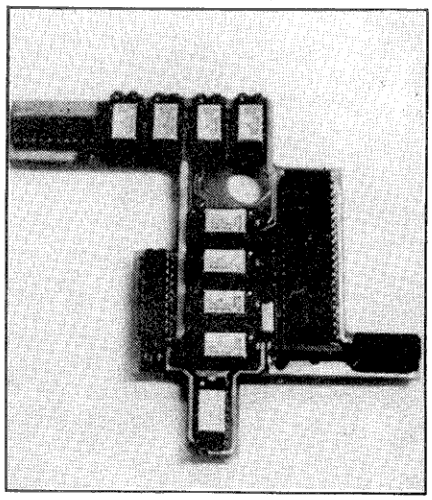
Reader Service ✓585

Speedup Enhancement

The 4MHz Speedup Enhancement doubles the processor speed of the MTI Mod III plus 140, 240 or 280 systems when used with the DOS plus operating system. The enhancement is software selectable.

The 4MHz speedup enhancement, Model #1414, sells for $149. A retrofit/installation is available for $50 for owners of Mod III plus or TRS-80 Model III owners. Contact Microcomputer Technology Inc., 3304 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 979-9925.

Reader Service ✓586



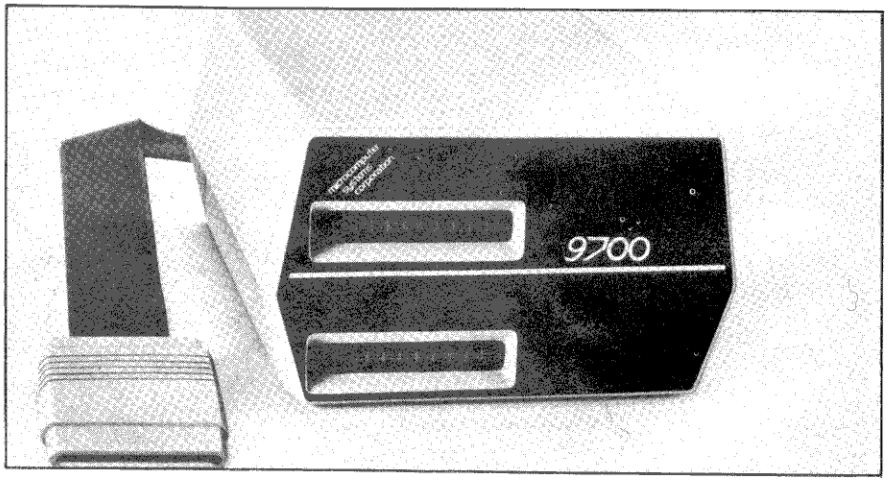
The 16 Plus Board.

Morse Code Tutorial

Code Class is a machine language Morse Code tutorial program for the Models I and III.

This program is interactive and presents a variety of formats, non-repetitive sequences, and user-adjustable speeds. It is available on disk for $39 and on cassette for $29. For additional information contact Macrotronics Inc., 1125 N. Golden State Blvd., Suite G, Turlock, CA 95380, (209) 667-2888.

Reader Service ✓587



The MSC 9700 Series.

An Index to Your Data Base

Newtrieve replaces Basic sequential searches with a machine language sequential search program.

When installed in a Basic program, Newtrieve locates key words to further access a data base. As an in-memory, recursive package, it has the ability to sequentially search an array of 500 40-character search string indexes quickly. Switches allow for Excluding, Divide Index, Single Search, in-memory changes, re-write of load module, and selectively browsing through the index.

Once a program has been established, either interactively or from an external data file, a load module may be created to facilitate start-up in less than 10 seconds. Additional indexes can be written and successively loaded and searched using the same or an alternate Basic program.

Newtrieve is available for $49.95 and is available from Unique Printing and Stationery Company Inc., 11 Maiden Lane, New York, NY 10038, (212) 732-2244.

Reader Service ✓575

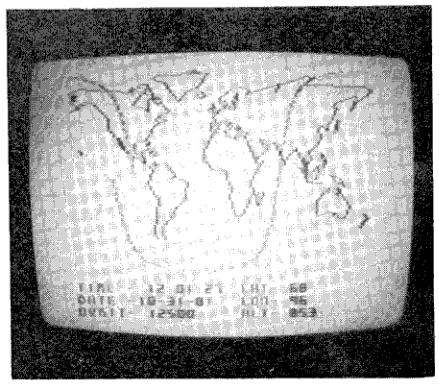
Introduction To Word Processing

Introduction to Word Processing explains in non-technical language what word processing is and how it can increase personal productivity.

This step-by-step guide provides a complete, comparative analysis of currently available equipment for anyone considering buying a system.

Contact Sybex, 2344 Sixth St, Berkely, CA 94710, (415) 848-8233 for information. The book is priced at $12.95.

Reader Service ✓576



The Orbitrak Screen Display.

Taxpro

Taxpro enables the user to compute the most profitable way of completing tax returns. All popular tax forms are available, as well as many of the more complicated ones.

Available for the Model I and III, Taxpro is priced at $149.95 for the first edition, and $60 for each yearly revised edition. For information contact Videotronics, 4086 Honolulu Dr., Sarasota, FL 33583, (813) 371-7255.

Reader Service ✓577

Satellite tracking With the Color Computer

Orbitrak is a real-time satellite tracking program for the Color Computer. The program displays a map of the world and plots the ground track of the satellite as its orbit progresses.

Of special interest to ham radio operators for use in tracking the Oscar satellites, Orbitrak also tracks the space shuttle or other objects in the earth's orbit.

The program requires a 16K Color Computer. It is distributed on cassette for $14.95 from California Information Company (CALICO), Box 462, Torrance, CA 90508, (714) 828-5429.

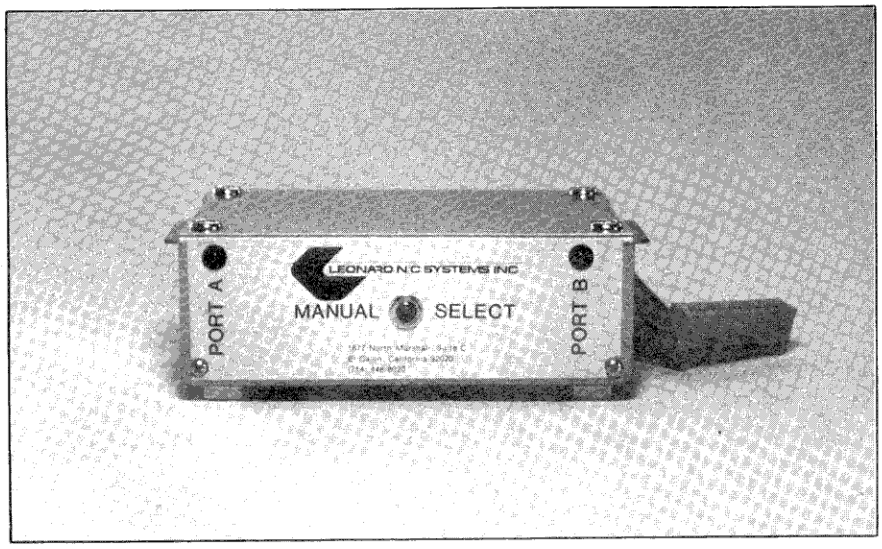
Reader Service ✓578

Pilot Directional Finder

Economical navigational program enables you to locate your position, distance to destination, heading to destination, I D's and their altitudes, and recalculates your position, distances and headings as radials change. The program is compact, portable and pocket size, no installation is necessary. Navigational Systems are available for the entire U.S. (except Hawaii & Alaska). Three adjacent states per cassette tape program are provided.

This system may be used on a TRS-80 or Sharp PC-1211 Pocket computer and printer interface with any tape cassette recorder with ear and remote hook-up. Contact PDF, 4388 Alpine Road, Portola Valley, CA. 94025, for additional information.

Reader Service ✓579



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Self-Contained Switch Box

Ultraswitch is a self-contained switch box that allows for expansion of your single Centronics-style port to dual ports. This allows the user to activate a second peripheral device through software selection or the flip of a switch, eliminating constant plugging and unplugging of peripheral cables.

Fully buffered inputs and outputs shield against noise interference. Ultraswitch is software-selectable. Each port buffers and controls eight datalines, one data strobe, and two status lines.

Priced at $165, Ultraswitch is available from Leonard N/C Systems, 1677 North Marshall Road, Suite C, El Cajon, CA 92020, (714) 448-8020.

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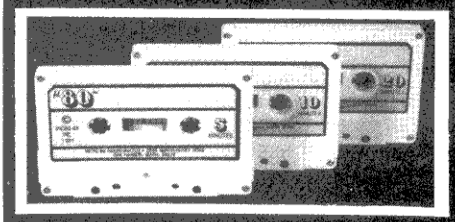

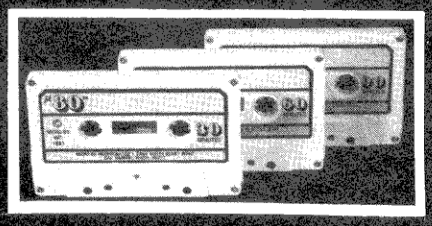

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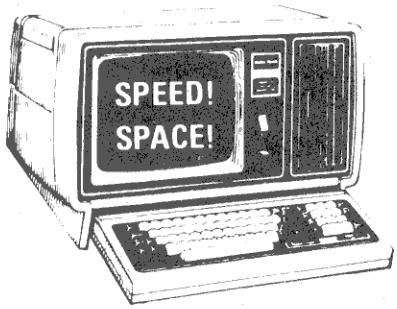

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ATON's unique JobStream™ CP/M 2.2, along with additional RAM memory; allows you to **simultaneously** compile, assemble, or link in one 64K background partition (62K TPA) while you edit files, **and** spool to the printer, **and** communicate with another computer in up to four 32K foreground partitions (28K TPA).

As you expand memory beyond 64K, you also enter the amazing world of TrackMode BIOS™ which not only **multiplies diskette speed** up to **five times**, but also automatically performs read after write checks for the ultimate in data reliability.

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NEW PRODUCTS

Book Covers Microprocessors

Introduction to Microprocessors: Experiments in Digital Technology is a guide to the use of integrated circuits.

The book's seven chapters contain 35 experiments encouraging the reader to construct electronics projects using integrated circuits. The use of microprocessors in microcomputers is stressed, with emphasis on construction, function and programming.

Priced at $10.95, the book is available from Hayden Book Company Inc., 50 Essex Street, Rochelle Park, NJ 07662, (800) 631-0856.

Reader Service ✓588

Video Glare Screens

Low-cost glare filters are now available for the Model I and III with a free home trial period.

The filters are four-layered optical filters, with two spectral responses. One is a neutral density filter (appearing grayish) and the other is a blue-green filter. The combination enhances contrast, even in brightly lit rooms, without greatly attenuating the image lines.

These filters are priced at $10 and are available from The National Institute for Rehabilitation Engineering, 97 Decker Road, Butler, NJ 07405, (201) 838-2500.

Reader Service ✓589

Air Combat Computer Games

Two new air combat computer games, Dawn Patrol and Chennault's Flying Tigers, are now being marketed.

Dawn Patrol deals with World War II, while Chennault's Flying Tigers covers the air war over China and the Pacific in 1937–1942. Both games feature real-time animated graphics.

In each game you fly a choice of a dozen or more fighter planes into combat against a computer-controlled force of opponents. Success or failure depends upon your ability to learn and exploit the advantages and weaknesses of every aircraft.

These games are available for the Model I, Level II and Model III machines on a 16K machine language cassette from Discovery Games, 936 W. Highway 36, St. Paul, MN 55113.

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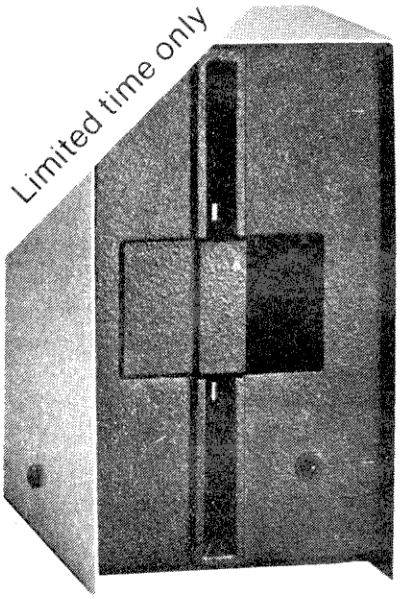

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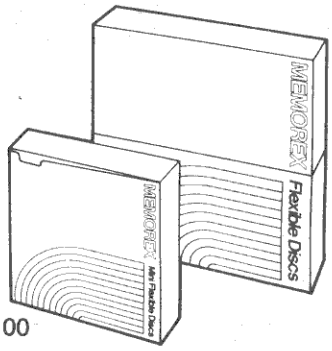

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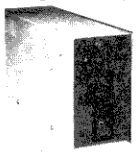

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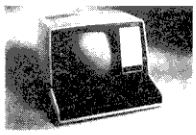

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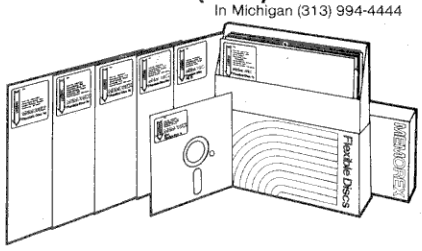

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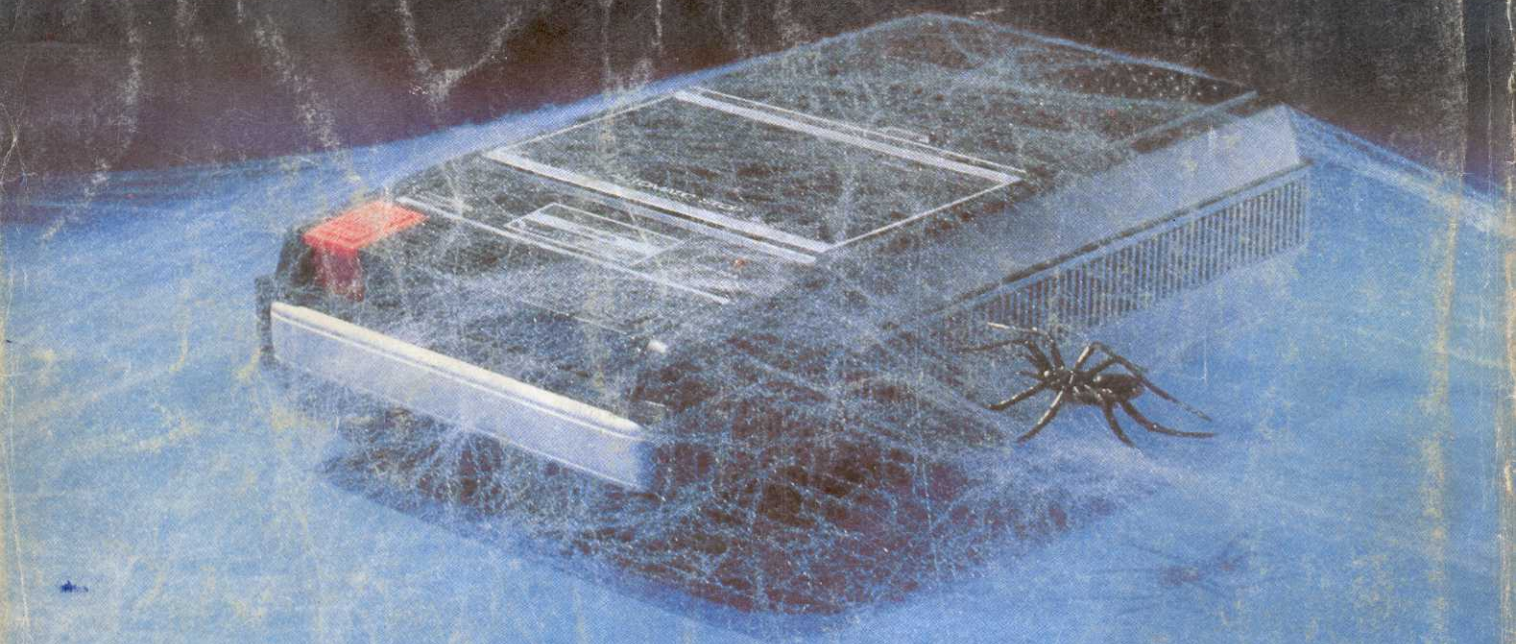

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