

The Model 2000: A Better Breed of Basic

July 1984 USA \$4.00  
Canada \$4.50

# 80micro

A CWC/I PUBLICATION

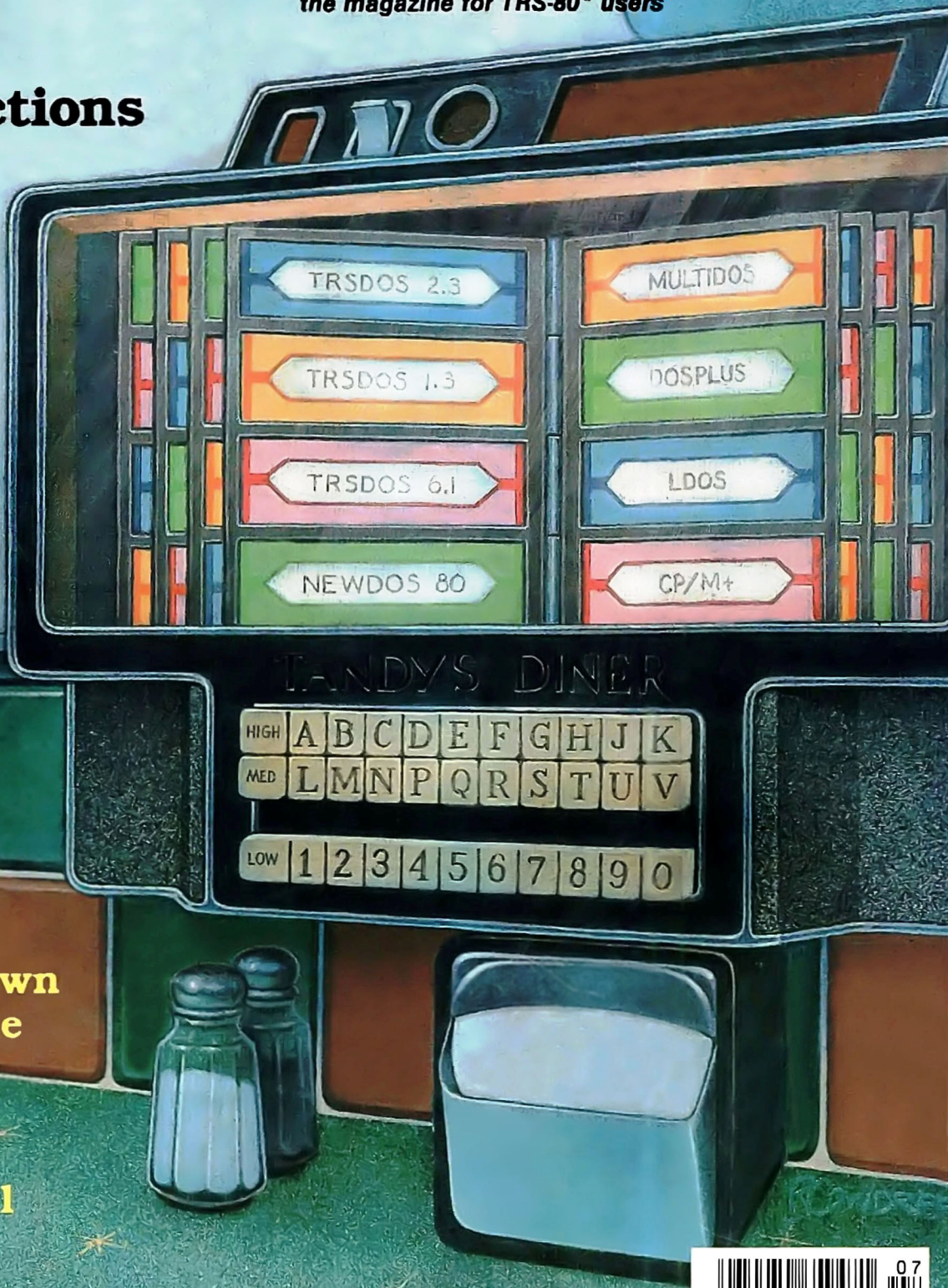
the magazine for TRS-80\* users

80micro

7/84

## DOS Selections

### Big Hits and Near Misses



**No Comment:  
Trimming Down  
Your A-L Code**

**A Hill of Beans:  
How to Be a  
Market Mogul**

**The Jet Set:  
A Look at H-P's  
Think Jet Printer**

#54

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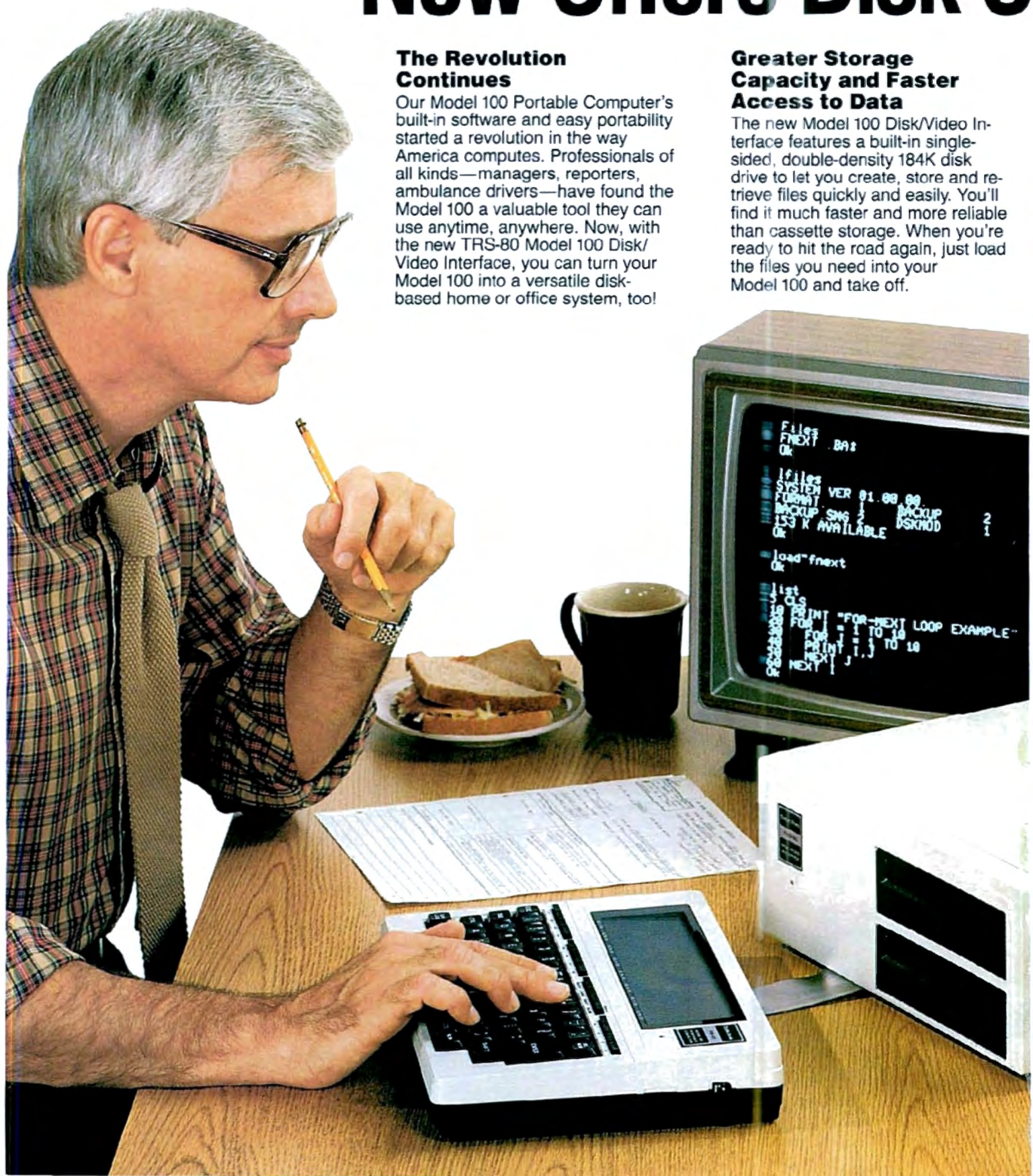
# Radio Shack's TRS-80 Now Offers Disk S

## The Revolution Continues

Our Model 100 Portable Computer's built-in software and easy portability started a revolution in the way America computes. Professionals of all kinds—managers, reporters, ambulance drivers—have found the Model 100 a valuable tool they can use anytime, anywhere. Now, with the new TRS-80 Model 100 Disk/Video Interface, you can turn your Model 100 into a versatile disk-based home or office system, too!

## Greater Storage Capacity and Faster Access to Data

The new Model 100 Disk/Video Interface features a built-in single-sided, double-density 184K disk drive to let you create, store and retrieve files quickly and easily. You'll find it much faster and more reliable than cassette storage. When you're ready to hit the road again, just load the files you need into your Model 100 and take off.



```
FILES FNEXT BA:
OK

FILES
SYSTEM VER 01.00.00
FORMAT
BACKUP SWG 3 BACKUP 2
153 K AVAILABLE DSKNO 1
OK

load fnext
OK

list
CLS
PRINT "FOR-NEXT LOOP EXAMPLE"
FOR I = 1 TO 10
PRINT I, I TO 10
NEXT I
NEXT J
```

# Model 100 Computer Storage and Video!

## Attaches Easily to Any Television

The Disk/Video Interface also lets you enjoy a big 40-character by 25-line screen display on any TV. The larger screen is perfect for writing notes and reports or developing your own programs in BASIC. When accessing data by phone, you can read a full 25 lines of information without scrolling. And you can utilize all of Model 100's graphics characters.

## No Computer Wizardry Required

It couldn't be easier to use. Just plug the Disk/Video Interface into an AC outlet, connect your TV and a Model 100 with a minimum of 16K—all cables are included. One simple command switches all the output to the video screen. There's no new operating system to learn, either—the command structure is exactly the same.

## Easily Expandable

You can add a second 184K disk drive (#26-3807, \$239.95\*) to the Disk/Video Interface for even more versatility. Best of all, the Disk/Video Interface doesn't use any of Model 100's standard connectors, so you can add a printer, bar code reader, RS-232C communications device or cassette recorder. You can make your Model 100 a high-performance desktop system.



## Get Down to Business With an 80-Column Display

### A Compact Office System

The Disk/Video Interface can turn your Model 100 into a professional desktop system for the office, too. With any standard video monitor, you get a large 80-character by 25-line display that's equal to other desktop computers. You'll also get the rapid access to files and storage reliability that are so necessary in today's business world.

### Perfect "Second System"

A disk-based Model 100 system is an economical alternative to a second office computer. And you'll still have the advantage of portability when you need it.

### Come In Today

The TRS-80 Disk/Video Interface, along with our complete line of Model 100 accessories, is available coast to coast.

Available at over 1100 Radio Shack Computer Centers and at participating Radio Shack stores and dealers

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**79900**

26-3806

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\*Installation not included. Prices apply at participating Radio Shack stores and dealers. TRS-80 Model 100, Disk/Video Interface and TV sold separately. CitILine is a service mark of Citicorp.

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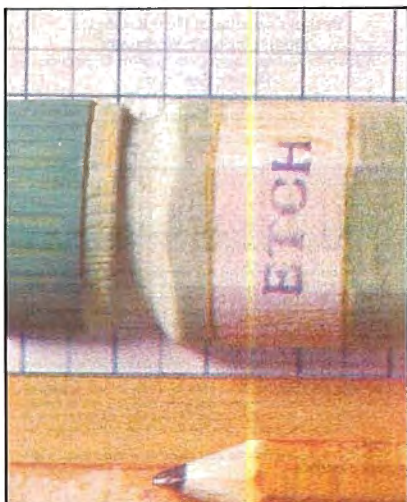
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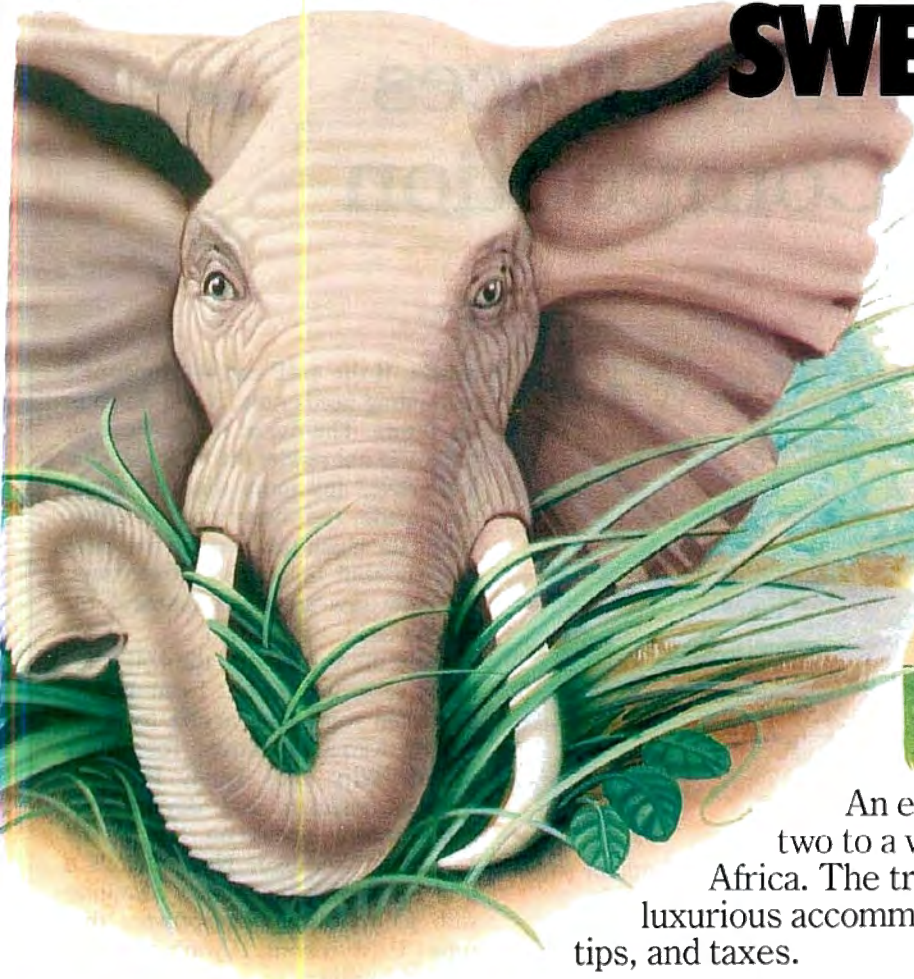
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80 formats its program listings to run 84 characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

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**ELEPHANT NEVER FORGETS**

# The 4/4P Faces The Competition

**C**oncern for the fate of the 4/4P seeps out at the seams of CompuServe's message boards like a slow leak in an old rowboat. The same questions repeatedly arise: Can the 4/4P survive the rising popularity of 16-bit machines? What will Tandy's place in the market be a year or two from now?

Make no mistake about it: There's a change in the air. But it's not necessarily bad, and does not irrevocably doom the 4/4P to an early grave.

## The 16-Bit Threat

Picture this scenario: Over the next year or so, the prices on the Models 4 and 4P drop several hundred dollars, perhaps more, with further price reductions on the way. The Model 4 continues to sell well, particularly to small businesses, secondary schools, and colleges. The 4P, too, finds a market, and quietly fights it out with the Kaypro for leadership among the 8-bit transportables.

On the high end of Tandy's line, the 2000 survives a jittery start and does respectably well. While Tandy sells a few units to small businesses, most go to large corporations as management tools and as parts of local area networks. Questions about software compatibility are resolved as Tandy markets an increasing number of third-party products and other manufacturers adapt their MS-DOS packages for the 2000.

Both machines find niches. But every silver lining has a cloud. As the gap between the 4/4P and the 2000 widens, Tandy is faced with a dilemma. What machine does it have for the midrange market traditionally served by the 4/4P?

The answer is obvious. Tandy must come out with a \$1,500, IBM/2000-compatible 16-bit machine. My guess is that Tandy recognizes the need, and



that we'll see such a computer sometime in the next six months.

Don't expect anything as charismatic as the Macintosh. Tandy has never put much stock in flash. Even the 2000, despite its 80186 microprocessor, is nothing revolutionary, relying instead on proven technology. What we can expect is another lunchbucket machine, a workhorse designed to get a job done rather than showcase electronic achievements.

What's the significance of this new machine? As Bob Dylan once said, you don't need a weatherman to know which way the wind blows. The announcement will commit Fort Worth to a future in 16 bits and MS-DOS. With the 2000 as its anchor, Tandy's line will most likely expand to embrace the IBM standard.

## Technological Imperative?

But back to my original topic: the fate of the 4/4P. At first glance, you might conclude that the 16-bit machines will stomp the hoary old Z80 into the ground. In fact, some people already state so as if the 4/4P were the helpless victim of a technological imperative. I don't buy it, for one simple

reason. If the 4/4P can fill someone's computing needs now, it will do so in the future. The rise of the 16-bit computer will not render the 8-bit machine ineffective, any more than the chain saw made the bow saw obsolete. While the chain saw became the more efficient tool for cutting down trees, the bow saw remained practical for smaller tasks.

In the above scenario, the 4/4P continues to drop in price. I can see the day when you might be able to buy a system with two drives for under \$1,000. Why not? Tandy has covered its research and development costs—mostly spent on the Model I—a long time ago. Now, there's a deal for you: a time-tested computer with a ton of proven software that runs CP/M to boot. If you're running a small business, or need a computer for home use, why spend more money on a high-powered system whose potential you'll never need? The 4/4P will do the job, and it'll do the job well.

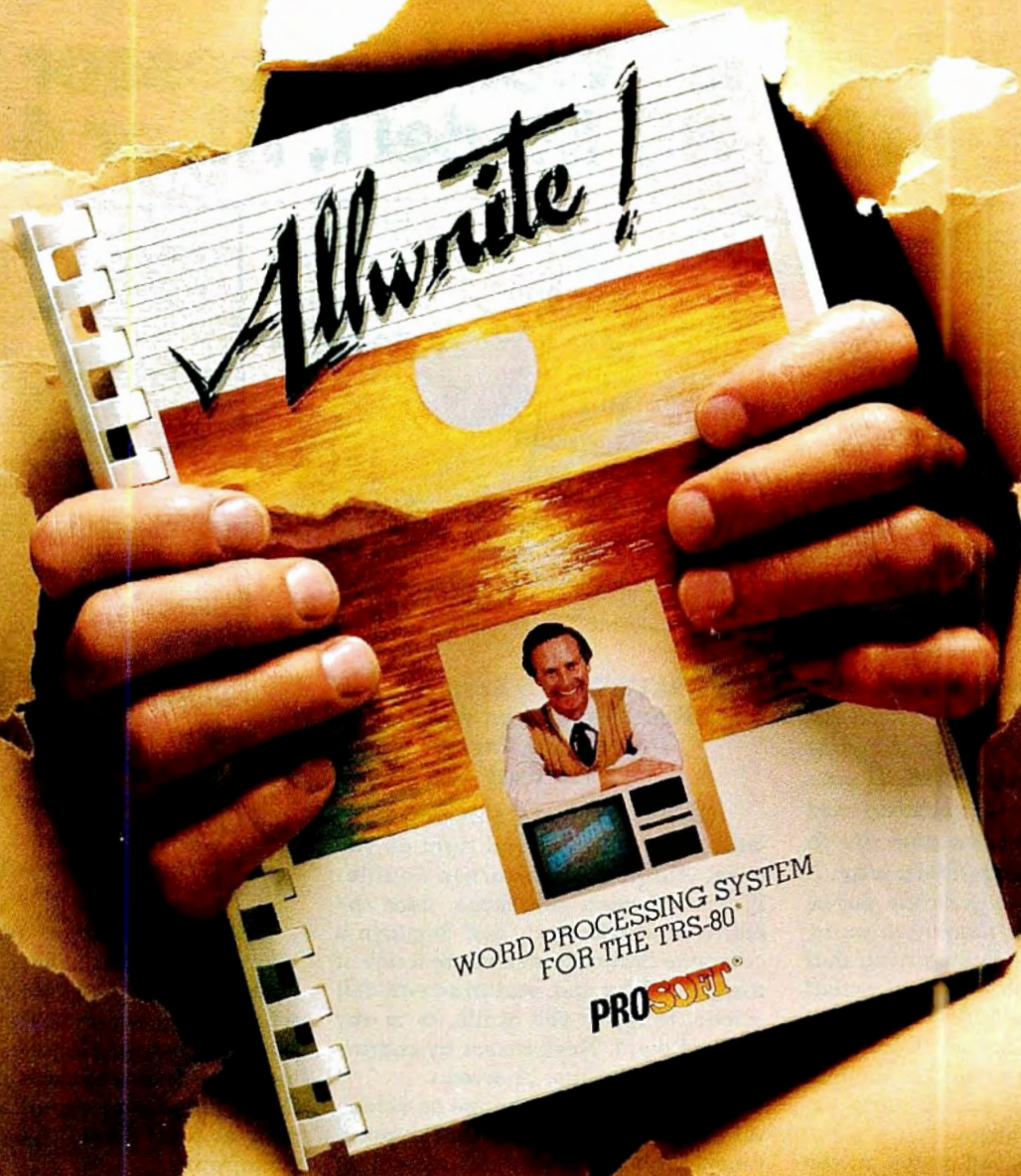
Continued life for the 4/4P is in no way guaranteed. Consumers could very well buy the myth that bigger means better, and turn exclusively to 16 bits. Software manufacturers could abandon the TRS-80 for the more lucrative Apple and IBM markets. Or Tandy could decide to drop the Z80 line entirely when it introduces its new machines.

I don't think so. Consumers are becoming wise to the enticements of manufacturers. The base of TRS-80 users remains large enough to attract and hold third-party suppliers. And Tandy would be foolish to simply discard a successful product until that product proves it is no longer viable.

The 4/4P isn't glamorous. It won't sell like the IBM or the Apple II. But it still has a lot of life, even as Tandy continues to drift into 16-bit waters. ■



# INTRODUCING...



## A Major Breakthrough in TRS-80. Word Processing

# ALLWRITE!

## The Premier Word Processor for Your TRS-80 Model I, III, or 4

The screenshots show the ALLWRITE software interface on a TRS-80. Key features visible include:

- RECOVERING TEXT AFTER A SYSTEM FAILURE:** A screen with instructions on how to recover text after a system failure, mentioning the use of the 'RECOVER' command.
- ADD-DISK:** A screen for adding a new disk to the system, showing a list of disks and their contents.
- FILE LISTING:** A screen displaying a list of files and folders on a disk, including file names and sizes.
- STATUS SCREEN:** A screen showing system status information, including the current file name, line number, and other details.
- ADVANCED FEATURES FOOTNOTES:** A screen showing the 'FOOTNOTES' feature, which allows for inserting footnotes into the text.

**W**e are proud to offer you the one Word Processor that will satisfy all your writing needs: ALLWRITE. It sets new standards for text editing and printing, and will give new life to your TRS-80. Let us tell you why...

In an attempt to push the public into expensive 16-bit computers, many manufacturers have been saying that the TRS-80 is obsolete. The truth is that the software, not the hardware, makes the difference. And the best word processor of all is now available only on the humble TRS-80, not on those expensive 16-bit machines!

ALLWRITE is based on the proven methods that made NEWSSCRIPT the most popular independently produced TRS-80 word processor, but it also has the speed and new features our customers have asked us for. ALLWRITE will save you time and let you produce the highest-quality, most professional-looking letters, term papers, and reports available on a micro-computer.

### Allwrite Can Save You Time!

Reads a 25,000 character file (10 printed pages) from disk in SIX SECONDS...does a global search-and-replace in FOUR SECONDS...outruns even the fastest popular micro-printer.

### ALLWRITE'S Screen Handling Makes Word Processing Easier Than Ever

Change text width at any time; wide lines shift left and right as you type. ALLWRITE preserves double-blanks between sentences, uses the entire screen for text, and displays a complete Status Screen at the touch of a key. Scroll by line, partial screen, full screen, to top or end of file, or to any marked point. Move cursor by character, word, tab, line, or screen.

You can set and change on-screen tabs and store them on disk. The print-time tabbing features are incredibly versatile: they allow left, right, and centered tabs, and even line up your decimal points.

ALLWRITE shows you where you forgot to turn off underlining, boldface, italics, or double-width. Special on-screen Preview feature shows page breaks and page layouts...including underlining and boldface...without annoying blinking or screen flicker. In "Summary" mode, ALLWRITE quickly flags formatting errors without

These were printed by ALLWRITE; shown 20% actual size.

wasting time printing all the text. These standard features make document preparation faster and easier than ever!

### State-Of-The-Art File Handling

There is no upper-limit on document size with ALLWRITE, because it chains files backwards as well as forwards, even across diskettes. Switch from one chained file to another in less than six seconds by pressing two keys. Select portions of other files for inclusion at print time...great for stock paragraphs.

ALLWRITE salvages text from bad disks! If a sector goes bad, you won't lose the entire file, because it will skip bad sectors, read the rest of the file,

### TAKES FULL ADVANTAGE OF YOUR MODEL 4.

The model 4 version of ALLWRITE uses the entire 80-by-24 screen. On a 64K machine, you can edit over 34,000 characters of text. On a 128K machine, you can edit THREE FILES AT THE SAME TIME! The second and third files can be over 32,600 characters each, for a total of almost 100,000 characters of text in memory.

and then show you where the lost text belongs. This advanced error recovery turns a disaster into a feeling of profound relief.

### User-Definable Soft Keys Reduce Typing Time

You can store 22 phrases or commands at a time into "soft-keys," then press just two keys to retrieve them. This makes frequently-used phrases and formatting controls a snap to use. You can store these definitions on disk and build a library of hundreds of pre-programmed keys to fit every one of your applications.

Our specially-designed templates fit right on your keyboard to let you see your settings at all times. Each template is also a Reference ("Cue") Card, so it is always right in front of you when you need it, without using up valuable screen space.

### ALLWRITE Is Easy To Learn

ALLWRITE's commands and control keys are easy to remember because they use the first letters of common English words: 'CE' stands for 'Center,' 'Search' and 'Replace' do just that, and so forth. The on-line HELP menu offers over fifty screens of topics.

NEWSCRIP's documentation was acclaimed in every review, and ALLWRITE's 350-page book is even better. Portions of it are designed for beginners, with every feature clearly explained in step-by-step tutorial style. Since you won't always be a beginner, other parts of the book offer advanced topics. There is a cross-reference summary chapter, a 14-page comprehensive index, and a detailed Table of Contents. We've been developing computer programs and manuals for over 20 years, and understand the importance of good documentation.

To make installation easy, we include Tiny DOSPLUS for the Models I and III, and special, pre-tailored versions of both TRSDOS 6.2 and DOSPLUS IV for the Model 4, all at no extra charge. The Model I and III versions work equally well with all major DOS's.

### PROSOFT'S On-Going Customer Support

Perhaps the best reason of all for having ALLWRITE is the continuing support we offer you: friendly, expert, direct support that is unsurpassed in the micro-computer industry. There is no-time limit to our support: if you are our customer and you need help, just call or write. We give free updates for 90 days, and charge little or nothing for minor updates thereafter.

### A Reliable, Well-Tested Product

Some of our customers have been field-testing ALLWRITE for nine months. Here's what they are saying about it:

"...beautiful...a marvelous piece of work." (W.C.)

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## American Standard

80 Micro is walking away from cassette-based Models I and III owners. Disks are great if you need massive data files and fast input and output, but processing the data is more important—that's why I run a program.

So what if it takes six minutes to read a data tape and another six minutes to copy it to a new tape? I can go to the bathroom while the work is being done!

Don't desert us old programmers who are disk-unsophisticated by choice.

Keith E. Wurster  
Oberlin, OH

## Straight Facts

Jesse Baker's "Using Data Files—Part II" (March 1984, p. 148) says that the specification of a logical record length is equivalent to blocking the data by means of an appropriate field statement.

He says that specifying a logical record length in the Open statement lets you put two files on a single sector. He discusses only one record until he says you can change this by adding a FOR...NEXT loop that permits multiple entries, but he fails to discuss the need for identification of the subrecord and physical record.

The Models I and III write data to tape in chunks of 256 bytes, and the programmer's task is to efficiently use the disk or tape space.

Blocking techniques are well known, but perhaps they should be discussed again—Baker's suggestions don't work, nor does the program he lists for converting sequential files to random files. Line 460 ties the program up in an endless loop.

I sincerely hope that beginners don't become confused by this article.

G.S. Bennett  
Alpena, MI



*My articles are not intended to be the definitive word on data file creation and handling. Their purpose is to help readers who want to start using random-access files and need a simplified example to get started.*

*The logical record length in the Open statement lets you put two records, not files, on a single sector. Also, correct the error in line 460 by redirecting the program to line 340.*

Jesse Baker  
Old Town, ME

## Math Mode

Regarding Tom Quindry's review of Math-Analyzer-Paks ("Mathematics in Modules," March 1984, p. 48), we have implemented several changes in response to his criticisms.

These include variable feedback, table jump through routines, file jump through routines, default visibility, and table and file deletion/rearrangement.

Also, the ACCEL compiler in no way affects the standard Basic error-trapping. If a division-by-zero error occurs, you don't have to reboot the module. Press the break key and type in RUN to restart the program.

Mark Felton  
Intercomex  
Denver, CO

## Mail-Order Matters

Regarding Gary Lee Phillips' letter in April Input (p. 10), I, too, have had problems with Omikron Systems. However, my feelings about ordering by mail have not changed.

I bought my Model III, my printer, and my first software package from 80 Micro's mail-order advertisers. I have since bought more software and hardware from these firms.

Perry Computers, Texas Computer Systems, Apparat, Cornucopia Software, BCCOMPCO, Micro Data Supplies, NEBS Computer Forms, Powersoft, and Langley-St. Clair have all provided me with excellent service in the past.

Although my experience with Omikron has given me second thoughts about making another \$500 purchase from a distant firm, I am nevertheless planning to purchase a modem and communications software from Applied Microsystems in Denver, CO.

80 Micro provides a responsible service to its readers and its advertisers in publishing "80 Alert" and promptly cancelling advertisers that are a source of reader complaints.

Keep up the good work.

Robert W. Ginn  
Towson, MD

## Love at First Byte

I think I'm in love! I just received my first copy of 80 Micro. Yours is the first computer publication I have seen for the TRS-80 hacker.

With the help of books and a few commercial programs, I taught myself Basic, Assembly-language, and machine-language programming, but had reached a standstill until 80 Micro came along.

I am fascinated with the articles and programs. Keep up the good work.

Joseph Noecker  
Portland, OR

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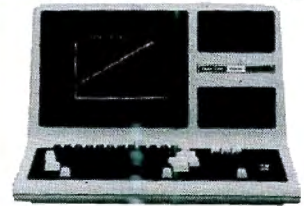
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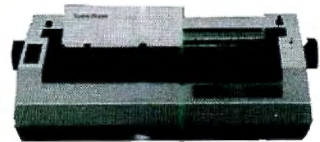
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**Q** ■ I recently purchased a Model I with 48K, an Expansion Interface, and one disk drive (double-density). I need some information.

Where can I get a list of commands for Level II Basic and all TRSDOS commands? How can I upgrade my computer for small business applications and programming in Basic and Cobol (without going to hard disk)? What kind of daisy-wheel printer (new or used) is pretty good and where can I get it (hopefully for under \$300)?

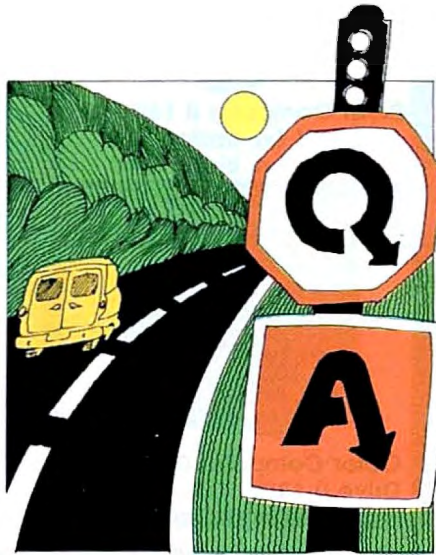
Can you suggest some software you feel no Model I owner should be without? I received some software with my computer (EDTASM, CPN, LIST/CIM, TEST1A, Superzap, GETDISK, and so on). How can I find out how to use them?

Where can I get information on starting a user's group (what they do, what it costs, etc.)?

Thanks for any help you can give. (Jack Sasportus, South Miami, FL)

**A** ■ First, you need the Model I, Level II user's Manual and the TRSDOS Model I user's Manual. Both can be bought directly from R/S National Parts (the address and phone number appear at the end of the column). Or you can ask your local Radio Shack dealer to order them for you. You mention that your disk drive is double-density; are you using double-density TRSDOS 2.77D? It should come up and announce itself as such when you boot up your system. If you are using TRSDOS 2.77D, you need to order that manual as well.

Second, what do you mean by upgrade? Adding more drives gives you greater capacity and freedom in DOS. If you're really cramped for disk space you can add 80-track double-density drives, but you'll have to buy a new DOS that supports these new drives (such as NEWDOS, DOSPLUS,



LDOS, and so on). As far as Cobol is concerned, I haven't heard anything all that complimentary about its implementations on Radio Shack Models I, III, and 4.

Third, the Radio Shack daisy wheels are rugged and pretty well designed. The Brother and Smith Corona machines are also pretty good, and about the same as the low-end Radio Shack daisy-wheel printer. The only daisy-wheel printers I know of that are under the \$300 mark are the electronic typewriters that double as computer printers. But when you add the cost of the required parallel interface box, the price approaches that of the low-end daisy wheel printers. If you look diligently through all the small advertisements in the magazine, you might find some of these printers discounted to the price you want. I haven't seen any low-end daisy wheels on the resale market yet.

Fourth, you definitely need the IJG book, *TRS-80 Disk and Other Mysteries* (IJG's address is at the end of the column). Since you already have Superzap, the book will complement it nicely if you run into disk problems.

Another necessary utility is Floppy Doctor, which you use to verify the

operation of your disk drives and disks, and includes a RAM diagnostics program, too. Floppy Doctor is available from Micro Data Supplies, 22295 Euclid Ave., Euclid, OH 44117, 800-321-3552, retail \$24 for Model I version. RPM (Prosoft, Dept. G, Box 560, No. Hollywood, CA 91603, 800-824-7888, \$29.95) tests the disk drive speed (as does Floppy Doctor). Another disk-driver timer is DDT (Disco-tech, 1150 Coddington Center, Santa Rosa, CA 95406, P.O. Box 11129, 707-523-1600). For all around use, I prefer Floppy Doctor.

Fifth, for your unexplained software, some of it (GETDISK, TEST1A) is explained in the TRSDOS manual. Superzap was put out by Apparat; you need to contact them about a manual for it (although IJG's book can help you use it, too). EDTASM is Radio Shack's Editor/Assembler, but I need to know more about the version you have before I can offer any advice.

Since you appear to have Superzap and EDTASM without documentation, you might be using NEWDOS from Apparat Inc. (4401 S. Tamarac Parkway, Denver, CO 80237, 303-741-1778). If you are, your screen displays NEWDOS instead of TRSDOS when you first boot up the disk in drive zero. If you do have it, you'll need to get a manual from Apparat about the DOS. Also, if you're using NEWDOS, the EDTASM you have is the original Radio Shack cassette-based system, altered by NEWDOS to work with disk drives. Their manual won't describe how to use EDTASM, but it does document the alterations they made to it.

I know of a user's group in N. Miami. It's the North Dade Computer Society, 17400 NE 7th Court, Box 2, N. Miami Beach, FL 33162, 305-947-7930.

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## FEEDBACK LOOP

**Q** ■ This is in response to E.F.'s letter from Augsburg, Germany (January 1984, p. 28) regarding the 50 Hz power problem. The HZ50/CMD file referred to is actually HERZ50/BLD, and you can use the Build function of TRSDOS to construct it as follows: Type in

BUILD HERZ50

then enter

```
PATCH *0 (ADD = 4047, FIND = 2935,  
CHG = BF42).
```

This patches the operating system, so there's no file name as noted in the TRSDOS manual under the Patch Library command syntax. Be sure to try it on a non-critical disk first. When you return to the states, you can reverse the patch with:

```
PATCH *0 (ADD = 4047, FIND = BF42,  
CHG = 2935).
```

On another note, using the standard Radio Shack disk controller in my Model III, can I run an 8-inch disk drive assuming that I have the appropriate clock speed-up and operating system (NEWDOS80 2.0) that handles the non-standard disk?

Also, I'm looking for an RS-232 board with built-in direct connect modem. I saw an ad in *80 Micro* (December 1982, p. 274) by Computex of Houston, TX, for their M3CB1, but they aren't at the address listed anymore.

If anyone knows where such a device is available, I'd appreciate the information. (*William Collins, San Diego, CA*)

**A** ■ Thanks for the patch information. The standard Radio Shack controller can run 8-inch disk drives if you set up the drive cables properly, and either install a speed-up kit or slow down the 8-inch drives to 300 rpm.

Many 8-inch drives have a screw adjustment potentiometer that lets you adjust the rotation speed. If you slow them down to 300 rpm, you fool the disk controller into thinking it's accessing 5¼-inch double-density, 77-track disks. This approach is simpler than installing a speed-up kit in the computer, and it doesn't void

your warranty. Frank DeSimone (1 Cannon Drive, Nashua, NH 03062) sells the patches for using Model III TRSDOS with 8-inch drives for \$29.

Total Access (P.O. Box 790276, Dallas, TX 75379, 214-458-1966) sells a Model III RS-232 plug-in board for \$79. But I couldn't find anyone selling an RS-232 with modem.

**Q** ■ I have a newly purchased Model 4 with 64K and two drives. I also have Adventure International's Sea Dragon game.

When I try to run Sea Dragon, the Model 4 accesses the disk, but a disk error message appears on the screen and then it goes blank. I know the disk works because it ran on my Model I without problem.

I feel that if I could remove protective loaders from the disk, I'd be able to get it to work. I've been in contact with AI, and they don't customize software. A Model 4 version looks to be a long way off (if at all) because AI only markets the products; it's up to the authors, whom I can't get in touch with, to make any updates or revisions.

I'd like to know if there's a driver or utility that can help me (Copycat 2.0 doesn't work). I'm not familiar with disk operation and was, therefore, limited in my experimentation. Help! (*James Basile, Cliffside Park, NJ*)

**A** ■ You have two problems. First, the Model I disk format isn't the same as the Model 4's, and second, the loader protection.

If the software were unprotected, you'd have to use the TRSDOS Convert utility to transfer the program over to Model III or 4 disk format. Just putting the disk in drive zero and trying to boot it up wouldn't work.

Next, the hardware connections for the sound and disk save-game features are different between the Model I and Model III/4, so even if you got it over to the new disk format, there's no guarantee that the program would work.

Finally, the load-protection routines complicate the problem enormously. I don't know of any way to unprotect the program and make it workable.

I think the best solution is to try to get AI to let you trade your Model I version for the Model III version.

With the Model III version, you should be able to play the program on the Model 4 in Model III mode (I have a friend who plays Sea Dragon on his Model 4P in Model III mode, using a Model III Sea Dragon disk).

**Q** ■ I have a 48K two-disk Model III with an Epson printer. After reading Eric Maloney's Side Tracks (March 1984, p. 10) I feel insecure about my Model III. Since I have a moderate-size library of software (games, utilities, self-written programs) my alternatives to the problem of old age appear to be few. The best alternative seems to be either converting my Model III, or selling it and replacing it with a Model 4. I haven't done this for several reasons.

Many of the programs I have written use Model III PEEK and POKE addresses, such as video display, keyboard input, and other fancy program techniques. Where can I find the necessary information to convert PEEK and POKE addresses to the Model 4 mode?

Since the number of programs (especially games) offered by third-party vendors is rapidly declining, will others abandon the TRS-80 market altogether and not make software for the Model 4? If I convert to a Model 4, will I have to rely on Radio Shack for games and utilities for both the Models III and 4?

I wrote to Tandy and they assured me that the Model III and 4 will be supported like the Model I was. But Radio Shack isn't whom I'm concerned about; it's the outside companies that produce great software that worry me. Can you include a list of software for the Model III that doesn't boot or run properly on the Model 4? Please realize that I'm a faithful TRS-80 user and hope to be one in the future. (*Jerry Goldbaum, Flushing, NY*)

**A** ■ Your best source of information on the Model 4 PEEKs and POKEs is probably *80 Micro*. (See April 1984, p. 96 for a Model III to Model 4 conversion utility for Basic programs). Each month we get letters from readers describing their discoveries about the Model III/4 connection. The Radio Shack manual has a few hints on that subject (primarily machine-language calls you can make).



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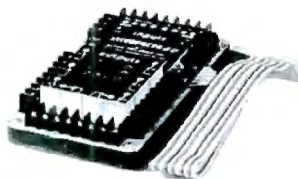
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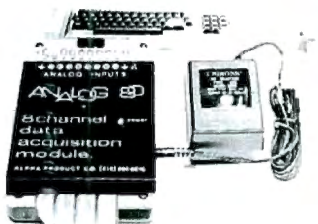
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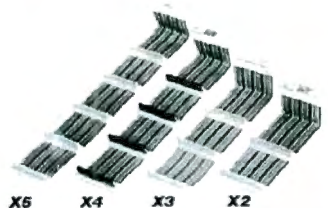
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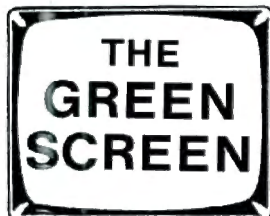
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## FEEDBACK LOOP

As the Model 4 begins to dominate the market place, more and more software writers will produce exclusive Model 4 software. Just as today many new games aren't designed to run on the Model I, so in the future games will be designed primarily for the Model 4, not the Model III. However, due to the design of the Model 4 (it can emulate a Model III) most manufacturers are writing for the Model 4's Model III mode so they can sell to Model III owners as well. This is just smart marketing.

Certain software packages will be written to use the special features of the Model 4, and will only operate in Model 4 mode. But that's to be expected, since software developers want their products to use the abilities of the computer to the greatest degree.

I can't supply a list of software that doesn't run on the Model 4 since I don't have a Model 4 or all the software created to make such a list.

**Q** ■ This is in response to several letters about Radio Shack's EDTASM (Disk Series 1, catalog number 26-2013), as supplied on a TRSDOS 2.3B disk. I've managed to circumvent all the compatibility problems with standard TRSDOS 2.3, double-density modification, and other DOSes.

When I upgraded to double-density and started using DOSPLUS 3.4, I tried copying the 2.3B files to DOSPLUS since DOSPLUS claims to read all current Model I disks. But it didn't read the 2.3B version correctly. This doesn't mean Radio Shack falsely advertised, since 2.3B came out after DOSPLUS 3.4. I tried MULTIDOS and it, too, failed to read 2.3B disks correctly. I finally found a way to do it. First, get some type of disk zap program (like Super Utility Plus or Trackcess). Then make a back-up of your 2.3B disk and load the zapper program.

Select 35-track operation, single density, no sector offset. Put the 2.3B disk in drive zero and go to track 11H sector 2, the first files sector of the directory track. Now step through the directory until you find the file you want to copy. If the file is protected (as are EDTASM/CMD and TPSRC/CMD), the first byte of the directory entry is 5EH; change it to 10H.

The password entry is immediately below this first byte, so change the 00 00 96 42 to read 96 42 96 42. Then go to the fifth byte on that second line (directly after the 96 42 96 42) and increment the number stored there by one (for example, if it reads 11H, change it to 12H); this is the file sector length indicator byte. On the EDTASM/CMD file, *don't* change this byte, since the EDTASM file length already indicates the length to be used.

Once this is done, exit the zap program and use your copy utility to transfer the altered file to any other disk or system you want.

I'd also like to comment on letters concerning EDTASM Source and Load 80. I subscribe to Load 80 and don't have any problems that I can't solve.

The parameters problem comes up because EDTASM expects a line number immediately, while the other editor/assemblers start with a file name or other such information. To get around this, after I've used TPSRC to transfer the file to disk, I use Electric Pencil (Hinrichs' word processor from *80 Micro* won't work for some reason) and load the source file into it.

Then I delete all the extraneous information at the start of the file and insert "B0 B0 B0 B0 B1" (terminated by a carriage return), then save the altered file as SOURCE/SRC. Then I enter EDTASM and load the file. Everything loads fine until the end of the file, where the computer generates a parameter error—it turns out that Electric Pencil appends various parameters to the file.

This is apparently where some of the other word processors fail; they put parameter information at the start of the file, which leaves you right back where you started. For this procedure to work, the extra information must be added to the end of the file.

Using this procedure still gives the parameters error message, but the entire file loads into memory, so who cares? The first time you save the file from EDTASM it overwrites the former file and eliminates the problem. (*Barry Erick, Dallas, PA*)

**A** ■ Bless you for solving the compatibility problem with TRSDOS 2.3B. It was all a problem of 2.3B underreporting the length of the files. For those of you who don't

know what the directory entries look like, here's a sample. I call the file SAMPLE/SRC and it's 65 sectors in length:

```
1000 0068 0053 414D 504C 4520 2053 5243
9642 9642 4100 0401 052B FFFF FFFF FFFF
```

The above is in hexadecimal notation. In ASCII code it looks like this (periods indicate values outside of the standard ASCII character set):

```
.. .S AM PL E SRC
.B B A . . . . .
```

For your information, the first byte of the directory entry (10 hex) indicates the file's protection level; the next 2 bytes aren't used and the fourth byte (68 hex) represents the relative position in the last sector of the end-of-file byte. The next byte is unused, the sixth through 16th bytes are the file name and extension, the 17th and 18th bytes (second line, 96 hex and 42 hex) are the update password, the next 2 bytes are the access password, the 21st and 22nd bytes are file length bytes, and the remaining bytes are the location and length of the different segments of the file.

In this example, the 0401 hex says that the file starts at sector 1 of track 4, with a length of two grans. The 052B hex says the next section of the file starts at sector 5 of track 5, with a length of 10 grans.

**Q** ■ I have a problem with the memory on a 16K revision Level II G Model I. I just installed the two-chip ROM for Level II and had such problems with the CPU/Keyboard interconnect cable that I had to replace it with a 40-conductor ribbon cable using every other wire. This cured the keyboard response problems. I would like to mention, for the sake of others making this modification, that nowhere in the Radio Shack manual does it say you have to break the top shunt on the DIP hunt in Z3; otherwise the screen fills with garbage. I found this procedure in an old Exclusive Oracle column (December 1981, p. 46) by Dennis Kitz.

My current problem occurred when I started testing all the RAM above my resident Basic program, which does the test. The program POKes a 255 into all locations and then starts over

*Continued on p. 180*

Welcome to the second issue of *In Touch*. This month, let's answer some common questions about the VS-100 voice synthesizer.

# In Touch

## The Alpha Newsletter

### ■ How good is the voice?

We think it's incredible for the price, but you can judge for yourself by calling our 24 hour Demo Line: (212) 296-0399.

### ■ What does it take to make my BASIC programs talk?

With *TALKER 1.4*, it's simple. With *TALKER 2.0*, it's incredibly easy. If you add an asterisk after a "PRINT" command, the PRINT now speaks. (e.g. PRINT★ "Hello Judy" will speak, not print). If you add an exclamation point instead of an asterisk, the PRINT command will print as usual, and in addition, it will speak! To add speech to your favorite BASIC program simply sprinkle a few "★" and "!" where you want speech. Could it be any easier?

### ■ Is it compatible with my DOS?

The software and hardware do not rely on any DOS feature, therefore the VS-100 system works with any Model I or III DOS.

### ■ Do I need any cables?

No, the VS-100 plugs directly into your TRS-80. It uses the expansion port on your computer, so it doesn't interfere with any printer, disk drive, or RS232 device. On the Model 4P, the card edge is recessed; be sure to order the special 50-pin extender cable

### ■ Do I need an amplifier?

No, the amplifier with volume control is built into the VS-100. All you need is a small speaker; we recommend our handsome mini-speaker (\$5.95).

### ■ Which port does it use?

All communication between the computer and the VS-100 is done using port 11.

### ■ Can I purchase the user manual alone?

Yes, it is available for \$5 plus \$1 shipping and handling. (The \$5 is applicable towards purchase of the VS-100).

### ■ How many words can the VS-100 say?

There are two ways to make speech synthesizers. One is to use a limited look-up dictionary. The VS-100, on the other hand, uses a much more powerful approach: the "text to speech" automatic translator. This means that any word will be pronounced. The text to speech translator, with its 400 pronunciation rules, achieves a 96% success rate.

### ■ Can I get speech automatically, without doing any programming at all?

Yes, Talker 2.0 has very powerful "automatic keyboard echo" and "screen echo" options. Everything that is typed and/or printed on the screen can also be spoken.

We would like to thank all our customers for the very nice feedback that we receive. (Such as the letter at right).



What is your reason for keeping your TRS-80 mute?



17

To Alpha Products, 79-04 Jamaica Ave., Woodhaven, NY 11421

Gentlemen:

I seldom write manufacturers of Computer products. However, I am so pleased with my purchase of the VS-100 Voice synthesizer. I felt I must let you know it.

The unit performs EXACTLY as advertised. The documentation furnished is clear, understandable and straightforward. The disk software seems absolutely flawless in use.

The VS-100 is simple to program and flexible enough in programming to accomplish exactly what I wish. I have incorporated it into all my computer tutorials. Congratulations on your product!

Sincerely yours,

  
Wendell R. Henry

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**ALPHA** Products

79-04 Jamaica Ave., Woodhaven, NY 11421

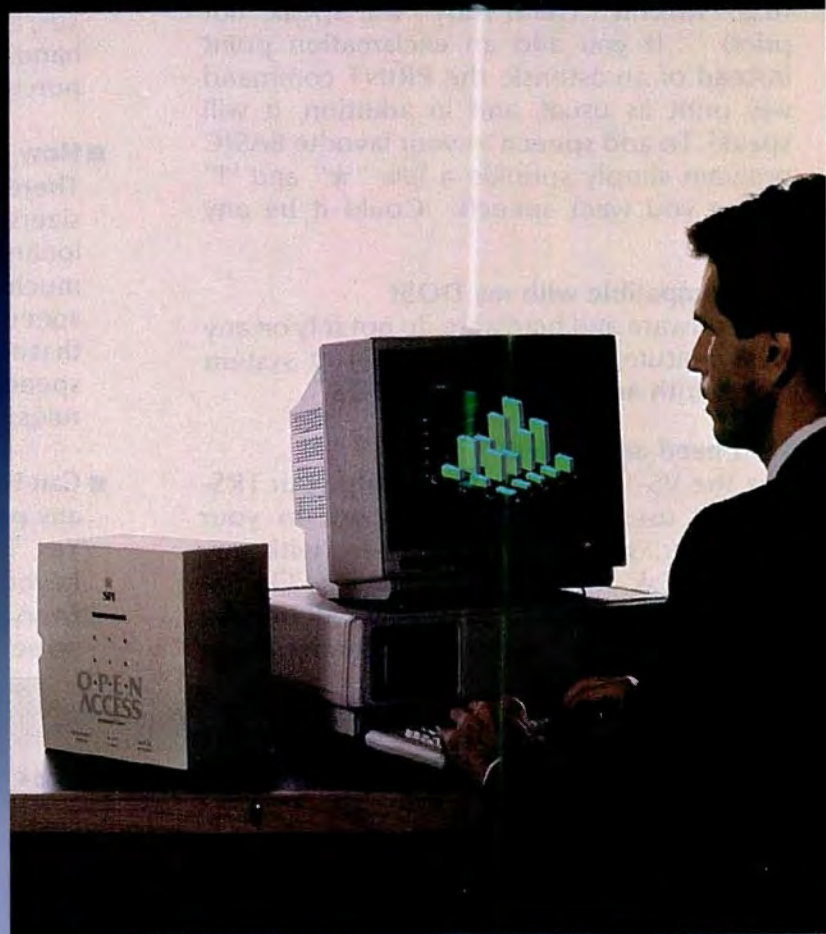
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1



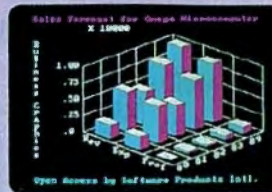
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Because they do not have a dedicated relational data-base manager that can quickly direct massive amounts of data, other programs simply can't do what OPEN ACCESS can. Some don't have a communications program, others no dedicated word processor, None have a time management program.

**There's just one conclusion: At \$595,** OPEN ACCESS can do more for you than any other comparable business program on the market. Bar none. But the only way for you to be convinced is for you to see OPEN ACCESS work its magic on your work load. So call your local software dealer today, or call us at SPI, at 619-450-1526.



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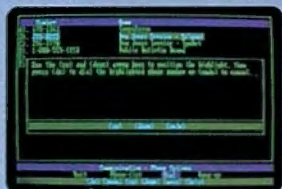
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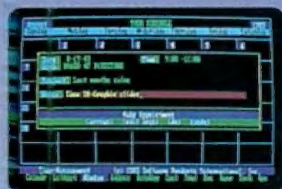
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6



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386



# The Model 100: Coming of Age

*Tandy's portable celebrates its first birthday.*

edited by Eric Grevstad



*The portable field is getting crowded.*

**B**asically, microcomputer buyers are fickle and greedy. No sooner do 16-bit chips appear than good 8-bit machines go out the window. Apple critics howl about Macintosh's limited 128K memory, when a 128K micro was almost unheard of a year ago.

This short attention span is particularly hard on pioneers. With the TRS-80 Model 100, Radio Shack practically defined the portable computer, pushing aside pretenders like the Osborne 1 and Epson HX-20. The briefcase micro has been a best seller, and—far more than the Model 4 introduced at about the same time last spring—established the “new” Tandy, the firm behind such aggressive market contenders as the Model 2000 and 64K Color Computer 2.

But the Model 100 is a year old, and the competition is getting fierce. Even when the 100 was brand new, buyers wished for a bigger display and more memory; today, with fancier portables reaching the market, Tandy has compromised between abandoning and clinging to its original. The next generation's in the wings, Fort Worth says, but there's a lot of life in the Model 100 yet.

## It Wasn't Lonely for Long

The portable was barely on the market before NEC introduced its PC-8201A, a 100 clone offering more memory and a disk interface (though NEC's ads didn't mention its missing modem); recently, Olivetti has offered a third version of the Kyocera Electronics-designed unit, with a flip-up LCD screen.

And newer machines have surpassed the Model 100's specifications alto-

gether, albeit at a price of \$2,000 to \$4,000. Sharp's PC-5000 offers 128K RAM, optional 128K bubble memory cartridges, and an 8-line, 80-column LCD display; Gavilan Computer Corp.'s Gavilan has 64K RAM, a 3½-inch microfloppy drive, and a 16 by 80 LCD.

Not only do these machines beat the 100's maximum 32K RAM and 8 by 40 display, but they use the same Intel 8088 microprocessor and some of the MS-DOS software library of IBM's PC. The newest competitor, Hewlett-Packard's HP-110, has a CMOS version of Intel's 8086 chip and both MS-DOS and Lotus 1-2-3 in ROM (see “No Screen and Lots of ROM,” later in this section, for details).

## On Sale, But Still Selling

Tandy, then, put the Model 100 on the table, only to have competitors say, “I'll call your eight bits and raise you MS-DOS.” This winter, Fort Worth shuffled its hand—some more Model 100 software appeared, as did a

disk/video interface with a 5¼-inch drive and provision for larger display on a TV set or monitor—but that wasn't the “Model 200” or “Model 100 Plus” that onlookers have been predicting since last year.

And in April, when Tandy sliced \$200 off the portable's price (to \$599 for an 8K model, \$799 for 24K), gossipers went wild: a machine on sale was obviously a machine about to be replaced. The rumor mill declared that the 100 was finished, and a big-screened, 16-bit portable would be in the Radio Shack catalog by summer.

The sages, however, never spoke to Radio Shack. Interviewed by *80 Micro*, Tandy's director of market planning was decisive: “There is nothing coming in a new or revised portable this summer for sure,” Ed Juge said.

“We've said that there are other things coming along, but all this talk about things coming along in the next month is garbage. And yes, the machine is going on sale in April, and yes, it's going to be on sale for a couple of months. But that doesn't mean we're going to dump it in favor of a new one. People who don't buy because of that [rumor] will be disappointed. All that'll happen is the price'll go back up.”

And why should there be a new machine? Bill Walters, who oversees the product line as Tandy's Model 100 buyer, told *80*, “The 100's not going to change. It's still doing very well.”

“It's a good machine,” Juge said. “It appears that we hit very nearly a magic combination of numbers when it comes to size and weight and shape and size of the screen and so forth.

“If you go to a larger screen you get into very small letters, and there are a lot of people who don't like very small let-

ters. The screen we've got is very adequate for a lot of users; the machine itself is just the right size for a lot of people. If it was half an inch thicker it wouldn't be."

Walters admitted that the 100's small screen has its critics, but said even a Gavilan-sized LCD wouldn't satisfy everyone. "People always want more memory, more software, and a bigger display," he shrugged. "People will be tickled to death with an 80 by 64 display."

#### Next Year, Though...

Gossipers can take some consolation: The fact there'll be no new portable this summer doesn't mean there won't be one a little later. In fact, Juge implied there may be two or three.

"There are some other machines coming," he said. "There is more than one other machine coming, but it's not going to happen, certainly not this summer or probably not this fall. I don't know, I honestly do not know when to tell you even as a rough guess, but I would guess that you're not going to see anything before the fourth quarter. It could be late [in the] fourth quarter or it could even be into '85."

As to the new TRS-80s' specifications, a bigger LCD seems certain and a 16-bit CPU seems likely, although Walters contended, "I think there's quite a bit of life left in 8-bit CPUs for handheld devices. Eight-bit devices are still around and being used productively."

Neither Tandy spokesman was enthusiastic about bubble memory, which Walters described as "very expensive in terms of unit cost and also in terms of battery draw when it's being accessed," and they shared Walters' opinion on CMOS RAM—the price is coming down, but "not as fast as it should be."

"If bubble would get cheap enough it'd be attractive," Juge said, "but it's just not cheap enough yet and I don't know if it will be. Maybe by the time it's ready CMOS RAM will be cheaper."

Walters conceded a place for Hewlett-Packard-style machines in the portable world, but Radio Shack remains a price-conscious retailer, and Tandy intends to stay in the sub-\$1,000 niche as well.

*Gossipers can take some consolation: The fact there'll be no new portable this summer doesn't mean there won't be one a little later.*

"I don't think a \$3,000 or \$4,000 product is viable," Juge said. "If we did [manufacture one], obviously I think a bigger screen would be in order. But my own feeling is that if we elect to do that we'd stay in the low end too, because I don't want to have to carry a machine besides my briefcase. I want to carry my briefcase." ■

—E.G.

#### Helping the 100

*What's available for portable buyers.*

by Bradford N. Dixon  
80 Micro staff

The Model 100 has attracted a lot of buyers, but not many hard-

ware or software suppliers; one year after the portable's debut, its third-party support remains limited. Companies that sell Model 100 programs include the Portable Computer Support Group in Dallas, TX, and Traveling Software in Seattle, WA. The most visible third-party hardware firm is Holmes Engineering in Murray, UT.

The biggest drawback to Model 100 software vendors is that many customers are content with the machine's built-in firmware; given a word processor, appointment and address book, and communications programs, portable users might wonder what else the Tandy totable needs. Tandy itself only markets nine additional programs for the 100.

Still, there are gaps in the 100's repertoire. Over the last year, Traveling Software has been very active in marketing a variety of software products for the Model 100, but finds their text formatting and time management programs most in demand.

According to the firm's Karen Hanka, the 100 supplies some simple applications firmware, but not enough to do a complete job. For example, Hanka claims, the 100's Text is little more than a text input and editor program, without the formatting power needed to make the 100 a true lap-sized word processor. To make the text editor more useful, you'd need a text formatting program.

In the same area, the Portable



PCSG's 3 1/2-inch Model 100 drive.



Computer Support Group (PCSG) in Dallas, TX, provides Businesspak+ and Businesspak2, bundled products designed to fill the needs of business people.

Businesspak+ is a six-program package with a text processor, an expense program, a graph generator, a Telex program for sending mailgrams, and a list organizer and accompanying sorting program. Businesspak2 is a five-program set that includes a database manager, another text formatter, a keyboard tutor game, an improved sorting program, and a numeric pad emulator.

Sam Redman, co-founder of PCSG, concurs with Hanka's observation that the first thing a Model 100 owner needs is a text formatter. But beyond that, Redman says, the field is still wide open. Data-base management and spreadsheet programs, as well as software on ROM packs, are all in some stage of development at PCSG. In fact, Redman says his company will soon release a spreadsheet program built into a ROM pack that will plug into the expansion socket on the bottom of the Model 100.

### Portable Peripherals

In the realm of hardware, the field of third-party suppliers is just as narrow. To maintain portability, Model 100 users can't rely on disk drives for data storage. Printers, too, are a feature needed when considering a micro-computer work station, but not when packing a briefcase (though some new models, such as Hewlett-Packard's book-sized, \$495 ThinkJet, indicate the possibility of portable printing). Fortunately, though, Tandy left a couple of areas open for outside hardware support.

The Model 100 is sold in two configurations, with 8K and 24K RAM; you can upgrade both to a maximum of 32K by adding memory modules to expansion slots inside the machine. Radio Shack provides 8K memory modules for \$119 apiece, plus \$15 for installation; for do-it-yourselfers, Holmes Engineering's IM-100 8K module retails for \$69.50. The Holmes offering comes with installation instructions, so you also avoid a service charge.

Cordell Norton, Holmes' vice president of marketing, says that the IM-100 is selling very well, with a re-

---

*As for other products,  
bar code applications  
seem to be  
at the top of the list.  
Tandy has even developed  
its own bar code  
format called Tandycode.*

---

cent order for 3,000 units coming from a single corporation. In addition, Holmes was the first company to address Model 100 owners' need for rapid-access mass storage, with its PMD-100 Portable Micro Drive.

The Holmes unit stores up to 64K on a stringy floppy tape, faster than a cassette but no match for a floppy disk. For Model 100 owners who want disk storage, Tandy developed its own storage device, the Disk/Video Interface. Besides providing 180K of space on a 5¼-inch floppy, the D/VI has the added advantage of providing a link for the Model 100 to a television or monitor; on the other hand, its \$799 price is a considerable increase from the PMD-100's \$369.95.

The Portable Computer Support Group also plans an entry in the Model 100 mass storage market. An April press release described a \$799 Percom Data disk drive, weighing three pounds and powered by a 12-volt rechargeable battery, that will store 360K on a 3½-inch microfloppy. The drive will contain an 8K ROM chip with interfacing software; a 5K Model 100 program called Portable DOS will give menu access to the disk, as well as the choice of MS-DOS-style subdirectories.

As for other new products, bar code applications seem to be at the top of the list. Tandy, Traveling Software, and PCSG are all moving to exploit the potential of the 100 with regard to bar code uses. Tandy has even developed its own bar code format called Tandycode, while the other software developers are sticking to the more conventional UPC, 3 of 9, and Plessey formats. The market for Model 100 bar code wands is held by Hewlett-Packard at the moment, but distribu-

tors like Tandy and BT Enterprises are selling HP wands under their own names.

In addition to bar codes, spreadsheet programs are in development for the 100. Besides PCSG's spreadsheet ROM pack, Tandy plans to sell Microsoft's Multiplan as a ROM pack for the Model 100, but it may not be available until the third quarter of 1984. The one drawback to both bar code applications and spreadsheets continues to be the 32K limit on the Model 100's RAM.

### The Market Ahead

Who'll be using these products? After a year on the market, the Model 100 seems to be attracting a mixed bag of business customers, ranging from small-business owners to corporate executives. Tandy adds that many portables are sold to journalists, who rely on the 100's telecommunications abilities.

While successful in business, the Model 100 has yet to gain a hold in the home market. Though it's perfect for simple record-keeping and note-taking, those qualities haven't attracted non-business people looking for an inexpensive, easy-to-use micro. Educational computing, for instance, requires a bigger screen.

For the future, the portable market in general looks bright, with new software, ROM-based software, more memory, and larger LCD screens all in various stages of development. Some onlookers have even mentioned color LCDs, but further advances in that technology are necessary before you'll have bar graphs in color on your lapsize computer.

Whether or not new portables' technology surpasses the Model 100's, the Tandy portable is still a popular item in the field. Between its impressive sales and Radio Shack's support, the 100 should attract more attention and applications for years to come. ■

## No Screen and Lots of ROM

*Apple and H-P hit the road.*

**T**andy has the Models 4P and 100, Commodore's Osborne-style suitcase (packed with a C64 and small color monitor) has reached retailers

after a year's delay, and even IBM has unveiled a Compaq-compatible trans-portable PC. Now Apple and Hewlett-Packard have joined the booming portable market—Apple with a streamlined, screenless IIC, HP with a high-tech briefcase micro.

The Apple IIC is a 7½-pound, 128K cousin to the Cupertino firm's familiar desktop. It's built around a 65C02, the low-power CMOS version of Apple's usual 8-bit 6502 CPU, and carries one 5¼-inch disk drive (users can add an external second drive).

What makes the IIC easy to carry is its missing monitor. An RF modulator connects the \$1,300 machine to a TV set, giving a 40-column display; with a computer monitor, IIC viewers can see an 80-column display, toggled by a keyboard switch. Apple sells a monochrome unit with a stand for \$250, and promises a high-resolution RGB color monitor by fall.

That's fine if travelers have a TV set or monitor at each destination. To make the IIC truly portable, you'll have to wait four to six months for Apple's liquid crystal display (\$600), which will offer 24 lines by 80 columns of text or 560- by 192-pixel graphics. The LCD will fold down over the IIC's keyboard; Apple claims the display will be faster and more responsive than current portable displays.

Compared to the IIE, the IIC is a closed box: There are ports for the second drive, a modem, a serial printer, a joystick or mouse, and display, but no expansion slots. This airtight architecture follows Apple's new practice, established with Macintosh; besides disappointing add-on board swappers, Apple is defying the industry standard by abandoning parallel printers.

## The Lotus Notebook

Hewlett-Packard's portable doesn't have a parallel port, either; there's an RS-232 serial outlet and the proprietary HP-IL interface for battery-powered peripherals. But if the IIC is an old workhorse given a CMOS chip and put on a diet, the HP-110 is the most advanced notebook \$3,000 can buy.

For one thing, Hewlett-Packard's nine-pound portable makes the most of CMOS technology: besides Harris Corp.'s 80C86, the low-power version of Intel's 16-bit 8086 chip, there's 272K of CMOS RAM, which should hold files for one year while the

HP-110 is turned off, and a whopping 384K CMOS ROM.

The machine runs on three permanently installed "D" batteries (lead-acid cells were chosen over NiCads for their more gradual power loss); Hewlett-Packard expects 16 hours of use between charges, and five years between battery replacements.

A 16 by 80 LCD screen and built-in 300 baud modem are standard, but it's what's in ROM that makes the HP-110 impressive. Besides a terminal program, Hewlett-Packard's Memo-Maker word processor, and MS-DOS 2.11, there's Lotus Development Corp.'s 1-2-3 integrated spreadsheet. (Later HP-110s will have Symphony, Lotus' upgrade that adds word processing and communications to 1-2-3.)

The machine's MS-DOS uses available RAM as drive A and ROM as drive B; drive C is the optional battery-powered 3½-inch microfloppy, which promises 630K of storage and six hours' service per charge. For those who don't care to learn MS-DOS, Hewlett-Packard's PAM (Personal Applications Manager), an operating system shell similar to the Model 100's, provides program access without DOS commands.

Hewlett-Packard has a sizable library of 3½-inch disk software for its HP-150 desktop; the firm plans to market most applications (such as

WordStar, dBase II, and Microsoft Basic, Word, and Multiplan) on microfloppies with HP-150 versions on one side and HP-110 versions on the other.

Matched against a desktop, the HP-110 suffers from its smaller and dimmer LCD screen and a stiff keyboard; matched against the Model 100, it's heavy and expensive. Still, Hewlett-Packard can boast a 272K MS-DOS micro, disk drive, and a quiet 150-cps ink jet printer, all able to run on batteries and with a combined weight of under 20 pounds. When it comes to portable technology, it seems Apple—like the IIC's screen—is left out. ■

## The Rest of This Year

### IDC's industry predictions.

They're not as flashy as the *National Enquirer's*, but International Data Corp. has its own set of predictions for the year ahead. In March, the Framingham, MA, industry analysts staged briefing sessions in six cities, presenting forecasts by research vice president William Zachmann and a team of staff specialists.

Attendees heard a dozen predictions. Some concerned mainframe and office computing—IBM's aging 360/370 architecture is on its way out; IEEE (Institute of Electrical and Electronics Engineers) standards for local area networks, similar to 3Com's and Xerox's Ethernet, are on their way in.

When it came to micros, IDC was explicit. Their main point, in effect, endorsed Apple's famous "Big Brother" commercial: 1984 is not going to be the year of IBM.

IDC's Prediction #1 read, "The proclamation of the dominance of the IBM PC will prove to have been premature." On one side, "PC compatibles, near compatibles, and semi-compatibles are likely to gain significant share"; on the other, "the Apple Macintosh/Lisa 2 line offers users a strong and attractive alternative to PC architecture."

In addition, IDC declared, "The Tandy 2000 represents another kind of challenge to the PC. With both superior features and an aggressive price, the 2000 suggests that we may be looking



Apple's portable: With no monitor, it's difficult IIC.



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at an Intel 8088/86 family standard rather than an IBM PC standard" in the non-Apple market.

"Only very aggressive moves by IBM to provide better performance at lower prices can prevent loss of [market] share," Zachmann concluded. "Such moves will be very difficult for IBM, however, because they will require both that IBM be more innovative in design than now appears likely as well as that IBM accept lower [profit] margins."

With Big Blue's color fading, IDC proceeded to predict "Apple blossoms in 1984." Besides Macintosh, which "clearly raises the standard of what users can expect at a given price to a new level," IDC complimented Apple on the improved, less expensive Lisa 2 and saw "new Apple II models [providing] fierce competition to the uninspiring PCjr, [which is] an unimpressive product likely to fall well below expectations."

Another prediction, related to the thumbs-down verdict for PCjr, was that "the home market will prove to be more significant and to demand more capable systems than many expect." In fact, IDC said, "Powerful user interface capabilities supported by very capable hardware [are] probably more important for home use than [for the business market]."

With so much at stake in the micro industry, IDC didn't anticipate an easy debut for AT&T: "We think it likely that AT&T will find that becoming a computer and office automation company brings with it more bumps and bruises (and maybe red ink) than AT&T management would like to encounter," Zachmann's team asserted. "Sheer size is not a guarantee of success in information system and office automation markets. Talk to Exxon about that one!"

AT&T's problem, said the forecasters, would be finding a niche. The telephone titan plans to come in "below the large mainframes but above the basic personal computer"; that avoids areas of IBM dominance, but is "the primary market for DEC, Wang, Data General, Honeywell, Burroughs, and a host of other vendors... a fiercely competitive market and one in which many vendors have taken their lumps in '83."

Moreover, IDC added, "There will be no clearcut sweep for Unix in

### *IDC predicted good news for Model 2000 buyers or others worried about scarce 80186 chips.*

1984." True, AT&T's would-be standard is "a highly desirable [operating] system for programmers" and "will undoubtedly get a boost from AT&T [hardware announcements]," but "it is not an ideal system for end users" and "is very consumptive of resources for a small system."

If IBM and AT&T aren't good bets, what is? For one, CMOS technology: IDC expects "numerous announcements" of low-heat, low-power processor and memory chips in 1984. For another, there'll be "important new optical disk products": the "movement of [optical] technology from arcade games to personal computers may be the single most important innovation over the next year or so."

Finally, IDC predicted good news for Model 2000 buyers or others worried about scarce 80186 chips: "The present semiconductor parts shortage will prove ephemeral." Not only should there be "[no] major impact on availability of end-user products," but two factors—rapidly expanding production and the collapse of a "panic buying and hoarding mentality" similar to early-'70s gasoline users—"may [bring] another round of precipitously dropping semiconductor prices" by fall. ■

### **Imaginary Benchmarks**

#### *Rating price/performance*

A few months ago, Auerbach Inc. compared the incomparable, rating different micros for various applications (see *80 Micro*, April 1984, p. 26). Now Dr. Bob Keston, president of the Management Training Institute of Rockville, MD, has calculated a "numeric indicator of 'bang-for-the-buck,'" comparing computers' costs and features for prospective shoppers.

Keston's "price-performance indicator" judges micros against an imaginary "standard system" with an 8-bit processor, 64K RAM, 256K disk storage, and a \$2,000 price tag. Features such as more memory or storage bring extra points; smaller screens or lack of Basic bring demerits.

With total score divided by price, the fictional machine rates exactly one point—a better value than the Apple IIe (0.96), but not as good as the TRS-80 Model 4 (1.03), IBM PC (1.13), or Apple Macintosh (1.6). The Tandy 2000 scored 1.4 points, while the Models 16B and 12 trailed with 0.86 and 0.62 respectively.

The worst buy in Keston's collection was the Grid Compass portable; it rated only 0.43 point, its fancy features failing to offset its \$8,150 price (since lowered to \$6,795). By contrast, two ordinary Z80 CP/M systems finished second and third overall—the obscure Starlite HD-20 scored 2.9 points and the Kaypro 10 followed with 2.71, boosted by their respective 20- and 10-megabyte hard disks.



*The Grid Compass: The worst value in computing?*

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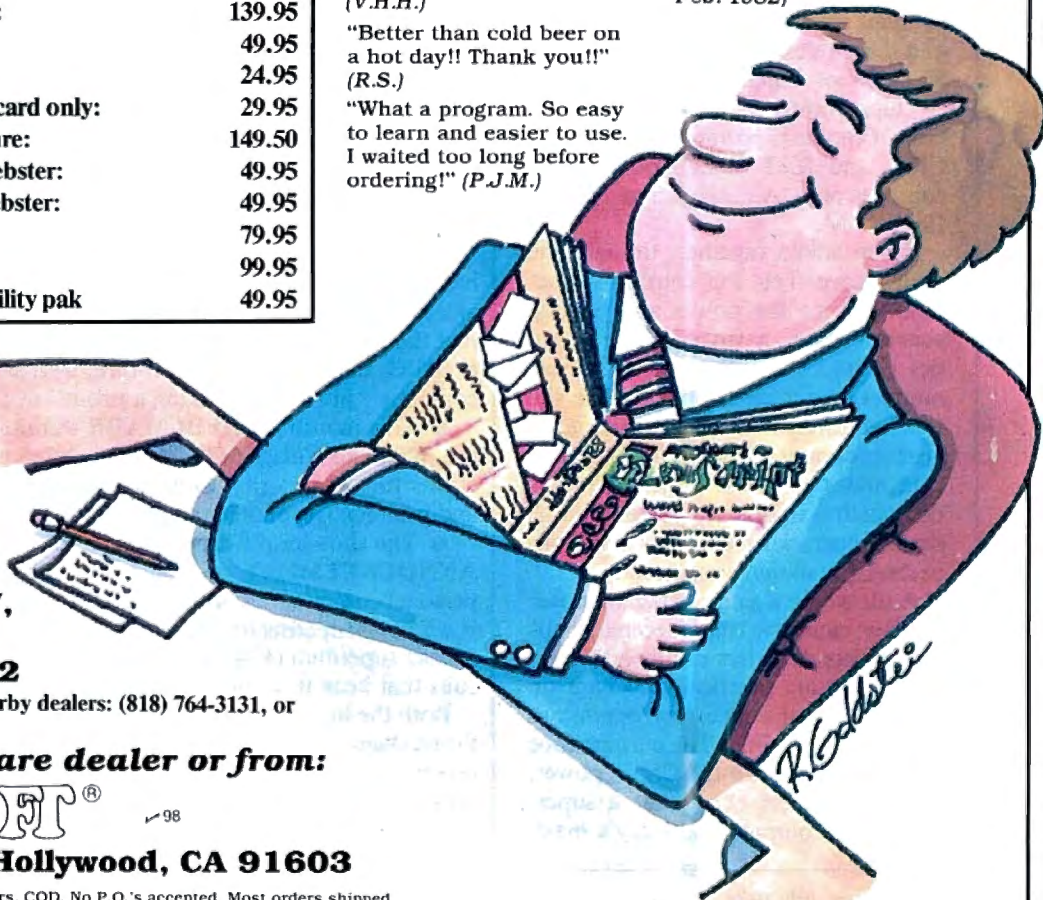
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And the best value of all? IBM's 64K, cassette-based PCjr (\$669), whose good graphics must have blinded Keston to its awful keyboard. The Peanut scored a dazzling 3.1 points. ■

## Look! It's Super Kludge!

*Can many micros rival one maxi?*

On a level above microcomputers, the high-tech hierarchy says, there are minicomputers. Above them are mainframes, and above them are monstrous supercomputers like the Cyber or Cray-1, capable of 100 million calculations per second. Surely there's nothing faster or more powerful than the \$7 million Cray—except possibly a whole bunch of micros.

That's the logic behind the Cosmic Cube, a California Institute of Technology project dedicated to the belief that microprocessors, teamed in huge numbers, can rival the fastest supercomputers for speed and accuracy. Cal Tech's biggest cube offers about one-tenth the power of Cray Research Inc.'s flagship, but costs only about a hundredth as much—roughly \$80,000.

Architecturally speaking, the cube contains little to intimidate the owner of a decent desktop micro. Each of its 64 nodes or building blocks contains 78 chips, mostly the pair found in the Grid Compass portable—Intel 8086 CPUs and 8087 floating-point math coprocessors. A node also carries 136K RAM.

When linked together, though, the nodes leave their PC cousins far behind. Except for power and cooling considerations, a virtually infinite series of nodes can be joined for vast number-crunching problems, like the weather forecasting and missile guidance programs that occupy Cybers. The nodes do what supercomputers do, which is to dissect tasks and do all similar operations (such as additions or multiplications) concurrently.

And, where a single supercomputer reaches capacity, the piecemeal approach lets designers simply add extra nodes, putting practically no limit on the number of concurrent operations possible at one time. The current cube may have one-tenth the Cray's power, but its designers claim that a supercube could outperform today's maxi-

computers by a factor of 1,000.

Right now, researchers Charles Seitz and Geoffrey Fox admit, the cube is a bit of a kludge—it uses the C language, rather than the Fortran algorithms normally found in supercomputer systems, and requires Digital Equipment Corp. VAX-11 superminis as front-end processors. The VAXes handle input/output while the microchips do the crunching.

But the concept of parallel processing is a powerful one, especially as advances in chip shrinking and circuit technology continue. Seitz claims that the cube's building blocks, the 78-chip nodal processors, might soon be replaced with one- or two-chip "mosaics," each perhaps as small as a micron. If that comes to pass, the sum of Cal Tech's parts may be much more than a supercomputer's whole. ■

## END BYTES

### Amazing New Development!

- According to a press release, Fifth Generation Technologies Inc., a Jersey City, NJ, firm, will **REVOLUTIONIZE** the market with its FGT Systems/2001, "a state-of-the-art 16-bit micro-computer system." The "Computer of the Future," as FGT's ads will proclaim, uses "16 bit 8088/8087 Micro Processors" to "take the initiative in today's personal computer age," offering PC-DOS, MS-DOS, CP/M-86, and Concurrent CP/M-86.

If you doubt that FGT's PC clone is "so advanced, so powerful, and so versatile as to make other entries into the market today almost obsolete," check out its Professional Software WP/2001 word processor, which features "character replacement, deletions, insertions, and search function." Clearly, Tandy, IBM, and Apple might as well fold their tents.

- By the time you read this, there may well be an IBM clone from **COM-MODORE**. After signing a technology licensing agreement with Canada's Bytec, makers of the Hyperion PC transportable, the home micro manufacturer gained Intel's permission to produce 8088 CPUs for its own use.

- Two other 8088 customers, **SANYO** and **IBM**, have also contracted with Intel to begin their own chip production. In IBM's case, it's the only way to keep up with PC orders: Entry Systems president Philip Estridge, while admitting to securities analysts that Big Blue has reached a "balance between supply and demand" for PCjr, predicted that IBM would more than triple PC shipments in 1984.

The giant's Florida and Texas plants complete a PC every 16 seconds, shipping more micros in the last eight weeks of 1983 than in all of 1981 and 1982; Estridge hopes to get the figure down to seven seconds by Christmas.

- When things are shaky, you cut expenses and increase income: **ATARI** has pared about 250 white-collar jobs and hiked its home computers by \$40 apiece. Chief executive officer James Morgan told the *Wall Street Journal* that the 64K Atari 800XL was selling "superbly" at \$280, while the 16K model 600XL faced an uncertain future, with sales "sputtering a touch" and the company "just barely making a profit" at \$180.

- This month's **TRADEMARK** dispute involves Corona Data Systems, the Westlake Village, CA, manufacturer of PC compatibles. SCM Corp. claims that the word "Corona" infringes on its Smith-Corona typewriters and printers; Corona Data has gone to court to settle the matter.

- The shoe hasn't dropped yet: AT&T made its first computer products **ANNOUNCEMENT** on March 27, but buyers waiting for the leviathan's personal computer are still waiting. The smallest AT&T system, the 3B2/300, is a \$9,950 supermicro that can support up to 18 terminals; the biggest, the 3B20D supermini (\$340,000), is "fault tolerant," meaning it has back-up circuits that keep it running during breakdowns or repairs.

Both the high- and low-end AT&T machines, as well as the four models between them, use Bell Labs' Unix operating system and WE 32000 32-bit processor. So, presumably, will AT&T's desktop—about which the firm says only that there will be additional product releases this year. ■



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The PRODUCER is a program development system that writes software. If you have a need to store and retrieve information, perform calculations on your data, and get displayed and printed reports, you can design the exact format you need and The PRODUCER will write that program for you. In short, it is the most simple, practical, and versatile program generator ever put on the market.

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■ **The PRODUCER makes programming easy.** If you can answer simple English questions and push buttons, it will do all the hard work for you. It helps you conceptualize your program, gives you complete freedom in drawing your screen, lets you edit until you are satisfied, and then writes all the BASIC code for you to produce a stand alone finished program.

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■ **The PRODUCER can save you big bucks.** How many data storage programs do you own? How much did you pay for them? It's likely The PRODUCER could have written all of them. With The PRODUCER, you may never again need to buy such programs. Add to that the advantage of having customized programs, the ability to edit them at will to suit your changing needs, and your ability to sell the programs The PRODUCER writes for you. That is really a big dollar savings that continues to grow and grow.

■ **The PRODUCER makes you more productive.** Of course you will save time that can better be spent doing other things. But your creativity also will be unleashed. With The PRODUCER as your partner, your computer will at last become the valuable tool you bought it to be. And you will get much more accomplished.

■ **The PRODUCER can turn you into a professional.** It writes complete, stand alone programs that you, as a licensed PRODUCER owner, can sell without paying royalties. And if you already are a pro, it can make you more of one. The PRODUCER writes fully commented BASIC code so you can use it as a building block to customize your own specialized software. The PRODUCER has the best screen and input module available anywhere at any price.

"The PRODUCER is a very impressive software package. It is well worth the money. While other micro owners are printing mailing labels, I am now selling them programs to use. I now have more time to spend enjoying my computer."

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S. R. Foster, Pensacola, Florida

Continued

**MAILLIST Fix**

I found a bug in the mailing list program included with TRSDOS 6.1. The problem occurs when you attempt to delete a file from the list. Pressing the Y and enter keys to delete a file returns you to the main menu without making your deletion. Worse yet, the program leaves the file open and crashes if you attempt to execute a command from the menu. The error lies in line 1670. You should change it to:

```
1670 GOSUB 2820 : IF REPLY% THEN
GOSUB 2870 ELSE 1760
```

*Will Fitzpatrick  
P.O. Box 806  
Pomeroy, WA 99347*

**Debooting**

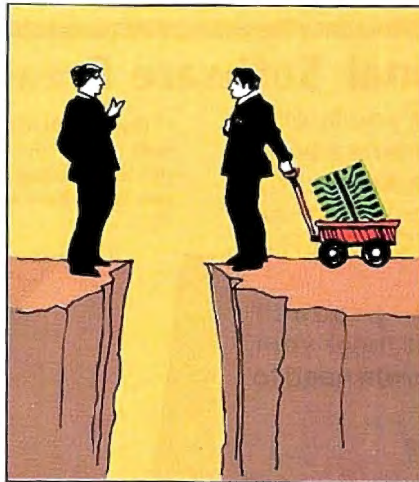
I used to have the same spontaneous rebooting problems with my Model I as Eric Maloney mentioned in his April Side Tracks column (p. 8)—but no more. I simply disconnected the cassette from the 110-volt line and installed batteries. I've been using this setup for over a year with no problems. Apparently, having the cassette recorder hooked up to the 110-volt line lets spikes through.

*Thomas E. Rider  
1102 Main St.  
P.O. Box 727  
Rainelle, WV 25962*

**Free Words**

I've written a word processor for the Model I that's capable of printing multiple columns, newspaper style. Called Intext 31.2, it requires at least 48K and one disk drive. And best of all—it's free.

Intext can print any number of columns, based on the number of pages contained in the document buffer and your printer's width capabilities. The program includes a utility that lets you use any printer.



If you're interested, send me a Model I TRSDOS 2.3 formatted disk with postage for the return trip. I'll send the entire program along with the necessary instructions on how to get multiple column printouts from an ASCII file. Sorry, but I can't send Intext's 15,000-word manual.

*Lynard Barnes  
320 S. Whipple St.  
Chicago, IL 60612*

**More 4P Storage**

After some experimentation, I found that the thinline drives in my 4P will format 42 tracks (cylinders in TRSDOS 6.1 language) instead of the usual 40. Use the following command:

```
FORMAT :1(cyl=42, Q=N, ABS)
```

This puts the directory on track 21, but it still functions properly. You can execute a back-up by answering yes to the backup prompt. The extra two cylinders provide an additional 9K of storage space. This is especially helpful on drive 1 because the operating system takes up so much space.

*Eric Burstein  
1515 E. Broad St.  
Columbus, OH 43205*

**More One-Liners**

Here's a one-line program that lets you change the name and date on your disks. I use it to prepare my disk files for indexing by an expensive program that doesn't have this feature. I designed the program for NEWDOS80, but I suspect it will work with any DOS that uses functions similar to PROT and TIMES.

```
10 INPUT "NAME";NS:CMD"PROT,1,
NAME=" + NS:CMD"PROT,1,DATE="
+ LEFT$(TIMES,8):GOTO10
```

*C.L. Robertson  
6 King Richard Drive  
Londonderry, NH 03053*

**Brownout**

During four years of trouble-free service with my Model I, I added a Percom doubler, LC modification, Omikron Mapper, and three disk drives. Everything was fine until the machine developed the nasty habit of shutting off in the middle of long programming sessions.

I thought the problem was a blown fuse in the main power supply, but after changing three supplies, I decided that wasn't the case. The problem persisted.

It seems that when the computer went down, the keyboard was the culprit. It couldn't handle the power strain caused by the recent addition of the mapper and doubler. The system worked fine when it was cool, but it fritzed out once it heated up.

I decided to parallel my two new extra power supplies to drive the keyboard. This meant mounting them externally, but what's a few more wires hanging from the back of the machine?

I've been using my Model I without problem nearly four hours a day since this latest modification. I hope my experiences can help fellow Model I users avoid similar frustration.

*R.M. Blunt  
692 S. High St.  
Denver, CO 80209*



# PICKING DAISIES?



## BROTHER HR15

Costs about the same—but it's slower, noisier, and needs its own brand of ribbon. To be fair, it's lighter.\* (But JUKI eclipses the BROTHER totally!)

## SILVER REED EXP500

Okay, it's lighter—but it's more than a whole word slower per second, it's noisier, lacks a buffer memory, and prints only a 10"-wide line.\* (JUKI triumphs again!)

## SILVER REED EXP550

You pay about \$100 more, and it's slower, noisier, has no buffer memory, and lacks the refinement of our linear stepper carriage motor. A little wider print line, yes. A bargain, no.\* (JUKI by a mile.)

## QUME LP20

Costs about \$300 more, needs its own brand of ribbon, and takes only a 96-character wheel. Is it worth it for just 2 more characters per second and a wee bit quieter machine?\* (Sorry, QUME, JUKI gets the trophy.)

## DIABLO 620

Costs about twice as much, weighs 19 lbs. more, and requires its own brand of ribbon. Pretty steep for a slightly quieter machine and 2 more characters per second.\* (The winner: JUKI.)

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\*Comparison based upon manufacturer's specifications rather than actual testing.

## READER EXCHANGE

### Parallel Punctuation

I'd like your readers to know that the apostrophes in Listings 3 and 4 of my article, "Parallel Driving" (March 1984, p. 126) aren't part of the Pascal programs. They can contact me at my new address.

*John Blommers*  
22526 N.E. 19th Place  
Redmond, WA 98052

### Help Wanted

Does anyone have a new or used Model II CPU in good condition for sale?

*Gregory S. Hancock*  
P.O. Box 1125  
Lebanon, VA 24266  
703-889-5570

I'd like to convert my TRSDOS 1.2 Electric Pencil to run on a TRSDOS 4.2 hard disk. I tried to transfer to TRSDOS 2.0a as an intermediate stage using an XFERSYS transfer with no luck. Does anyone have a patch that can help me?

*William F. Jupp*  
41 Queens Road  
Dorset DT11 7LA  
England

I recently purchased Micro Control System's CHROMAtr's high-resolution board. It's a great enhancement, but I can't find software for it, so I'm starting a club for the exchange of original games and programs designed

for the device. Interested readers can contact me at the address below.

*Adam Wallas*  
Route 12 Cherry Grove Road  
Franklin, TN 37064

Can anyone help me find a Level II kit for my Level I Model I?

*Danny Longcoy*  
5517 Ave. M  
Alta Loma, TX 77510

Does anyone know how to run Sea Dragon on a 64K Model 4 with two disk drives? I'd appreciate any comments, suggestions, or solutions.

*James Basile*  
220 Fulton Terrace  
Cliffside Park, NJ 07010

I have a C.Itoh 8510A parallel printer on my Model I with 48K, two drives and a Percom Doubler. I'd like to know what the control code is for double-width characters. The only way I have to print double-width characters is with Newscript. I seem to have gotten the manual for a serial printer (also the manual for the Apple). The command for double-width characters on an Apple is PRINT CHR\$(18). This does nothing on my printer except normal print. Is there an easy way to do bit image graphics on this printer? The section in the manual is about as easy to understand as a menu from an Italian restaurant in northern Tibet. I think I have the DIP switches

set properly, but I'm not sure. What are the correct DIP switch settings for a C.Itoh 8510A?

*John Solie*  
9731 Blanche Ave.  
Garden Grove, CA 92461

### New BBSes

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P.O. Box 486  
Jackson, CA 95642  
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Sysop: Dean Perano

Iso-Link  
Baltimore, MD 21224  
301-335-3103  
Sysop: Howard Leadmon

NationServ  
P.O. Box 391  
Fairfield, IL 62837  
618-847-2291  
Sysop: Ben Nation

### New User's Groups

Isle of Wight TRS-80 User's Group  
11 Star St.  
RYDE  
Isle of Wight  
PO33 2HX  
England  
Contact: S. Colson

Three Rivers User's Group  
533 Villa Park Court  
Fort Wayne, IN 46808  
Contact: R. Gainer

## DEBUG

I found several errors in the Debug (March 1984, p. 40) corrections for my article, "Catching Rays" (October 1983, p. 256). Readers who have made the Debug corrections should delete lines 1045, 1425, 1432, and 1435, change lines 480, 990, 1180, 1190, 1410, 1430, and 1670, and add line 1010 as shown below. Readers who have not made the Debug corrections should delete lines 1030, 1040, 1050, and 1060 of the original listing and incorporate the changes in Listing 1.

*Smith Harris*  
Route 4, Box 59  
Gray, GA 31032

```
480 MX=LO-SX
830 SI=INT(S):SM=(S-SI)*.6:SH=SI+SM:IF INT(SM*10+.5)=6 THEN
SM=0:SI=SI+1
835 SH=SI+SM
860 C=(12-S)*15*DR+ER+MR
990 IF LA-Z<0 THEN AZ=INT(A*RD-MG-SIN(AL*DR)*(MX+ED)-.5)
ELSE AZ=INT(A*RD-MG+SIN(AL*DR)*(MX+ED)-.5)
1010 IF LA-Z<0 AND S-ET-MC>12 THEN AZ=AZ+180
1180 IF LA-Z<0 THEN T=INT(ED-MG+MX+.5) ELSE T=INT(180-ED
-MG-MX-.5)
1190 IF T<0 THEN T=360+T
1410 IF LA-Z<0 THEN AL=FIX(90-(Z-LA)*RD-.5) ELSE AL=INT(90
-(LA-Z)*RD-.5)
1430 LPRINT ":",LPRINT USING P$;SU;:LPRINT " @INT(AZ-MG-.5),
":LPRINT USING P$;SD;:LPRINT " @INT(360-AZ-MG-.5),AL;"@T
1670 IF N>212+Q1 AND N<=243+Q1 LPRINT "AUG" N-(212+Q1);
```

*Program Listing 1. Catching Rays corrections.*

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# READER EXCHANGE

## Error Trap

"TRS-NUKE" (March 1984, p. 50) contains three errors. On p. 52, Table 2's steam generator level should be 30 for Rx/Turbine Trip and 40 for Lo Alarm. On p. 54, Fig. 6's 7805 voltage

regulator should read 1 2 3 instead of 1 3 2. Also, see Fig. 1 for corrections to Fig. 12 on p. 64. The upper right corner contains grounding information, and a connection change appears to the left of % Steam Dump.

—Eds.

```

9030 WA=WA/2/WP:WA=WA-FIX(WA)+1:WA=(WA-FIX(WA))*2/WP:WY=WA:
W=1:W8=1:W9=WA:I=1:I2=1:REM WY=SIN(WA) W=COS(WA)
9031 W1=WY:FORI=1TO2:I=I+1:W9=W9*WA/I:W8=W8*WA/I:WY=WY+
I2*W9:IFY<W1THEN9031ELSEI=0:I2=1
9032 W3=W:FORI=1TO2:I=I+1:W8=W8*WA/I:WY=WY+I2*W3:
W8=IFW<W3THEN9032ELSERETURN
9040 IFW=0THENWA=0:RETURNELSEW2=1/W:W3=W:I=3:IPW=1ORW=-1
THENWA=SGN(W)*WP/4:RETURN
9041 WA=W:IFABS(W)>1THENWA=SGN(W)*WP/2:I=1:GOTO9043:REMWA=
ATN(W)
9042 W5=WA:W3=W3*W*W:WA=WA-W3/I=-1*SGN(I)*(ABS(I)+2):IFWA<
W5THEN9042ELSERETURN
9043 W5=WA:WA=WA-W2/I:W2=W2/W/W:I=-1*SGN(I)*(ABS(I)+2):IFWA
<W5THEN9043ELSERETURN
9050 W4=.5:I=3:W1=W*W*W:WA=W+W4*W1/I:REM WA=ARCSIN(W)
9051 W2=WA:W1=W1*W*W*W4*I/(I+1):I=I+2:WA=WA+W5*W1/I:IFWA<
2THEN9051ELSERETURN9055REM End of Double Precision
Routines.
    
```

Program Listing 2. Additions to Feedback Loop (March 1984).

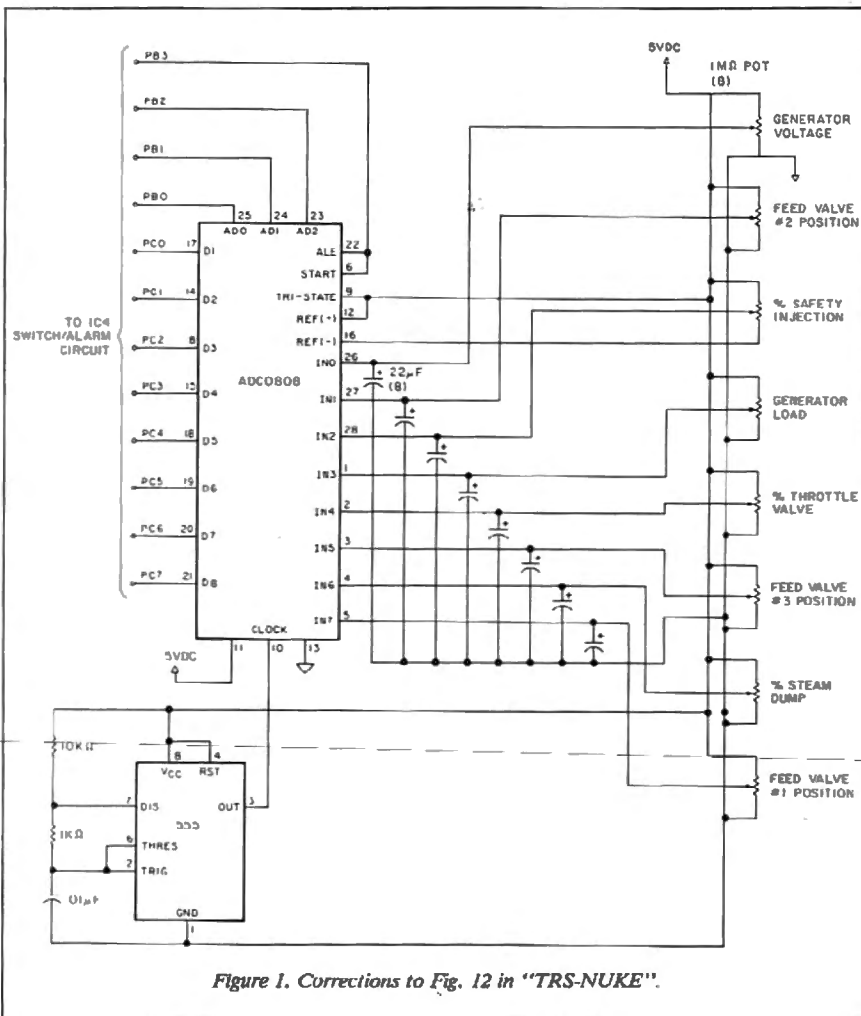


Figure 1. Corrections to Fig. 12 in "TRS-NUKE".

We failed to give Bradford N. Dixon, technical editor at 80 Micro, credit for his flower graphics demonstration program in the article "Up Close" (May 1984, p. 80).

—Eds.

Tidbit #2 in March 1984 (p. 178) contained several errors. All patches should have a space before and after the filespec. For example, the first patch should read:

```
PATCH *0 (ADD=4EB5,FIND=CD1B02,
CHG=B72846)
```

In the group of patches that alter the stepping speed of TRSDOS 1.3, the first patch was inadvertently printed twice; it also contained an error, as did the last one. Additionally, the second, fifth, and tenth patches that alter TRSDOS 1.3 from 40 to 80 tracks were inaccurate. Therefore, we have reprinted correct versions of these two groups of patches in their entireties (see Fig. 2).

—Eds.

In the double-precision subroutine that appeared in the March 1984 Feedback Loop (p. 16), lines 9030-9051 were incomplete or missing. To make the program run correctly, make the additions in Program Listing 2.

—Eds.

The formula for cell D14 is missing from Bruce A. Kurtz's article "Amortified" on pp. 59-62 of the May 1984 issue. The formula is @IF(C12=1,0,C8\*C14).

—Eds.

- ```

PATCH *0 (ADD=42EE,FIND=0C,CHG=0E)
PATCH *0 (ADD=4516,FIND=0C,CHG=0E)
PATCH *0 (ADD=4544,FIND=1C,CHG=1E)
PATCH *0 (ADD=4F61,FIND=0C,CHG=0E)

PATCH *0 (ADD=4926,FIND=28,CHG=50)
PATCH *0 (ADD=499B,FIND=28,CHG=50)
PATCH *0 (ADD=4B29,FIND=29,CHG=51)
PATCH *2 (ADD=4F61,FIND=28,CHG=50)
PATCH *6 (ADD=5C06,FIND=28,CHG=50)
PATCH *6 (ADD=5D53,FIND=28,CHG=50)
PATCH *7 (ADD=5203,FIND=28,CHG=50)
PATCH *7 (ADD=53FF,FIND=28,CHG=50)
PATCH *7 (ADD=5504,FIND=28,CHG=50)
PATCH *7 (ADD=5C4F,FIND=28,CHG=50)
PATCH *7 (ADD=5CD4,FIND=28,CHG=50)
PATCH *7 (ADD=0000,FIND=00,CHG=00)
    
```

Figure 2. Tidbit #2 corrections.

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| Double-Side Drive Support                                       | YES                | NO             |
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# H-P's Quiet Little Dynamo: The ThinkJet Printer

by Jim Heid

**Q**uick: Name a jet that doesn't hurt your ears when it runs. Give up? Try ink jet. Now name an ink-jet printer that won't empty your bank account when you buy it. Give up? Try "ThinkJet," billed as "the personal printer from Hewlett-Packard" (see Photo 1).

ThinkJet is an outstanding printer. It almost noiselessly prints at 150 characters per second, it's fast, versatile, rugged, easy to use and set up, and it's reasonably priced.

ThinkJet features a 1K print buffer; a bidirectional, logic-seeking print head; and an easily changed (one hand, two seconds), \$8 disposable print head that is good for 500 pages. It supports dot-addressable graphics (96 by 96, or 96 by 192 dots per inch) and underlines and prints bold in a single pass. It has four print pitches, prints on fanfold paper or cut sheets, and—get this—weighs five and a half pounds. It's only about the size of a box of cereal.

And it's not much louder. Thanks to its ink-jet technology, ThinkJet is quieter than any impact printer. You won't have to shout to be heard over it. You won't have to buy a printer silencer, and you won't have to put your printer in a padded closet.

## How It Works

There are two types of ink-jet printer technology. One, called continuous-stream printing, is complex and expensive. Typical continuous-stream ink-jet printers like the one made by IBM cost as much as \$30,000—cer-

edited by Susan Gubernat

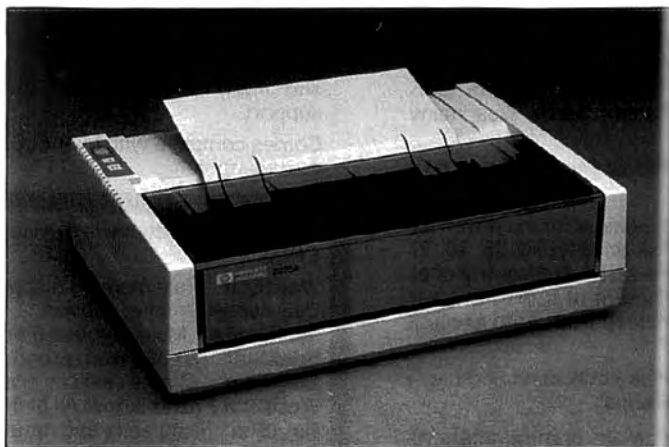


Photo 1. The ThinkJet printer.

tainly beyond the needs and budgets of most micro users.

The other type of technology, the kind used in ThinkJet (and by most manufacturers), is called drop-on-demand. ThinkJet employs an airtight ink cartridge that supplies ink to 12 channels on the print head. Each channel has a microscopic nozzle at its end; the nozzles are stacked vertically on the print head (see Fig. 1).

When the printer determines that a dot is to be printed, it sends a spurt of current through the proper channel to vaporize a minute amount of ink. When the ink vaporizes, the vapor bubble it forms travels through the channel, pushing the ink that's in front of it out the nozzle and onto the paper. The nozzle is refilled automatically through capillary action.

If you're having trouble visualizing a vaporized bubble of ink, think of water boiling. At boiling point, bubbles shoot from the bottom of the pan toward the surface, moving the water around them. The same principle makes ThinkJet work.

ThinkJet is available with three different interfaces. The Centronics-type parallel model is the one TRS-80 owners should consider. For this review, I tested the printer with a Model 100 and with a Texas Instruments Professional Computer.

## Installation

To set the printer up, you connect the cable at both ends and make sure that the printer's handy eight rear panel switches are properly set for your computer. The switches control certain printer actions and settings, such as

carriage return and line-feed activation, automatic form feed, page length, choice of character set, and so on. You don't have to know what each switch does to set it properly; the printer's manual contains a chart showing the correct switch settings for H-P, IBM, Apple, and Radio Shack computers.

ThinkJet responds to two different sets of control codes. One of the switches tells the printer which set to use. If the switch is up, the printer works with software that expects an Epson MX-80 or MX-100 printer. If the switch is down, the printer responds to Hewlett-Packard's own escape codes. In the H-P mode, the printer works with most software that doesn't specify a particular printer or that specifies an H-P printer.

Installing the print head couldn't be easier. You pull a lever, drop the cartridge in place, and snap the lever shut. Don't bother wearing gloves; your fingers are insulated from the ink by two layers of plastic. (H-P does tell you not to put the ink cartridges in

# Answer: Smith-Corona

**Question:** What company offers a new daisy wheel printer, three dot matrix printers and a combination printer-typewriter, with suggested retail pricing of \$395 to \$795?

**Question:** What printer company offers print quality that challenges printers costing hundreds of dollars more?

**Question:** What printer company offers dual interfaces for all five of its printer models?

**Question:** What printer company offers removable and adjustable tractor feeds as standard equipment on all of its dot matrix models?

**Question:** What printer company has a toll-free telephone number to call if you ever have a problem? And an extensive service system, too?

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your pocket, however. The ink can "wick out" through the microscopic nozzles.) When the ink runs out, you throw the old print head away.

Paper installation is equally easy. You pull the spring-loaded paper bail toward you, insert a sheet of paper in the printer until it comes out near the print head, make sure the pins are aligned with the holes in the paper (if you're using fanfold paper), and snap the bail back against the paper. If you use cut sheets, the procedure is the same, except that you don't have to worry about aligning pins with holes.

You can use any kind of paper in ThinkJet—I've even seen it print on a napkin—but you'll get better results with paper made for use with ink-jet printers. Most paper doesn't absorb the special ink-jet ink as well, and the result is often light print that smears easily.

The small perforations in the fanfold paper that H-P sells make separating the holes from each sheet easy, giving you printouts with neat edges. The small perforations have a disadvantage, however: they're not strong. The strips with the holes separate occasionally from the sheet while the paper is on its way through the printer, especially if there's a little resistance on the paper, causing the printer to jam. This didn't happen to me regularly, just often enough for me to wish the perforations were a bit stronger.

**Special Features**

To access the printer's special printing features (boldface, underlining,

*You can use  
any kind of paper—  
I've seen ThinkJet  
print on a napkin.*

and so on), your programs have to send it the proper escape sequence. As mentioned earlier, ThinkJet can respond to two control code sets. You can access all but a few of the printer's special features using either code. For example, the sequence to activate bold printing when the printer's in Hewlett-Packard mode is control-N, or LPRINT CHR\$(14), while the sequence in "alternate mode" is ESC E, or LPRINT CHR\$(27);CHR\$(69) in Basic. Figure 2 illustrates some of the printer's capabilities.

To measure ThinkJet's speed under average working conditions, I set up two test files on my Model 100. One file comprised 25 lines of 40 characters each; the other, 17 lines of 60 characters each. Printing in its normal character width (12 characters per inch), the printer printed the first file at an average speed of 76.9 characters per second, and the second at 92.7 characters per second.

**Documentation**

The preliminary documentation I received with my evaluation unit was thorough and easy to understand. The sections on setup had lots of square boxes where photos and figures will go, so the final manual should be well illustrated. Of course, this printer is so easy to use that you'll only have to

**ThinkJet**

★ ★ ★ ★

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\$495

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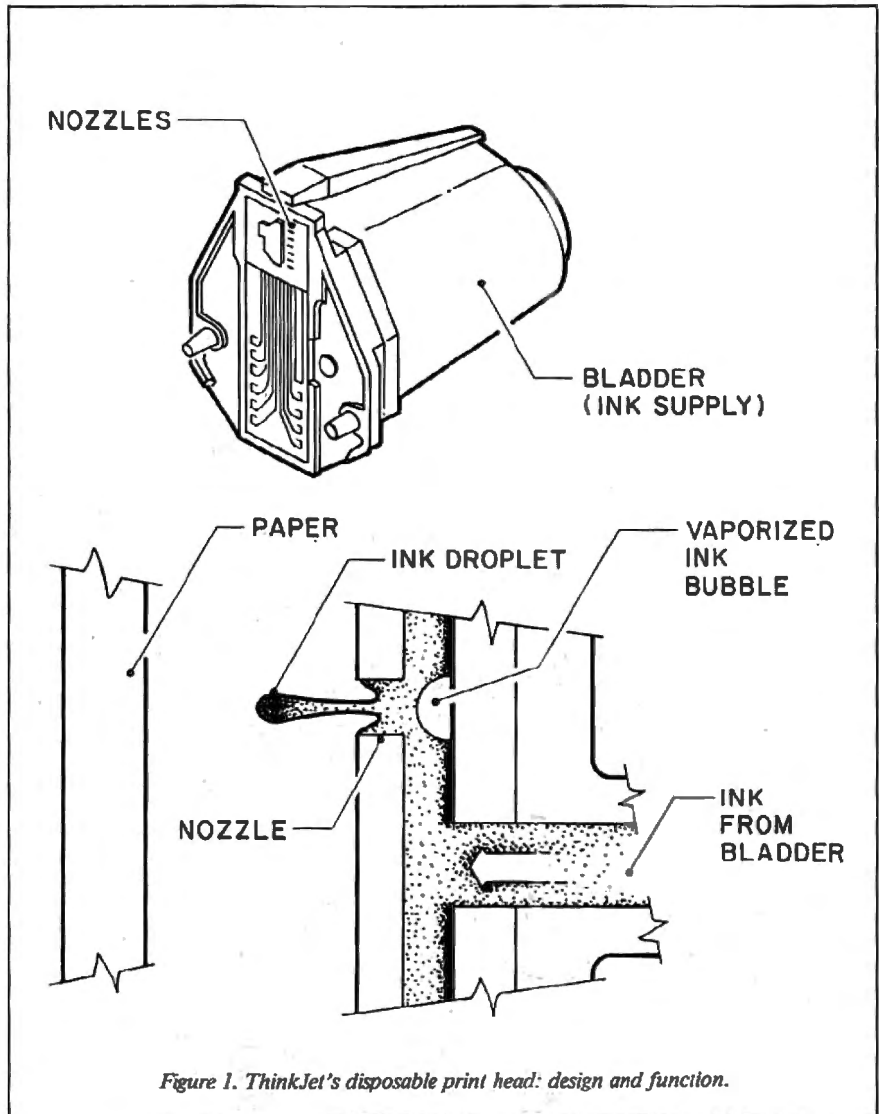
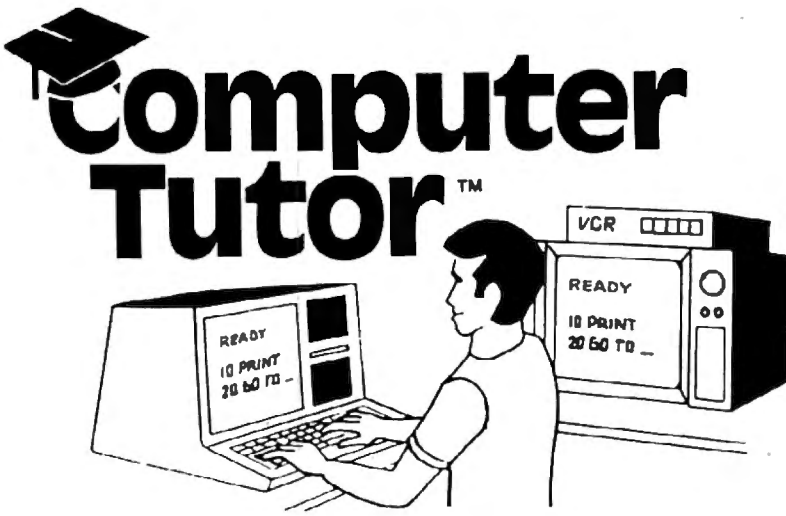


Figure 1. ThinkJet's disposable print head: design and function.



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The expanded CHARACTER SET

```

!@#$%^&*~'`1234567890-=~?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~mnop
qrstuvwxy-:;<=>?@ABCDEFGHIJKLMNPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~mnop
~?@ABCDEFGHIJKLMNPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~mnop
qrstuvwxy-:;<=>?@ABCDEFGHIJKLMNPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~mnop

```

Figure 2. ThinkJet's special printing features.

read the documentation if you want to control the printer with your own programs.

Unfortunately, that's where the documentation's weaknesses lie. It contains only two Basic program listings, and neither of them is more than 11 lines long. I would like to see more sample programs that illustrate the printer's features and show how to access them.

The section on graphics is equally weak. My preliminary manual devotes only three single-spaced, 8½ by 11 pages to graphics, and one of them contains the two Basic programs mentioned above. ThinkJet has fine graphics capabilities, but they're not very valuable if you don't know how to exploit them. Other printer companies have devoted a lot of attention to their manuals; I hope Hewlett-Packard follows suit.

### Conclusion

ThinkJet is an outstanding printer—fast, incredibly quiet, easy to set up and use, rugged, and reasonably priced. My only complaints—the fan-fold paper's occasional tendency to separate from its guide holes and the preliminary documentation's lack of detailed programming examples—are minor in comparison with the printer's advantages. If only you could use the battery-powered model with the Model 100—what a convenient setup that would make.

The Hewlett-Packard representatives with whom I spoke when this printer was introduced told me the company determined to get a bigger piece of the peripherals market. If ThinkJet is an example of what its products will be like, I'd say H-P stands a good chance of doing so. ■

## Transfer Your Files To the Model 2000

by Dan Keen and Dave Dischert

If you're a Model I/III/4 user upgrading to a Model 2000, you'll probably want to convert many of your Basic programs to run on the MS-DOS machine. We highly recommend Transfer's excellent Model I/III-to-Model 2000 transfer program, but cannot do the same for the Convert utility, which was a big help with spaces, but little else.

The Transfer package contains three programs: IBMI/CMD, IBM-III/CMD, and CONV. With Transfer, once you create an MS-DOS 1.0-formatted disk on the Model III and copy your programs and files to it, you can use it on either the Model III or the Model 2000.

Transfer's main handicap is that it is developed around the Model III. You must have access to a two-drive Model III in order to transfer the desired files onto a 1.0 disk.

With the Model III TRSDOS Convert utility, you bring the three machine-language programs supplied on a Model I disk over to a Model III disk. You then create a Model III system disk by placing a Model III system disk containing the uploaded Transfer programs in drive zero and a blank disk in drive 1.

### Transfer



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*Convert acts  
on only one of five  
major differences  
in GW-Basic dialect.*

After you enter the command IBM-III at the TRSDOS Ready prompt, the program displays a short menu that includes the option to create a 1.0 disk. When you've made that disk, you can copy programs and files on TRSDOS system disks from any disk in drive zero to the MS-DOS disk in drive 1.

You then can place the 1.0 disk in drive B on the 2000, with an MS-DOS system disk in drive A, the primary drive. The Model 2000 reads the programs on disk B and writes new ones to it. The Model III can read these new programs as well.

While the 2000 can store data on both sides of a disk, the Model III cannot. Because the 1.0 disk isn't a system disk, consider it merely an intermediate vehicle for transferring programs between the III and the 2000.

Besides formatting an MS-DOS disk on the Model III, the Transfer menu includes these options: a directory read, displaying an alphabetic sort of MS-DOS files; a utility to copy MS-DOS files to TRSDOS; a utility to copy TRSDOS files to MS-DOS; and an alphabetic sort of directories.

The Transfer program is easy to use and works well. Documentation is brief but adequate. This intermediate method may not be the most convenient, but it gets the job done.

**The Convert Utility**

Once you've put a Model III Basic program on a 1.0 MS-DOS disk, it won't necessarily run on the Model 2000 without certain modifications. Transfer's Convert utility aids in the conversion process.

After extensive study of the Model 2000's version of Basic, we discovered at least five major differences in the GW-Basic dialect. Yet Convert acts on only one of these differences and attempts to accommodate another.

Model I/III programmers have always been spoiled by the no-space shortcut allowed in cramming Basic instructions together. The proper syntax includes a blank space after each reserved word. For example, the instruction FORX = 1TO100 is valid on the Model I/III but generates a syntax error on the 2000. You must insert a space after the reserved words FOR and TO: FOR X = 1TO 100 here.

Transferring a long program over to the 2000 requires the time-consum-

ing task of adding spaces within program lines. The Convert utility takes the drudgery out of this task; this feature alone makes Convert a useful tool.

We tried to trick the utility into adding spaces where they didn't belong,

*Program Listing 1. Test of the Convert utility.*

```
10 REM TESTORPROGRAM
20 OPEN"R",1,"TEST/BAS:1"
30 PRINT@70,"SORTING DATA"
40 CMD"O"
```

but the software author had taken that possibility into account: The program does not add unnecessary spaces. We used the line

```
10 REM TESTORPROGRAM
```

to see if Convert would add a space after the embedded keyword OR, but the program made no changes in the REM line comments.

Still, the utility is incomplete. We wrote a test program (see Program Listing 1) and submitted it to Convert. The resulting program contained the necessary spaces, but Convert didn't make four other changes, any of which would crash the program on the 2000. The changes are:

- You must replace the slash (/) separating a file extension from the main body of a file name with a period to yield TEST.BAS; otherwise, you get an error message that reads, "Too Many Files."

- MS-DOS doesn't use drive designation numbers zero, 1, 2, or 3. The primary drive is A; the secondary drive, B. So you need to edit the Open statement to

```
OPEN"R",1,"B:TEST.BAS"
```

changing the slash to a period and the :1 to B:, placed before, rather than after, the file name.

- The PRINT@ command doesn't exist on the Model 2000. Locate Y,X, a similar command, assigns row and column numbers to place the cursor at any character position on the screen. You change the PRINT@ command to Locate by calculating the X and Y values.

- Finally, it's obvious that you won't be able to translate certain instructions from one machine to the other directly. Such is the case with PEEK and POKE since the memory map is different. Also, the instruction CMD should be flagged and brought to the user's attention.

The Convert program actually makes a mistake by changing CMD to the word SYSTEM. That works only when you change the Model III command CMD"S" (taking you back to the TRSDOS Ready mode) to SYSTEM. In our sample program we included the instruction CMD"O" (used to call an alphabetical sort routine on the Model III). The Convert utility changed this to SYSTEM "O"—improper syntax on the Model 2000. ■

**PAT-1 Road Tests,  
Realigns Drives**

by Amee Eisenberg

**B**efore I drop nearly a thousand bucks on a disk-drive diagnostic tool, I want to know that it's accurate, multi-functional, and easy to use. Dyan's Performance and Alignment Tester (PAT-1) Model 450 is such a tool. Use it to test your disk drives and to realign drives that need maintenance. In both capacities this small black box is a giant.

At its price, not including the \$30 to \$40 more for the digital diagnostic disks (DDD), PAT-1 is not a product for a one-computer owner. Similar system-specific products can do the same job. PAT-1's virtue is its hardware independence. It can test drives for a number of different computers, from the TRS-80 Model I to the Tandy 2000. It works on IBMs, IBM clones, and generally any disk drive (including 8-inch drives) that uses a standard ribbon cable connection. The person who maintains a fleet of computers, the computer store owner,

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## The PAT-1 System

PAT-1 comprises five parts: a hand-held black box Star Trek fans will immediately associate with a Tri-Corder (see Photo 2); a ribbon cable that connects the box to your disk drives; an external power source; a Dysan DDD; and the PAT-1 manual. The whole kit and caboodle weighs in at under five pounds, making it a natural for the technician who makes house calls. Pop the lid on the box and PAT-1 presents you with a 4-by-4-inch matrix keypad, a one-line display screen, and the place to plug in the ribbon cable that lets you hang up to two disk drives off PAT-1 at the same time.

The keypad has real buttons, not a monopanel, with the first 10 keys numbered zero through nine; the other keys are labelled as shown in Table 1.

## Testing

A disk drive, if it is to read and write to a disk correctly, must clamp the disk firmly into place, spin it at the correct speed, place the read/write head accurately on the disk, and repeat that placement with the utmost precision. The six tests programmed in PAT-1's automatic sequence (see Table 2) give you an accurate profile of the condition of your drive.

Index width and index timing (see Table 2) are two closely related tests. Since all locations your drive finds on a disk are relative to the disk's index hole, the time it takes for the drive to read the index hole pulse and the time between pulses are crucial to correct

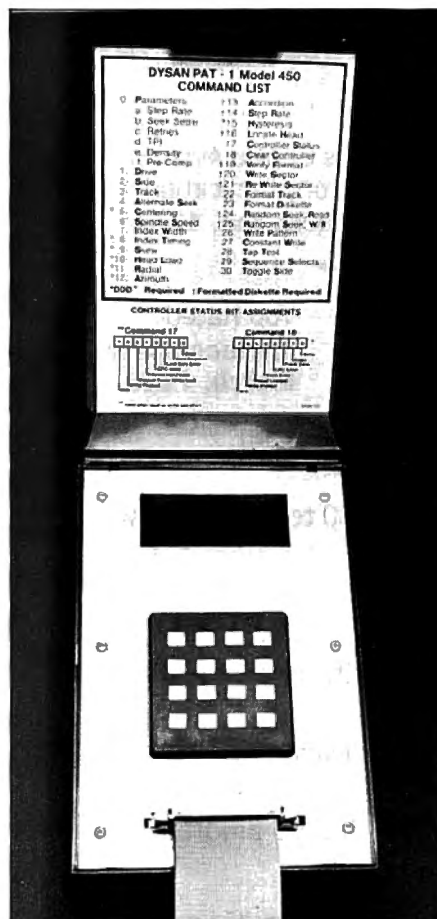


Photo 2. Dysan's PAT-1.

disk testing. The information these tests generate helps confirm the findings of the centering and spindle-speed tests, since any eccentricity in the disk adversely affects the index width and timing measurements. Radial and azimuth, tests for the drive's head alignment, give you information you need to optimize the drive's ability to read and write magnetic pulses on the disk.

Beyond its preselected test sequence, PAT-1 has a repertoire of 18 more exercises that diagnose every aspect of your disk drive's abilities (see Table 3). These additional commands "road test" your disk drives. Accordion, for example, is a torture test that sends the head from tracks 39 to zero, to 38 to 1, to 37 to 2, and so on, in waning sweeps until it arrives at the middle, then waxes back to its longest sweep. This pattern continues until a seek error appears (the drive can't find the track) or you press the abort (ABT) key.

Accordion, in concert with other tests like step-rate (which searches for the fastest speed at which the head can move) and the random seek tests (which randomly try to read, or read from and write to the disk) ensure that your drives really can take it. If you've spent time tracking down a problem that only shows up when the repair person's not around, then you'll appreciate PAT-1's thoroughness when examining a drive.

## Using PAT-1

PAT-1 lets you set up the physical parameters of the drive under consideration before you begin testing, then remembers those parameters for the duration of the exercises. Its default parameters include a 40-millisecond (ms) step rate and a 15-ms seek settle for a drive set to read a 48-tracks-per-inch (TPI), single-density disk. The first option PAT-1 presents on power-up is resetting these default parameters. PAT-1 defaults to zero retries of any given test, but may be set to retry up to 99 times.

Since the diameter of a track close

*Continued on p. 186*

| Key    | Function                                                            |
|--------|---------------------------------------------------------------------|
| Zero-9 | Enter any numerical input test programs require                     |
| SEQ    | Initializes preprogrammed exercise to evaluate drive's condition    |
| RST    | Reset                                                               |
| ENT    | Enter                                                               |
| DEL    | Delete                                                              |
| ABT    | Abort                                                               |
| TK0    | Track zero: relocates drive's read/write head to track zero on disk |

Table 1. PAT-1's keypad and associated functions.

| Test              | Function                                                                                                                              |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Centering         | Checks that disk is properly seated in drive; if not, other test results suspect                                                      |
| Spindle speed     | Indicates rotations per minute (rpm) at which drive spins disk (passing = 300 rpm); also reports speed in milliseconds per revolution |
| Index pulse width | Measures time it takes index hole to pass detector                                                                                    |
| Index timing      | Measures time from start of one index pulse to start of next                                                                          |
| Radial            | Checks distance from spindle to location of drive's read/write head                                                                   |
| Azimuth           | Checks for angle of head relative to disk                                                                                             |

Table 2. Tests programmed in PAT-1's automatic sequence (SEQ).

ANSWERS QUESTIONS  
YET TO BE ASKED!

TRSDOS/LS - DOS 6.x

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# The DOS

by John B. Harrell III

**W**hat is a disk operating system (DOS) and what can it do for you? Basically, all computers require some system in order to function in and communicate with their environment. In the early days of the Model I (Level I and Level II), an excellent read-only memory (ROM) executive provided the Basic interpreter and cassette operating system at a touch of the power-on switch.

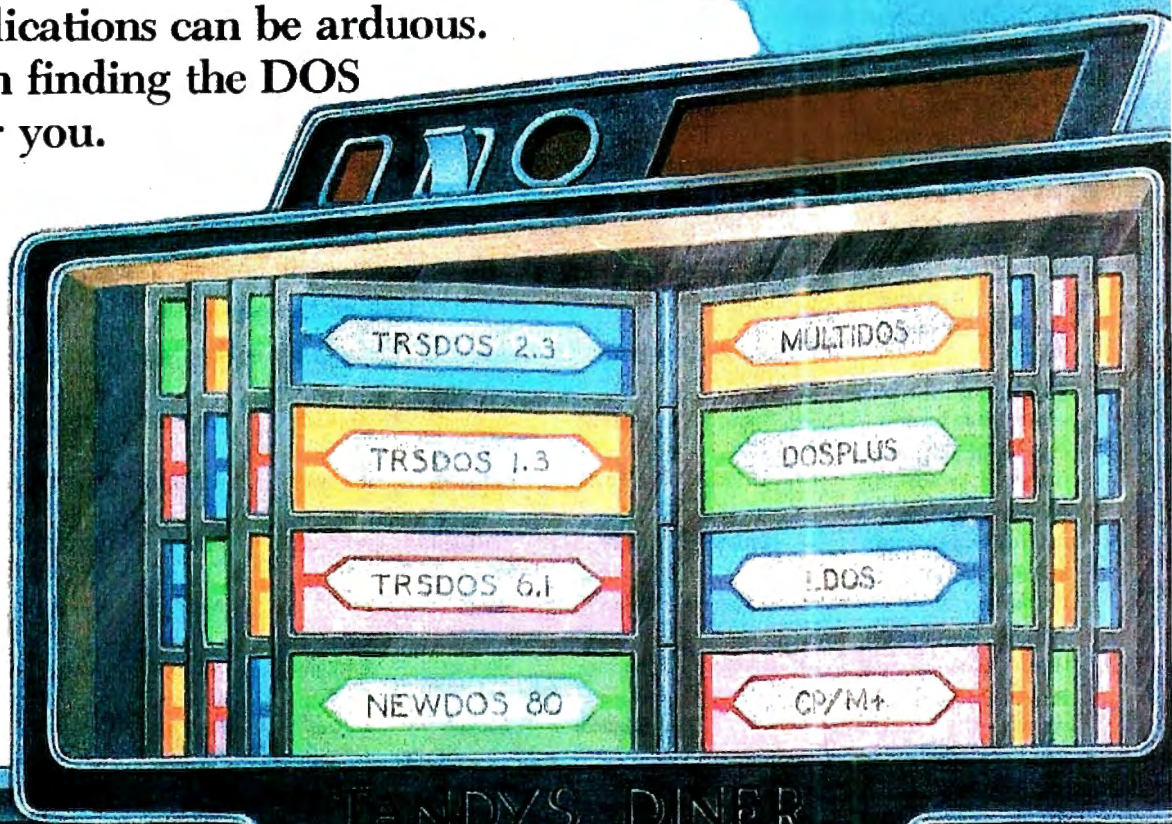
With the advent of the disk drive, the system's complexity and manageable resources changed significantly. The DOS is the collection of programs that control the computer's behavior, interpret command input, and manipulate data files on the disk. It also manages control over your program's requests for system resources and other automatic processes (interrupts).

DOSes fall into one of three categories: single-user systems (such as TRS-DOS), multi-user/multi-tasking systems (such as XENIX), and real-time operating systems (such as a manufacturing process control system). Here I explore only single-user operating systems for the TRS-80 Models I, III, and 4. These systems support one user and one terminal, and perform only one task at a time.



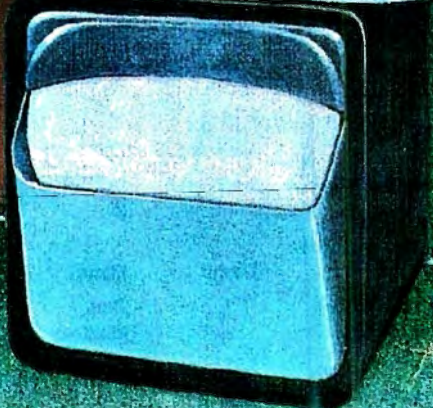
# Dilemma

Choosing the right disk operating system for your applications can be arduous. Here's help in finding the DOS that's best for you.



FANDY'S DINER

|      |   |   |   |   |   |   |   |   |   |   |
|------|---|---|---|---|---|---|---|---|---|---|
| HIGH | A | B | C | D | E | F | G | H | J | K |
| MED  | L | M | N | P | Q | R | S | T | U | V |
| LOW  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |



The first operating system was the TRSDOS 2.X series for the Model I. This system is primitive by today's standards and was originally plagued with errors. Tandy released numerous versions of TRSDOS over a brief period of time in an attempt to correct the problems.

Tandy's successors to Model I TRSDOS didn't fare much better. This system was succeeded by the Model III disk operating system, the TRSDOS 1.X series, and by the double-density version of the Model I system (TRSDOS 2.7DD). Several other manufacturers consequently introduced popular

Radio Shack-compatible DOSes that I'll also discuss here.

This article is not an attack on or an endorsement of any one DOS. If I put 50 people in the same room and asked them to justify their choice of a favorite DOS, they would have 50 different reasons why one system was better than another, and each reason would be valid from the user's viewpoint.

However, for purposes of comparison, I've used the Model 4 DOS (TRSDOS 6.2) as my base in this article and in the Table because it's the latest Z80 technology. I will consider other alternatives for the Model 4 and the major

operating systems for the Model I/III.

I will present the features of each DOS to help you choose the one that's right for you. Along with its features, I'll consider its compatibility with other commercially available software and other disk formats.

I'll also indicate the type of user for which each system is best suited. My criteria include how well the operating system does its job, how much you have to know about computers to use it, how much you have to know about the DOS to use it, and how much technical information about the system is available for advanced programming applications.

Table. Features of the major Model I/III/4 DOSes compared.

| Operating System Feature                        | Applicable Command in DOS |                |            |            |              |              |                |                |
|-------------------------------------------------|---------------------------|----------------|------------|------------|--------------|--------------|----------------|----------------|
|                                                 | TRSDOS 2.3                | TRSDOS 1.3     | TRSDOS 6.2 | LDOS 5.1.4 | DOSPLUS 3.5  | NEWDOS80     | MULTIDOS       | CP/M Plus      |
| Concatenate the contents of one file to another | Append                    | Append         | Append     | Append     | Append       | Append       | Append         | PIP            |
| Change file parameters (password, protection)   | ATTRIB                    | ATTRIB         | ATTRIB     | ATTRIB     | ATTRIB       | ATTRIB       | ATTRIB         | Set            |
| Change parameters of a disk (name, password)    | PROT (limited)            | PROT (limited) | ATTRIB     | ATTRIB     | PROT         | PROT         | PROT           | Set            |
| Specify automatic startup Procedure             | Auto                      | Auto           | Auto       | Auto       | Auto         | Auto         | Auto           | Submit         |
| Provide mirror-image copies of disks            | Backup                    | Backup         | Backup     | QFB/Backup | Backup       | Copy         | Backup         | COPYDIS        |
| Provide multiple files copying—single command   |                           | Copy (limited) | Backup     | Backup     | Copy/SYSGEN  | Copy         |                | PIP            |
| Perform a software reset of computer            |                           |                | Boot       | Boot       | Boot         | Boot         | Boot/Dead      | CTL-C Warm ST  |
| Build a file of ASCII data (for JCL)            |                           | Build          | Build      | Build      | Build        |              | Build          | ED             |
| Clear the video screen                          |                           | CLS            | CLS        |            | CLS          | CLS          | CLS            |                |
| Smart terminal software for RS-232/modem        |                           |                | COMM       | LCOMM      |              |              |                |                |
| Copy a file from input to output device         | Copy                      | Copy           | Copy       | Copy       | Copy         | Copy         | Copy           | PIP            |
| Create and pre-allocate file space              |                           | Create         | Create     | Create     | Create       | Create       |                |                |
| Set system date                                 | Date                      | Date           | Date       | Date       | Date         | Date         | Date           | Date           |
| Dynamic, interactive debugging system           | Debug                     | Debug          | Debug      | Debug      | Debug        | Debug        | Debug          | DDT/SID        |
| Display System Device status and data paths     | Device (non-functional)   |                | Device     | Device     | Force/CONFIG | PDRIVE/Route |                | Device         |
| Display disk directory and space usage          | DIR (no usage info)       | DIR            | CAT/DIR    | DIR        | CAT/DIR      | DIR          | DIR            | DIR/Show       |
| Execute a command language procedure            |                           | Do             | Do         | Do         | Do/EX        | Do/Chain     | Do             | Submit         |
| Copy selected memory areas to a disk file       | Dump                      | Dump           | Dump       | Dump       | Dump         | Dump         | Dump           | Save           |
| Link together two devices for input or output   |                           | Dual (limited) | Link       | Link       | Join         |              | Link (limited) | Device/Get/Put |
| List the contents of a file to display/printer  | List/Print                | List           | List       | List       | List         | List         | List/Print     | PIP            |
| Load a machine-language file into memory        | Load                      | Load           | Load       | Load       | Load         | Load         | Load           | DDT/SID        |

## TRSDOS 2.3

Early Model I disk owners could best classify their experiences with TRSDOS 2.3 as a stormy love affair—the relationship ranged from very good to terrible. TRSDOS 2.3 relieved the user from the uncertainties of the cassette recorder and provided all the basic functions required to manipulate data on disks (see the Table).

TRSDOS 2.3 introduced vagaries of its own that caused spurious system crashes and losses of entire disks of data. These problems persisted throughout the Model I's production run; they caused many users to flee to the first

of the new wave of products—NEW-DOS21 by Apparat.

Apparat's first entry into the disk operating system field provided a revised and enhanced copy of TRSDOS. This system was the forerunner of the NEW-DOS80 series and the start of a major enterprise for software houses. NEW-DOS21 was basically a much improved version of TRSDOS 2.1; I'll further discuss Apparat's contribution to this field when I study NEWDOS80.

Radio Shack's last venture in the Model I arena was the introduction of a DOS that supported their double-density modification. Arriving on the scene

after release of the Model III and many of the third-party operating systems, TRSDOS 2.7DD is only a modified Model I/III DOS that isn't truly compatible with either system.

You can find many of the new features incorporated into the Model III DOS in this system. However, Tandy's lack of support for double-density operation and failure to maintain compatibility with the Model I single-density format and system entry points destroy this system's usefulness.

In summary, the Model I TRSDOS versions offered a respite from the cassette recorder, but for anyone other

| Operating System Feature                          | Applicable Command in DOS |                   |                           |                           |                        |                        |                        |                      |
|---------------------------------------------------|---------------------------|-------------------|---------------------------|---------------------------|------------------------|------------------------|------------------------|----------------------|
|                                                   | TRSDOS 2.3                | TRSDOS 1.3        | TRSDOS 6.2                | LDOS 5.1.4                | DOSPLUS 3.5            | NEWDOS80               | MULTIDOS               | CP/M Plus            |
| Reserve memory locations and change parameters    |                           |                   | Memory                    | Memory                    | System                 | HIMEM                  | TOPMEM                 |                      |
| Make minor corrections to disk files              |                           | Patch             | Patch                     | Patch                     | Patch                  | SUPERZAP               | 7ap/<br>Patch          | DDT/<br>Patch        |
| Bulk deletion of selected disk files              |                           | Purge             | Purge                     | Purge                     | Kill                   | Purge                  |                        | Erase                |
| Delete a file and return allocated disk space     | Kill                      | Kill              | Remove                    | Kill                      | Kill                   | Kill                   | Kill                   | Erase                |
| Rename a file or the file's extension             | Rename                    | Rename            | Rename                    | Rename                    | Rename                 | Rename                 | Rename                 | Rename               |
| Read another system's disk format                 |                           | Convert (Model I) | CONV/Repair (Model I/III) | CONV/Repair (Model I/III) | Convert (Model I/III)  | PDRIVE (limited)       | VFU/<br>Convert        |                      |
| Reset a system device to its original condition   |                           | Route             | Reset                     | Rcset                     | Force/Join<br>Reset    | Route                  | Link/<br>Route         | Device/<br>Get/Put   |
| Route the data from/to one device to/from another |                           | Route (limited)   | Route                     | Route                     | Force                  | Route (limited)        | Route (limited)        | Device<br>Get/Put    |
| Activate special drivers for system devices       |                           |                   | Set                       | Set                       | Assign                 |                        |                        | GENCOM               |
| Set or change parameters for RS-232 serial I/O    |                           | SETCOM            | SETCOM                    | uses Set with driver      | RS-232 (Model III)     | SETCOM (Model III)     | SETCOM (Model III)     | Setup/<br>Device     |
| Change keyboard driver parameters                 |                           |                   | SETKI                     | (uses a filter)           | (uses a driver)        |                        | KEYBRD                 | Setup                |
| Spool data to a device                            |                           |                   | Spool                     | Spool                     | (uses a driver)        |                        | Spool                  |                      |
| Change system configuration, drive configuration  |                           |                   | System/<br>SYSGEN         | System                    | System                 | PDRIVE/<br>System      | CONFIG/<br>KEYBRD      | Setup/Set/<br>SETDEF |
| Set system time                                   | Time                      | Time              | Time                      | Time                      | Time                   | Time                   | Time                   | Date                 |
| Select a verification after each write operation  | Verify                    | Verify            | Verify                    | Verify                    | Verify                 | Verify                 | Verify                 |                      |
| Filter the transfer of information to/from device |                           |                   | Filter                    | Filter                    | Filter                 |                        |                        |                      |
| Format a blank or old disk for use                | Format                    | Format            | Format                    | Format                    | Format                 | Copy/<br>Format        | Format                 | COPYDISK             |
| Forms control of printer output                   |                           | Forms             | Forms (uses a filter)     | (uses a filter)           | Forms                  | Forms (Model III)      | Forms                  | Setup/<br>Device     |
| Display disk free space and disk allocation map   | Free (disk space only)    | Free (map only)   | Free                      | Free                      | Free (disk space only) | Free (disk space only) | Free (disk space only) | Show (only space)    |
| Display on-line help information                  |                           | Help              | Help                      |                           | Help                   |                        | Help                   | Help                 |
| Display a listing of all library commands         | LIB                       | LIB               | LIB                       | LIB                       | LIB                    | LIB                    | LIB                    |                      |

than the beginner, serious use of this system was hampered by the many software deficiencies that remain in the code today and by the almost total lack of technical information available from Radio Shack. Early users developed many tools to overcome this significant shortcoming, some of which were almost as misleading as the code was error-prone.

### TRSDOS 1.3

TRSDOS 1.3 evolved from the Model I's DOS as a "fully upward compatible" system. While this is partially correct—the system entry points are similar and the functions are a superset of the Model I system's commands—nothing could be further from reality.

TRSDOS 1.3 was designed to support the expanded capabilities of the Model III, primarily its double-density operation and a more powerful Basic interpreter in ROM. Many features of the computer and the operating system are incompatible with the Model I.

As with Model I TRSDOS, Tandy marketed numerous versions of TRSDOS 1.3 to correct a multitude of problems. To date, many bugs still exist, causing problems with the software developed for it.

Like its predecessor, TRSDOS 1.3 is of limited usefulness to Model III users. While its authors included many new DOS commands in the system in an attempt to increase its power and flexibility, the enhancements failed to overcome its incompatibility with other similar systems, its inherent problems, and its generally sluggish response. Again, I don't recommend this system for anyone but the beginner.

### TRSDOS 6.2

With the advent of the Model 4, Radio Shack demonstrated a significant departure from previous marketing practices. The DOS distributed with the Model 4 was written by an independent firm and bore no relationship to its predecessors for the Models I and III.

TRSDOS 6.2 is a derivative of the LDOS family (distributed by Logical Systems Inc., 8970 N. 55th St., P.O. Box 23956, Milwaukee, WI 53223), and was completely redesigned for the Model 4.

It incorporates many sophisticated features commonly found on more expensive computers. In addition, it uses the Model 4's new architectural concepts while providing you with a sound and dependable operating system for almost any application.

For those of you using hard disk drives on a Model I/III, TRSDOS 6.2 is closely related to Radio Shack's Hard Disk Operating System. That system is actually a version of LDOS licensed to Radio Shack for distribution.

---

**The Model I TRSDOS versions offered a respite from the cassette recorder, but for anyone other than the beginner, serious use of this system was hampered by the many software deficiencies that remain in the code today and by the almost total lack of technical information available from Radio Shack.**

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**While TRSDOS 1.3's authors incorporated many new DOS commands into the system in an attempt to increase its power and flexibility, the enhancements did not overcome its incompatibility with other similar systems, its inherent problems, and its general sluggish response. I don't recommend this system for anyone but the beginning user.**

---

In addition to a number of new commands (see the Table), TRSDOS 6.2 supports other valuable features, such as full device independence and redirection, comprehensive device filtering capabilities, an extremely capable telecommunications program, and a comprehensive Basic interpreter.

The TRSDOS 6.2 Basic interpreter incorporates the features of Microsoft's MBASIC interpreter series. This allows much more powerful programming structures and provides virtual compatibility with any other computer operating the MBASIC interpreter (such as the Model 2000). Microsoft's interpreter is also the prevalent one used under CP/M.

This switch to a new interpreter has been the subject of some controversy and criticism. So many programmers have written software for the Model I/III using the techniques provided in the TRSDOS reference manual for increased operating speed (i.e., compression of all the blank characters from the text, and POKEs and PEEKs in the operating system) that conversion to Model 4 Basic is a monumental task. But don't let this deter you—the power you get from the Model 4's higher clock speed and greater capabilities for structured programs make it all worthwhile.

Some other extensions of TRSDOS 6.2 require mention. The Model 4 architecture is significantly different from that of the Model I or III. The major difference is that the Model 4 doesn't have an installed ROM containing system functions or a Basic interpreter. It is structured as a 64K Z80 computer, similar to its larger family members—the Models II and 12.

Logical Systems has already transported TRSDOS 6.2 to the Models 11 and 12 under the product name LS-DOS 6.2. I haven't tested this system, but the distributor claims that Model 11 software runs on the Model II/12 under LS-DOS 6.2 with no changes. Logical Systems also provides the system's source code to OEMs for transportation to other Z80 computers. Are you looking at the successor to CP/M?

A well-written user's manual documents the features of TRSDOS 6.2 and the Basic interpreter. Also, a technical reference manual available from Radio Shack fully documents the system features required by advanced programmers and applications designers. The cost of this documentation is minimal and its availability is a significant departure from the principles Tandy used to market earlier DOSes. Logical Systems has recently released the TRSDOS 6.2 source code as well.

TRSDOS 6.2 is also directly compatible with Model I single-density disk formats and with LDOS Model I/III double-density formats. You can indirectly access other formats (such as NEW DOS80 double density or TRSDOS 1.3

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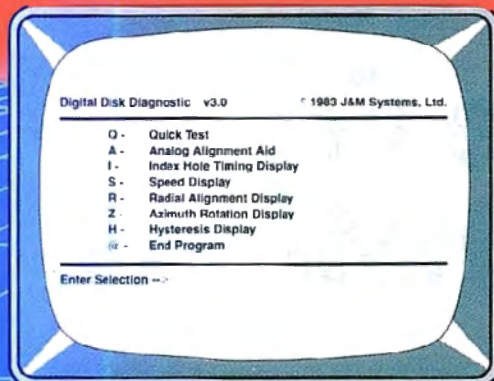
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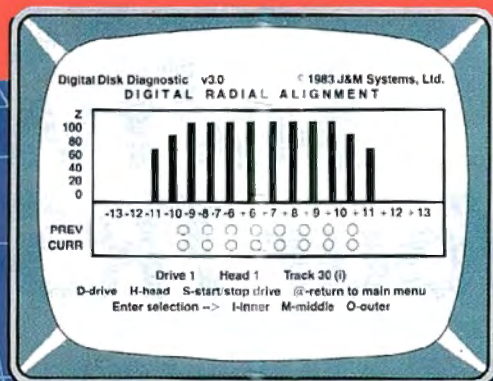
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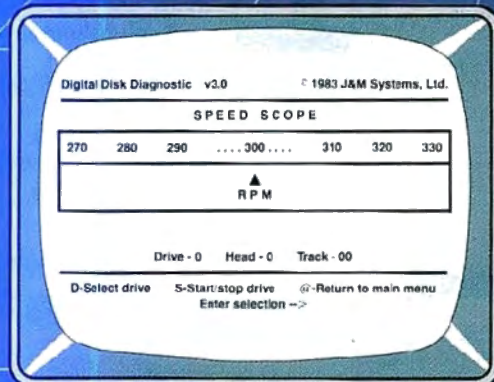
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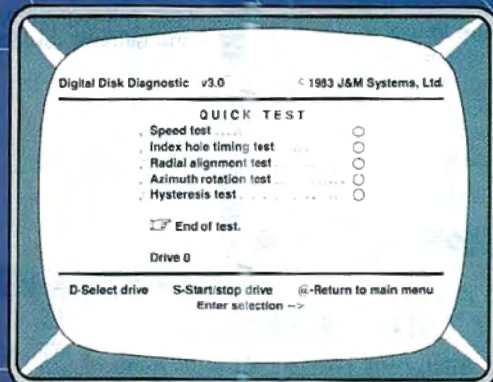
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by using the Model 4's Convert utility or by copying disk files to single-density disks and reading them with the system.

TRSDOS 6.2 is a full-featured DOS. Don't let that scare you if this is your first experience with a computer. The basic operations are simple and easily understood after a few hours of reading and experimenting with the system.

Don't be deterred if you're a more experienced programmer either. This system has plenty of features available for even the most experienced user. I'm constantly learning new capabilities of TRSDOS 6.2.

### **LDOS 5.1.4**

TRSDOS 6.2's nearest relative is LDOS 5.1.X for the Models I and III. It is available through Radio Shack and from Logical Systems.

LDOS 5.1.X is one of Radio Shack's first departures from software developed in-house. As I mentioned previously, LDOS was first adapted for Radio Shack's hard disk installation because it was one of the first DOSes to support this option easily and adequately.

If you compare the features in the Table, you'll see that this system is similar to TRSDOS 6.2. In fact, my first experiences with TRSDOS 6.2 were without reference to the operator's manual—I was able to rely almost completely on my familiarity with LDOS 5.1.4.

The most noticeable differences between the two systems include the Basic interpreters, the size of user workspace (TRSDOS provides more), the video appearance (the Model 4's screen is 80 characters wide by 24 lines long), the Model 4's higher clock rate (twice the speed of the Model III's), and LDOS's lack of an on-line, interactive Help facility.

LDOS is data-compatible with TRSDOS 6.X-formatted disks, allowing a complete interchange of information between the two modes of operation on the Model 4 without difficulty. This is exceptionally valuable in transporting software from the Model III mode to the Model 4 mode under TRSDOS. (~~Machine-language software is generally not transferable to the Model 4 mode unless you rewrite it to conform to TRSDOS 6.2's standards.~~)

Like TRSDOS 6.2, LDOS has a wealth of information available. Logical System's policy is to provide as much information as possible to assist you in using this powerful DOS. Unlike TRSDOS 6.2, the LDOS manual contains all this information.

LDOS 5.1.4 is a fully supported DOS with quarterly technical information available from LSI. Given all this technical material, this system initially appears to be too difficult for the beginning user. I feel that this isn't the case at all.

LDOS has something for everyone—the beginner will find the system forgiving, and it easily accomplishes each task. The experienced user will

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**TRSDOS 6.2 is a full-featured DOS. The basic operations are simple and easily understood after a few hours of reading and experimenting with the system. This system also has plenty of features available for even the most experienced user.**

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**LDOS is a particularly good, well-rounded system, offering the beginner powerful tools with which to experiment and learn. It also offers the advanced programmer or applications designer a firm base for software implementation in a reliable and capable environment.**

---

*find continuing challenges and a greater understanding of operating systems in the accompanying technical material.*

Most software is compatible with LDOS, but some exceptions do exist. First and foremost, LDOS makes extensive use of drivers and filters to enhance the DOS.

Using drivers and filters is an old concept. Each peripheral device requires a driver to communicate with the com-

puter and to provide the functions necessary to deal with the device's special features and requirements. A filter is a special-purpose code segment placed temporarily between the device and the driver. To avoid rewriting the entire driver, you can use a filter to perform specialized functions for a particular device.

LDOS's drivers and filters load and automatically relocate themselves to high memory. Software that doesn't honor the contents of the high memory protection address compromises the integrity of the operating system by overwriting these protected areas.

Secondly, software that uses non-standard and undocumented calls to the operating system (such as early TRSDOS 1.3/2.3 software) will probably fail. LDOS doesn't guarantee support for any function in any operating system other than those functions similarly documented and identified in the LDOS technical reference section. This isn't a hindrance; this section documents many more calls than you can find in similar sections of other DOSes and includes all TRSDOS function calls.

LDOS is a comprehensive, well-rounded system, offering the beginner powerful tools with which to experiment and learn. It also offers the advanced programmer or applications designer a firm base for software implementation in a reliable and capable environment.

LDOS requires no more user knowledge than TRSDOS 6.2. You can learn basic functions quickly and simply by reading the documentation and trying its many examples.

### **DOSPLUS 3.5**

DOSPLUS 3.5 is the latest operating system for the Model I/III from Micro-Systems Software Inc. (4301-18 Oak Circle, Boca Raton, FL 33431). It's a radical departure from the other systems developed by Micro-Systems Software. Earlier versions of DOSPLUS (the popular version 3.4, for example) operated in much the same way as TRSDOS 1.3/2.3 did—internal device drivers, no filters, and minimal device independence.

Of the major systems, DOSPLUS is closest to the LDOS family and, consequently, is fully data compatible with LDOS and TRSDOS 6.2. As the Table indicates, DOSPLUS contains almost all their standard features. In fact, the differences between these two families are difficult to distinguish.

# Why DOSes Disagree

by John B. Harrell III

Several important elements affect DOS compatibility: physical disk format (both directory and data area), density of the normal working medium, ability of the DOS to perform automatic density recognition, similarity of DOS entry points, and DOS device handling.

## Disk Format and Media Density

The first key factor that you must consider when implementing a DOS is the format and layout of the disk itself. This is the predominant area of incompatibility among TRS-80 operating systems, particularly those that are part of the Radio Shack product line.

The TRSDOS 2.3 disk format uses a granule (the smallest block of disk allocation) of five physical sectors of 256 bytes. Since each track on the disk can hold 10 sectors, two granules can be allocated per track.

This allocation scheme remained standard through several other systems (NEWDOS21, NEWDOS80 1.0, and so on) until the introduction of the Model I double-density controller and the Model III computer. Although storage density doubled, you couldn't write twice as much on the disks as before.

This is a physical limitation of the floppy disk controller and the amount of control bytes that the disk must store for a track format image. Because of this additional overhead, you can write only 18 sectors on each track in double-density format.

This strange number of sectors is the predominant reason for most DOS incompatibilities. How can you best format the sectors on a track to most effectively use the disk? TRSDOS 1.3 provides one alternative: Allocate space in granules of three sectors, providing six granules per track with no single-density support.

The LDOS/DOSPLUS families use another alternative. They use the standard allocation scheme to support single-density media: six sectors per granule (three granules per track) in double-density mode. LDOS's phrase "cylinder" is technically more correct; a cylinder is the collec-

tion of all tracks that the computer can read without repositioning the disk heads.

NEWDOS80 uses a third method that allocates granules with five sectors of disk space no matter what the disk density. This method doesn't easily fit the double-density track—hence, the birth of the term "lump." Apparatus defines a lump as the functional equivalent of a track normally containing two granules of storage. The user can redefine the number of granules per lump.

Another major area of incompatibility is the directory. Again, the most incompatible features exist in the Radio Shack DOSes. TRSDOS 1.3 manages the granule allocation map and handles the end-of-file marker totally differently from the other DOSes. The password encode routine is also different.

For one DOS to be able to read another's directory, it must know the disk location and entry format. Barring TRSDOS 1.3, the operating systems obey the general well-defined rules of TRSDOS 2.3. Additional features shouldn't interfere with the directory's basic functions.

Locating the directory is another matter. Most DOSes record the directory's track location in byte 3 of the boot sector. The track start location in NEWDOS80's boot sector is a lump start location that doesn't necessarily correspond to the beginning of any track. LDOS and DOSPLUS use the middle track (normally track 20 for a 40-track disk), while the other DOSes use track 17 as the directory starting track.

## System Function Calls

The next major area of incompatibility is system function calls. A system function call is an address that the DOS's documentation says will yield a specific result for any given call or invocation. This can include simple functions such as adding two numbers or complex functions such as opening and writing to a file.

Not only must you consider the DOSes individually in this area, but you must also consider the machine. Most DOSes have a basic kernel of

functions that are identical with other DOSes. The more sophisticated the DOS, the more complex the functions. Unfortunately, other operating systems don't usually implement these functions at compatible addresses. This is obviously the case in newer systems such as LDOS and DOSPLUS.

Not so obvious are the subtle differences in all DOSes due to hardware changes between the Models I and III. These hardware differences give the functions outside the basic kernel incompatible addresses. Programs using DOS's advanced functions don't run on the other model's version, let alone on another DOS.

To complicate this further, TRSDOS 6.2 uses a supervisor call (SVC) to communicate with the Model 4. It contains no standard addresses for communication, and Model I/III software doesn't run on the 4 without total revision of the input, output, and other system calls.

LDOS also has this feature, letting you develop software and move it to the Model 4 with few changes. This is the general method of implementation for a major computer system, and the beauty of it is that you don't have to rewrite your software to accommodate revisions in the DOS.

## Device Handling

Finally, the DOS's use of physical resources is vital. Each system has an integrated software package that allows communication with peripheral resources.

Implementation of device-independent drivers is an exceptionally powerful feature. Unfortunately, it makes obsolete any software that ignores the possibility of device independence.

For example, if LDOS routes all printer output to a disk file and the printer is off, routine calls to print characters function normally. If the program bypasses the printer device control block (DCB) and does its own output at the printer output port, the computer hangs up waiting for a printer-ready condition when output via the printer DCB would have succeeded. ■



One distinguishing feature concerns the system configuration during initial loading. Under LDOS, loading a configuration file is automatic if a file is present on the system disk. DOSPLUS requires that you load the configuration file as a system command function; you can specify this with the Auto command.

The strength of this option lies in the fact that the operator can change the system configuration at will without resetting the system simply by using the name of a configuration file as a command. LDOS has no provision for this feature.

DOSPLUS also lets you specify a number of commands on a single command line. You can specify some very powerful command sequences without resorting to a do-file.

The DOSPLUS distribution disk comes with two Basic interpreters: one with Micro-Systems Software's full enhancements and the other with a tiny Basic providing more program space. DOSPLUS Disk Basic is loaded with special options that afford you the easiest programming experience. For example, you can use names as the target of GOTO and GOSUB statements

instead of line numbers, and the error messages are the best I've seen.

The distribution disk also contains some powerful utilities. Software such as DISKZAP, DISKDUMP, DIR-CHECK, Map, and Restore should be a

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**DOSPLUS provides more support for the user who is technically oriented. Its many features for disk editing and its additions to Basic will be lost on the first-time user. It also is an easy and friendly system to use.**

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part of any serious programmer's library.

DOSPLUS does have some undesirable features. I don't like its job control language (JCL) facilities. LDOS can provide full parameter substitution and

conditional execution through compiled JCL procedures. DOSPLUS offers the same capability, but you have to execute a procedure JCL/CMD to load a driver into high memory. And you have to use two different commands: Do for the normal command line file and EX for the special JCL file.

Another serious limitation is the way DOSPLUS filters system devices. I'll call the two distinctly different methods of filtering a device "active" and "passive."

The active filter can intercept any data transferred to or from the device and perform a discrete action on it. For example, in LDOS this method activates and uses the functions in the MiniDOS filter; the filter intercepts clear-shift keys and activates the appropriate action routine.

DOSPLUS uses the passive filtration method. This provides for character translation by performing a table look-up operation. DOSPLUS intercepts a character and passes the matching byte in a table as the translated character. This method severely limits the extensions to the system that you can link in as part of the device handler routines.

DOSPLUS's technical documenta-

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tion is also superior. It supplies complete details about all facets of the system for the casual reader and for the serious programmer. Unfortunately, this information is disorganized and doesn't contain an index to help you locate material in the reference manual.

DOSPLUS is very similar to LDOS and TRSDOS 6.2. This system provides more support for the technically oriented user. Its many features for disk editing and its additions to Basic will be lost on the first-time user. It also is an easy and friendly system to use and supports any type of applications software within those stipulations I've mentioned for LDOS.

## NEWDOS80 2.0

NEWDOS80 is an extension of Apparat Inc.'s (4401 S. Tamarac Parkway, Denver, CO 80237) first venture into operating systems for TRS-80s, NEWDOS21—modified code from the original TRSDOS 2.1.

NEWDOS80 is a completely redesigned system. It supports the Models I and III in single- and double-density disk formats, and a wide variety of disk types. One version of the system supports hard disks. Unfortunately, in spite

of this sophisticated ability to handle many disks, NEWDOS80 can't automatically recognize disk density.

It also uses nonstandard concepts of "lumps" to format a double-density disk in a totally incompatible manner.

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**Based on its features, similarity to TRSDOS 1.3/2.3, and smaller volume of technical information, NEWDOS80 is ideal for the beginning disk user who is interested in extending beyond basic TRSDOS.**

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Lumps are units of disk allocation that NEWDOS80 uses in place of the more common track or cylinder (see the sidebar, "Why DOSes Disagree," for further information).

If you look at the Table, you'll note

that NEWDOS80 contains many of TRSDOS 6.2's features; as such, it's a powerful addition to your software library. One of its nicest features is the stringent compatibility Apparat tried to maintain with the older TRSDOS versions while producing a new and powerful system. Many software packages that won't run under LDOS or DOSPLUS run without modification under NEWDOS80. Apparat is to be commended for this effort.

Serious limitations do exist in the system, primarily in the areas of extensions to device drivers and filters. LDOS and DOSPLUS can easily extend the capabilities of devices, but NEWDOS80 has no such provisions. Also, it doesn't have an easy method for adding a filter to a device.

Another deficiency is that NEWDOS80 allows only limited device independence and input/output redirection. You can establish routes, but they're primitive and limited. For example, no command allows simple linking of the printer and display output devices, such as you can accomplish with TRSDOS 1.3's Dual command.







NEWDOS80 has relatively limited JCL capacity. You can concatenate

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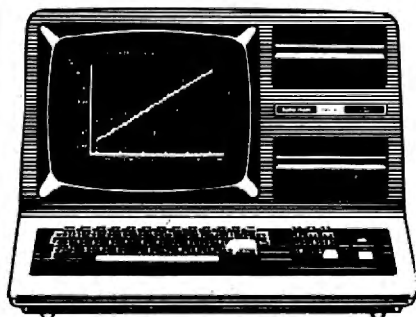
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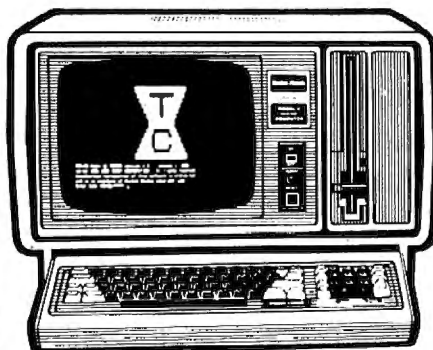
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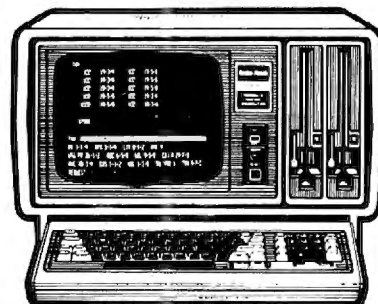
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procedures into one disk file to conserve disk space, then retrieve it easily. NEWDOS80 doesn't have features for conditional execution or parameter substitution in JCL file execution. One surprising missing feature is the capability for even a rudimentary Build command to create JCL files.

NEWDOS80's technical documentation isn't as voluminous as that for LDOS or DOSPLUS. However, it provides a complete discussion of the DOS's features and a great deal of clear, concise information on disk structure and file implementation. These principles are applicable to most DOSes.

Based on its features, similarity to TRSDOS 1.3/2.3, and smaller volume of technical information, NEWDOS80 is ideal for the beginning disk user interested in extending beyond basic TRSDOS. It lets him grow into more sophisticated functions without burdening him with the massive volume of technical detail in the other systems.

## MULTIDOS

MULTIDOS (Cosmopolitan Electronics Corp., 5700 Plymouth Road, Ann Arbor, MI 48105) has been available for the Models I and III for some time. While MULTIDOS is one of the less expensive operating systems, don't let its price fool you. MULTIDOS is full of goodies.

One of MULTIDOS's selling points is its ability to read all types of disk formats. I used MULTIDOS on as many different formats as I had available and was able to read them all without problems. The power of this one feature alone is exceptional, particularly if you work with many different formats.

MULTIDOS is a programmer's operating system. Not only is it full of disk editors and powerful memory management tools, but its Basic implementation contains many similar extensions. SuperBasic's functions include the ability to download/upload Basic Level II programs from disk, powerful program editing functions, and Boss features (single step, trace, variable review, and stacking a Basic program in memory while you work on another program).

As the Table indicates, MULTIDOS lacks several features that would give it big-system appeal. These include multiple-file selective copying, special device drivers and filters, and good support of file redirection and device independence.

MULTIDOS contains the most limited documentation I've encountered

since I first used TRSDOS. In fact, the documentation contains fewer pages than the TRSDOS 2.3 manual and the details on system entry points are even more sparsely documented.

Due to the sophistication of MULTIDOS's material and the general lack of depth in technical presentation, this system isn't useful to anyone but a dedicated programmer who needs its specific features to develop some application.

Billed as the "most compatible, user friendly operating system on the market," MULTIDOS doesn't even at-

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**Due to the sophistication of MULTIDOS's material and the general lack of depth in technical presentation, this system isn't useful to anyone but a dedicated programmer who needs its specific features to develop some application.**

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**CP/M Plus is a powerful option for the advanced user to have due to its flexibility and features, as well as its almost complete functional compatibility with the CP/M family of software.**

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tempt to maintain compatibility with the other operating systems on a functional level. Although MULTIDOS's data compatibility is important, so is being able to move your most valued program from your development system to your marketing system and still having it run.

## CP/M Plus for the Model 4

Digital Research Inc. has licensed CP/M Plus (otherwise known as CP/M 3.0) to Radio Shack for the Model 4. The system operates on the Model 4 in

two modes: non-banked mode for 64K computers and banked mode for 128K computers. Due to memory limitations the non-banked mode doesn't provide all of the CP/M 3.0 options; I will limit my discussion to options available in the banked version.

CP/M Plus is a far more powerful operating system than CP/M 2.2\*—the comparison is roughly like that between TRSDOS 6.2 and 2.3.

Features of the banked version include enhanced command line editing, full password protection for files and the disk itself, extended error handling, date/time stamps for each file, and faster execution via disk buffering of directory and data sectors read from disk.

In addition, system extensions let you execute more than one command per line, provide fairly flexible redirection of system character stream input/output devices, and allow conditional execution of Submit (JCL) files.

The Table shows that CP/M Plus provides most of the same features as TRSDOS 6.2. Considering my experience with CP/M 2.2, this one comparison is incredible. Top off this feature comparison with a quick look at the manuals and software provided in the package, and you'll realize that CP/M Plus is well worth the money.

Many new file names appear on the CP/M Plus distribution disks. These are the new commands that CP/M Plus implements; they provide the system's most powerful attributes. For example, Get and Put let you redirect the console/printer input/output for the duration of the next command.

SETDEF allows modification of the system's disk-file search method (no more "File Not Found" errors because you haven't referenced the correct drive). In fact, SETDEF lets you specify the order for searching the disk drives.

You no longer have to experience a "Read/Only" error on a disk drive because you forgot to reinitialize the system after changing disks. CP/M Plus recognizes when you've changed a disk and forces an automatic disk reinitialization.

The most radical difference between CP/M Plus and its predecessor is inter-

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\*CP/M 2.2 is available for the Model III via hardware modifications from Holmes Engineering Inc., 5175 Green Pine Drive, Salt Lake City, UT 84123, and Memory Merchant, 14666 Doolittle Drive, San Leandro, CA 94577. You can get the system for the Model 4 from Montezuma Micro P.O. Box 32027, Dallas, TX 75232.

nal. While CP/M Plus retains the Basic disk operating system (BDOS), Basic input/output system (BIOS), and console command processor (CCP), these routines perform significantly different functions.

Software written for CP/M 2.2 operates under CP/M Plus if operating system calls are made properly through the BDOS. CP/M Plus guarantees compatibility with the earlier version at the BDOS level.

Does it maintain compatibility? (I know you remember the earlier discussion about Model I/III TRSDOS.) Everything I've tried (MBASIC, WordStar, MicroProof, dBASE II, and so on) works without problem.

One word adequately describes the documentation in this package—extensive. An unbelievable array of reference manuals cover system use: Radio Shack's specific additions are a user's guide to the utilities, and programmer's and system reference guides. Unlike earlier Digital Research documentation, these manuals are clear, written in laymen's terms, and peppered with examples.

I indicate in the Table that CP/M doesn't provide a command for filtering

a device or modifying its performance by replacing the device driver. This isn't completely correct; CP/M Plus contains a powerful facility called the resident system extension (RSX) that you can invoke separately or embed in another program.

An RSX is a relocatable module that loads just below the resident operating system and intercepts all calls to the BDOS. You can make an RSX interpret any BDOS call and take any action you desire, such as performing the BDOS function itself or modifying the result of the normal system function.

Use of a simple flag controls whether the RSX is resident only until the next system warm start or remains a part of the system until you press the reset key. Using the RSX in system utilities allows powerful extensions such as nested Submit procedures and file redirection.

You also receive the Assembly-language source code necessary to tailor your system to your desires. The documentation covers the procedure, and all the required relocating assemblers and linkage editors come with the distribution package. The total retail value of the software included with this package is far in excess of the reasonable price

that Radio Shack charges for the system.

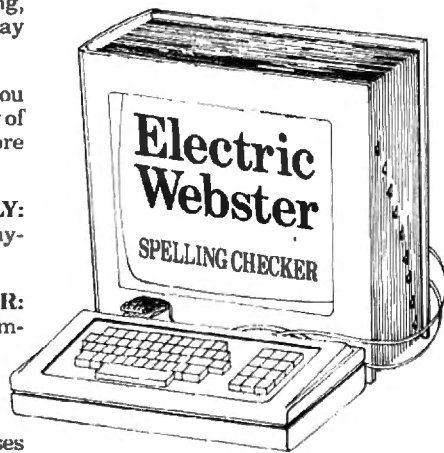
I also have some criticisms of the system. First is the strange disk format chosen: eight sectors of 512 bytes each for a total user capacity of 154K. However, the CCP and the CP/M Plus system files are stored as part of the user space and not on the system tracks; this reduces the figure by 27K, giving you total free space of 127K.

If you compare this to TRSDOS 6.2's or LDOS's disk format, you see that those systems give you 174K of usable space on a data disk and approximately 122-131K of usable space on a minimal system disk.

What bothers me most about this disk storage allocation is the apparent waste of 1K per track of disk space. The disk is capable of holding 10 sectors of 512 bytes per track, yielding a total disk capacity of 193K (an additional 1K for each of the 39 user tracks). With an operating system designed to use 8-inch disk drives, any limitation of drive capacity is unwarranted.

Another distinct disadvantage of this disk format is the inability to purchase CP/M software from any outside source. In the CP/M world, the 5¼-inch disk has never had a standard

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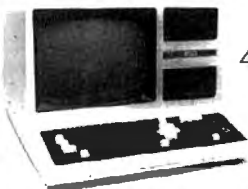
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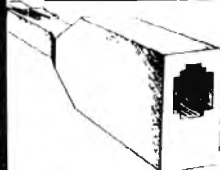
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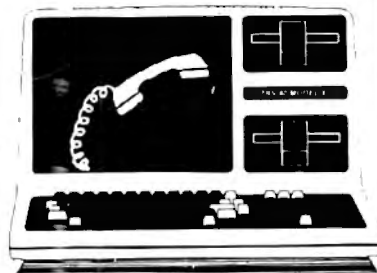
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format like the 8-inch drives. Some common alternatives, like the Osborne or Kaypro formats, let you easily integrate outside software such as dBASE and WordStar into the system.

Like many other CP/M systems, CP/M Plus is distributed with no Basic interpreter on the system disk. That's an additional option, complicated in this case by the CP/M Plus disk format. One alternative is Digital Research's CBASIC compiler/interpreter available from Radio Shack for their CP/M Plus.

CP/M Plus is mostly for advanced users and programmers who want a powerful DOS and compatibility with the CP/M world. However, like TRSDOS 6.2 this system has something for everyone, including the beginner. The most serious problems for the beginner are the formidable volumes of documentation, the mounds of detail, and the lack of a Basic interpreter.

The supplied documentation contains a lot of information about this operating system. CP/M Plus is a powerful option for the advanced user to have due to its flexibility and features, as well as its almost complete functional compatibility with the CP/M family of soft-

ware. I do not recommend this system if you don't have the full memory expansion; you won't recognize its full benefits.

## Conclusion

I've presented the salient points of each of the eight major Model I/III/4 DOSes on the market today so you can choose the one that will perform best for you. The additional information in the Table provides you with a rapid comparison of the systems.

Which is the best DOS? I can't answer that question to each reader's satisfaction—I have to consider too many variables. For example, TRSDOS 6.2 is my personal favorite, and it's part of the Model 4 system that you buy.

If you own a Model I or III, the choice is much more difficult. I would not recommend the TRSDOS series as your primary system. It's just too limited in scope to be really useful in any application. Another, more powerful, DOS is a necessity.

I recommend that you consider LDOS or DOSPLUS for their increased capabilities and compatibility with TRSDOS 6.2 for the Model 4. The choice between LDOS and DOSPLUS

is hard; they provide almost identical capabilities.

If you want to maintain close ties with Radio Shack, LDOS is the obvious choice as it is the only officially sanctioned system other than the TRSDOS series. DOSPLUS provides the advanced user with a somewhat more powerful system. It has numerous utilities for manipulation of disk structures and many programming advantages.

If you own a Model 4, you should have an operating system similar to LDOS. What you gain in system compatibility more than offsets the system's cost. You also have basically equivalent systems for Model III and 4 mode—no more referring to the TRSDOS 1.3 manual when you occasionally use Model III mode.

To make full use of the Model 4, you must add CP/M Plus. You gain the use of a fantastically powerful system and an introduction into the most prolific software community in the world. ■

*You can contact John B. Harrell III at 1519A Carswell Circle, Bolling Air Force Base, Washington, DC 20336.*

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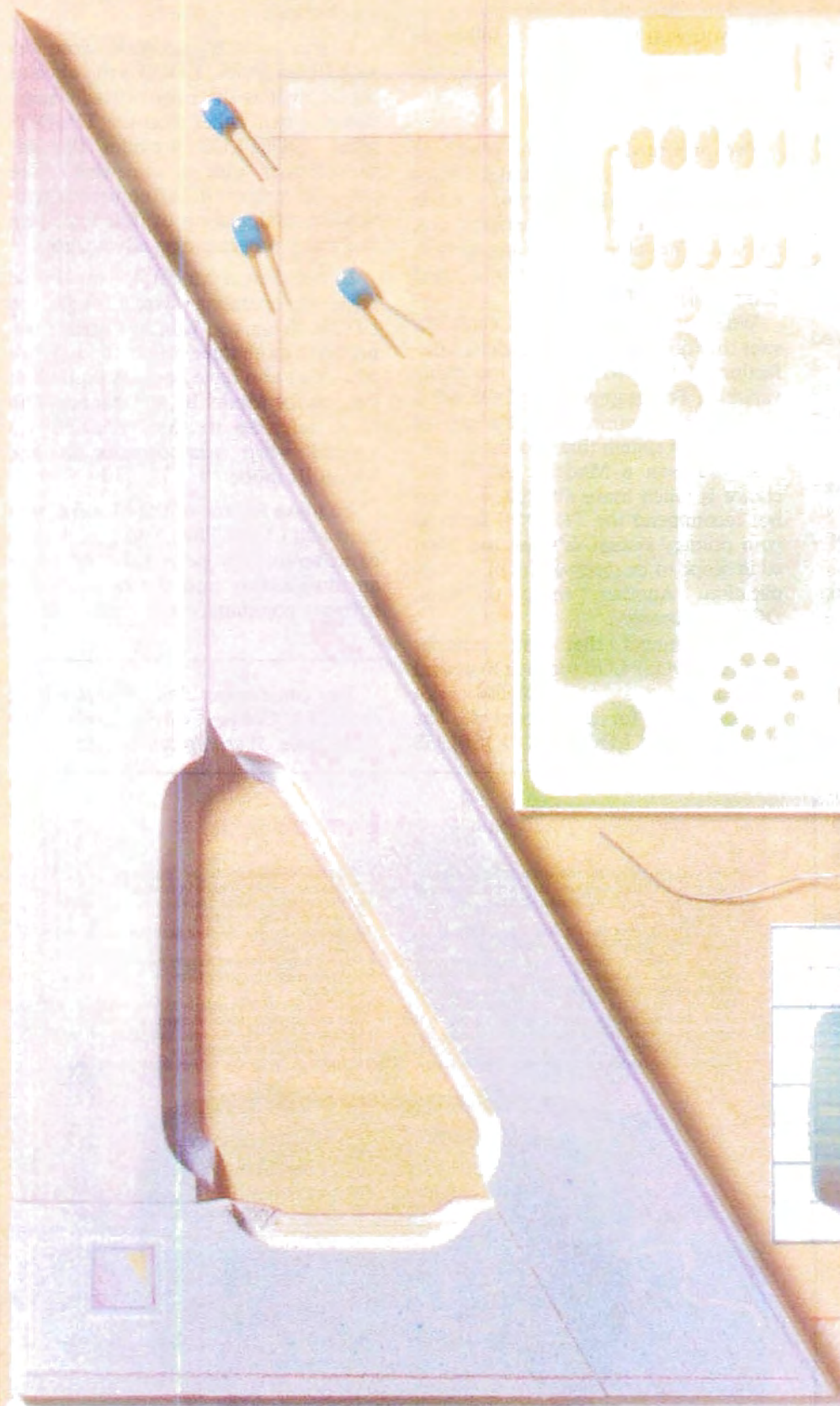
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# DRAWING BOARDS

Design a printed circuit board on your screen, then make a full-scale plastic template from the printout.

by Jim Clark

**I** got tired of wire-wrapping my electronics projects, so I tried designing printed circuit (PC) boards. Even though I used drafting materials, the boards never came out right. And it took as long to design a single PC board as it took to wire-wrap several devices.

One day while experimenting with my printer, I tried to print out a DIP (dual in-line package) socket. It worked. The sockets were exactly the right size—DIP pins fit in the DIP socket outlines perfectly.

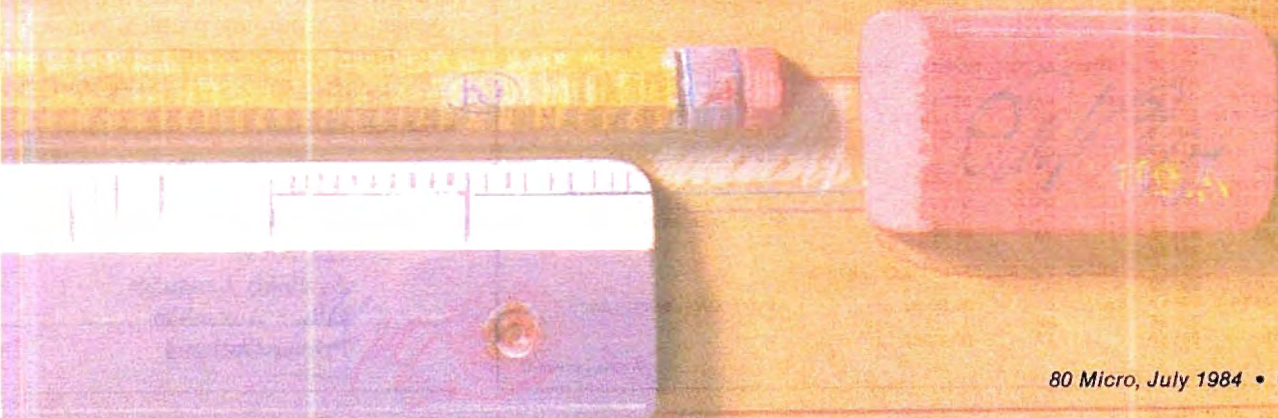
Armed with this knowledge, I wrote a machine-language program called Draw that lets you design PC board patterns on your Model I, III, or 4 (in Model III mode) and print them out on a dot-matrix printer (see the Program Listing). Draw works like a word processor, but manipulates graphics instead of words. If you

don't need printed circuit boards, you can use the program for drafting or sketching.

Draw lets you design both sides of a PC board and save the drawings to disk. You can also make a contact negative of your printout and use photo etching chemicals to make an actual PC board. Figures 1 and 2 contain sample printouts produced with Draw.

Draw requires one disk drive, at least 32K of memory, and an editor/assembler. Since the designs use lots of disk space, I suggest you save Draw on a clean disk.

The program works with TRS-80 Line Printers VII and VIII, and the Radio Shack DMP-100, -120, -200, -400, -420, and -500 printers. The DMP-100 and Line Printers VII and VIII print too large for exact reproduction and use as PC boards, but you can still use the program to draw



or draft. Connect your printer through the printer port, not the RS-232 port.

Draw might work with other printers, but I'm only familiar with Radio Shack models. I've included the modifications for other printers in this article.

### First Draft

After you assemble the program, return to DOS and type in DRAW. The program clears the screen and prints a title, pauses a few seconds, and prints whatever pattern is in memory. Press the zero key to clear the screen and type CL at the Enter Command prompt to clear the program's memory.

Now you can start to draw. Draw's cursor first appears in the upper left corner of a large drawing area; I suggest you try moving it with the arrow keys first. Draw scrolls the screen up, down, left, and right as you move the cursor across the drawing surface.

To get a sense of the program's capabilities, experiment with Draw's special commands (see Table 1). For example, you can press the enter key and one of the arrow keys to erase in that direction, press the space bar and one of the arrow keys to scroll in that direction, or press the shift key to draw on or display the PC board's other side.

Draw also prints a large assortment of pins, pin connectors, and pin sockets with one-key commands (see Table 1 again). The program prints the first pin of a connector or socket at your cursor position.

To make sure Draw is working correctly, you should test all the commands. Then print what you've drawn by pressing the zero key and typing P1 (see Table 2 for a complete list of command-mode commands). To stop the printer, press the break key. If Draw isn't working correctly, check the appropriate section of the program. Figure 3 contains a memory map of Draw, and Table 3 contains a list of Draw's subroutines.

For example, if your printout looks strange, check the program's SCRPT routine. If a printing problem persists, you might need a different printer.

*Continued on p. 70*

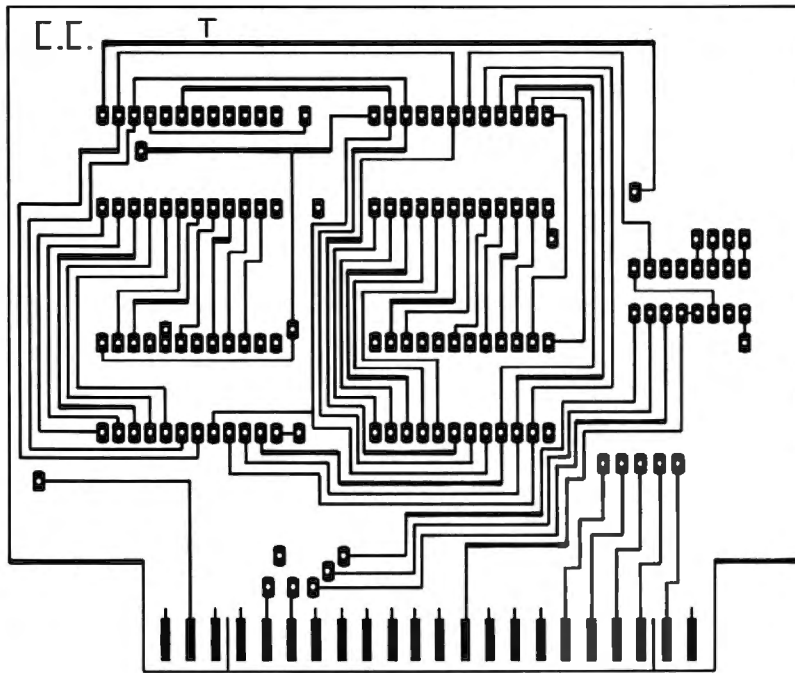


Figure 1. Sample PC board printout, side 1.

### Program Listing. Draw.

```

                                00010 ; PC BOARD DRAFTING HELPER   BY JIM CLARK 1983
                                00020 ;
                                00030 ;
                                00040 ;
                                00050 ; SET EQUATE STATEMENTS
                                00060 ;
3840 00070 KYB EQU 14400
95B7 00080 DOT EQU 95B7H
BBAA 00090 DOT1 EQU 0BBAAH
7FF8 00100 EDG EQU 7FF8H
7FFA 00110 DIR EQU 7FFAH
7FF9 00120 SPD EQU 7FF9H
3C00 00130 VID EQU 3C00H
01C9 00140 CLS EQU 1C9H
7FF6 00150 SID EQU 7FF6H
7FF7 00160 X EQU 7FF7H
7FFE 00170 Y EQU 7FFEH
7FPD 00180 X1 EQU 7FPDH
7FFC 00190 Y1 EQU 7FFCH
                                00200 ;
                                00210 ; START BY LOADING IN BEGINING CORDINATES
                                00220 ;
7000 310060 00230 START LD SP,6000H ; PUT STACK IN SAFE PLACE
7003 CDC901 00240 CALL CLS
7006 AF 00250 XOR A
7007 32F67F 00260 LD (SID),A ; START ON SIDE 1
700A 3E17 00270 LD A,17H
700C 32FE7F 00280 LD (Y),A
700F 3E40 00290 LD A,40H
7011 32FF7F 00300 LD (X),A
7014 3E01 00310 LD A,1
7016 32FD7F 00320 LD (X1),A
7019 32FC7F 00330 LD (Y1),A
701C 3E07 00340 LD A,7H
701E 32F97F 00350 LD (SPD),A ; SET SPEED TO (7)
7021 CD2E75 00360 CALL INTRO
7024 CDE671 00370 CALL MTSC
                                00380 ;
                                00390 ; START ACTUAL DRAWING ROUTINES
                                00400 ;
7027 CD3D70 00410 NEXT CALL KEYS
702A ED53FE7F 00420 LD (Y),DE
702E 79 00430 LD A,C
702F B7 00440 OR A
7030 2006 00450 JR NZ,SKIP
7032 CDF970 00460 CALL OFFSC ; TEST IF DOT OFF SCREEN
7035 CDBA71 00470 CALL SET ; SET IF B=0:RESET IF B=1
7038 CDD371 00480 SKIP CALL DELAY ; SLOW DOWN PROGRAM
703B 18EA 00490 JR NEXT
                                00500 ;
                                00510 ; CHECK FOR DIFFERENT KEY INPUTS
                                00520 ;
703D 3A4038 00530 KEYS LD A,(KYB) ; ARROW KEYS,ENTER,ETC
7040 B7 00540 OR A
7041 2017 00550 JR NZ,SOME

```

*Listing continued*

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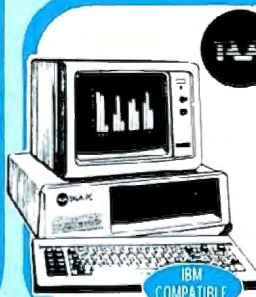
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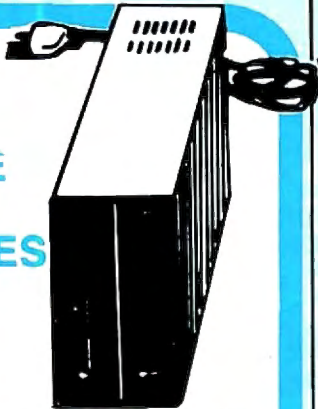


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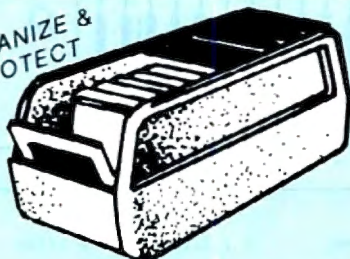
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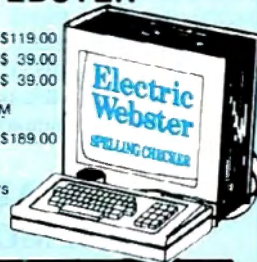
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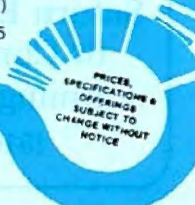
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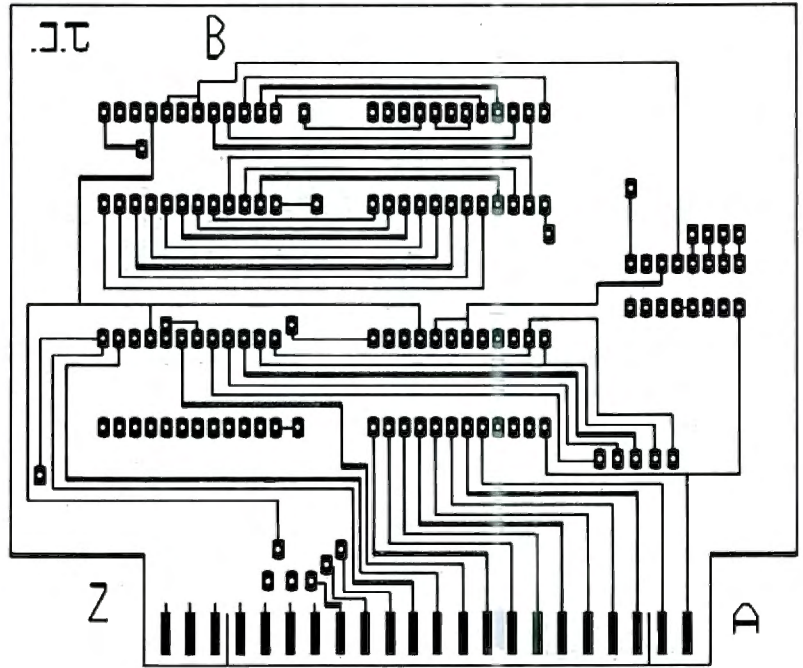


Figure 2. Sample PC board printout, side 2.

Listing continued

|               |       |           |                                     |                         |
|---------------|-------|-----------|-------------------------------------|-------------------------|
| 7043 3A1038   | 00560 | LD        | A, (3810H)                          | ; 1,2,3,4,5,6,7,0 :KEYS |
| 7046 B7       | 00570 | OR        | A                                   |                         |
| 7047 C27773   | 00580 | JP        | NZ,FUNCT                            |                         |
| 704A 3A8038   | 00590 | LD        | A, (3880H)                          | ; SHIFT KEYS            |
| 704D B7       | 00600 | OR        | A                                   |                         |
| 704E C24B73   | 00610 | JP        | NZ,SFLIP                            | ; @ABCDEFG KEYS         |
| 7051 3A0138   | 00620 | LD        | A, (3801H)                          |                         |
| 7054 B7       | 00630 | OR        | A                                   |                         |
| 7055 C2E372   | 00640 | JP        | NZ,FUNCT2                           |                         |
| 7058 18E3     | 00650 | JR        | KEYS                                | ; NO KEYS HIT           |
| 705A 4F       | 00660 | SOME LD   | C,A                                 |                         |
| 705B 0680     | 00670 | LD        | B,80H                               |                         |
| 705D ED5BFE7F | 00680 | LD        | DE,(Y)                              |                         |
| 7061 FE80     | 00690 | CP        | 80H                                 |                         |
| 7063 28D8     | 00700 | JR        | Z,KEYS                              |                         |
| 7065 FE02     | 00710 | CP        | 2H                                  |                         |
| 7067 2004     | 00720 | JR        | NZ,ARROWS                           |                         |
| 7069 CDC901   | 00730 | CALL      | CLS                                 |                         |
| 706C C9       | 00740 | RET       |                                     |                         |
| 706D 79       | 00750 | ARROWS LD | A,C                                 |                         |
| 706E FE01     | 00760 | CP        | 1H                                  |                         |
| 7070 28CB     | 00770 | JR        | Z,KEYS                              |                         |
| 7072 EG01     | 00780 | AND       | 1H                                  |                         |
| 7074 FE01     | 00790 | CP        | 1H                                  |                         |
| 7076 2030     | 00800 | JR        | NZ,MOVE                             |                         |
| 7078 0601     | 00810 | LD        | B,1                                 |                         |
| 707A CDBA71   | 00820 | CALL      | SET                                 |                         |
| 707D ED5BFE7F | 00830 | LD        | DE,(Y)                              |                         |
| 7081 0600     | 00840 | LD        | B,0                                 |                         |
| 7083 3A4038   | 00850 | LD        | A,(KYB); SEE WHICH ARROW KEY IS HIT |                         |

Listing continued

Continued from p. 66

driver (see lines 3120-4050 in the Program Listing).

**Printer Changes**

To make Draw work with a printer other than the ones I mentioned you should change the data at the end of lines 3160, 3180, and 3200 that set the printer's graphics mode. (Figure 4 contains the changes owners of Epson MX-80 printers should make to the Listing.) You should also change the "30" in line 3600 that takes the printer out of the graphics mode.

If your printer can't print more than

640 dots on a line, delete lines 3430, 3440, 3480, and 3520. Since some printers put the least significant byte (LSB) at the top of a line, and some put it at the bottom, you might need to change the data at the end of lines 3670, 3710, 3750, 3810, 3850, and 3890 to fit the number of bits and the order of LSB/MSB your printer uses. See Fig. 4 for an idea of what you need to do.

**Printout Preparation**

After you become familiar with Draw's features and they all work properly, you can design your first board.



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| 26-1069 20K Model 4 B&B RS232C Pure Radio Shack | 1259 |
| 26-1080 64K Model 4 Plus/Color 20K B&B RS232C   | 1399 |
| 26-1011 MC 10 Macro Color Computer              | 499  |
| 26-3026 16K Color Computer 2                    | 139  |
| 26-3027 16K Extended BASIC Color Computer 2     | 199  |
| 26-3127 16K Extended BASIC Color Computer 2     | 219  |
| 26-3590 Pocket Computer 3                       | 219  |
| 26-3601 Pocket Computer 2                       | 199  |
| 26-3650 Pocket Computer 1                       | 159  |
| 26-3801 Model 100 B&B Portable Computer         | 499  |
| 26-3802 Model 100 24K Portable Computer         | 679  |
| 26-4004 Model 12 2 Drive                        | 2310 |
| 26-4005 Model 12 2 Drive                        | 2370 |
| 26-5103 Model 2000 2 Drive 128K                 | 2333 |
| 26-5104 Model 2000 W/ Hard Disk                 | 3099 |
| 26-6004 Model 16B 1 Drive                       | 3361 |
| 26-6000 Model 16B 2 Drive                       | 3923 |
| 26-6006 Model 16B with built-in 12MB Hard Disk  | 5267 |
| 26-6050 DT 1 Terminal                           | 547  |

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|                                                  |     |
|--------------------------------------------------|-----|
| 26-1084 Model 4P Modem Board                     | 128 |
| 26-1173 DC Modem II                              | 127 |
| 26-1174 Acoustic Coupler Modem                   | 169 |
| 26-1175 DC Modem III                             | 89  |
| 16-1176 DLZ 22.2 High Speed Modem                | 330 |
| Anchor Mark 1000 Baud Modem with cable & RS-232C | 270 |
| Hayes Smartmodem 300 Baud                        | 225 |
| Hayes Smartmodem 1200 Baud                       | 575 |

### PERIPHERALS

|                                                          |      |
|----------------------------------------------------------|------|
| <b>LNW Model 1 Expansion Interface</b> 20K B&B RS-232C   | 329  |
| <b>12" Amber</b> Non-Glare Video Monitor                 | 98   |
| Video cable for Model 1 - keyboard to monitor            | 98   |
| 26-2017 Laminar 10" Flatbed Scanner                      | 24   |
| 26-1085 <b>NEW!</b> Model 4P Carrying Case               | 18   |
| 26-1130 Model 1 1.44MB Hard Disk Primary                 | 1019 |
| 26-1131 Model 1 1.44MB Hard Disk Secondary               | 1019 |
| 26-1132 Model 1 Hard Disk Disk 2 Primary                 | 1019 |
| 26-1133 Model 1 Hard Disk Disk 2 Secondary               | 1019 |
| 26-1183 Model 100 Bar Code Reader                        | 85   |
| 26-1197 <b>NEW!</b> Mouse for Model 2000                 | 20   |
| 26-1208 CCR II Cassette Tape Recorder                    | 17   |
| 26-1304 Ant. Gain Panel Model 101, 116                   | 34   |
| 26-1342 Detail Keyliner for Model 314                    | 11   |
| 26-1410 Model 100 Modem Cable                            | 17   |
| 26-1420 Automatic Mouse Spring Protector                 | 59   |
| 26-1467 Non-Automatic Mouse Spring Protector             | 42   |
| 26-1497 Ant. Gain Panel Model 101, 116                   | 34   |
| 26-2228 Color Computer Deuce RS-232C Kit                 | 99   |
| 26-3007 Color Computer Carrying Case                     | 34   |
| 26-3008 Color Computer Antenna Per Pair                  | 21   |
| 26-3012 Color Computer Deuce Joystick                    | 34   |
| 26-3022 Color Computer 2 Drive 12 or 3                   | 339  |
| 26-3033 Color Computer 2 Drive 12 or 3                   | 337  |
| Same as above except our brand Save \$\$\$               | 199  |
| 26-3024 Color Computer Multi-Pin Interface               | 153  |
| 26-3025 Color Computer Multi-Pin Interface               | 153  |
| 26-3029 Data Disk for Color Computer 2                   | 339  |
| 26-3503 PC 1 Cassette Interface                          | 9    |
| 26-3508 PC 1 Carrying Case                               | 29   |
| 26-3608 PC 2 Carrying Case                               | 29   |
| 26-3610 PC 2 RS-232C Interface                           | 26   |
| 26-3615 PC 2 48K RAM Adapter                             | 118  |
| 26-3616 PC 2 8K RAM Module                               | 118  |
| 26-3651 PC 4 Cassette Interface                          | 26   |
| 26-3652 PC 4 16K RAM Adapter                             | 118  |
| 26-3654 PC 4 Carrying Case                               | 8    |
| 26-3804 Model 100 AC Adapter                             | 3    |
| 26-3805 Model 100 Acoustic Coupler                       | 208  |
| 26-3806 <b>NEW!</b> Model 100 Disk Drive Thing           | 619  |
| 26-3807 <b>NEW!</b> 2nd Disk Drive                       | 208  |
| 26-3809 Model 100 Carrying Case                          | 412  |
| 26-4154 Model 12 160K Internal 12MB Hard Disk Kit        | 2120 |
| 26-4164 Model 12 160K Internal 12MB Hard Disk            | 2120 |
| 26-4166 Model 12 160K 15MB Secondary Drive               | 1690 |
| Use 700 3017 to add 26-4156 to Model 12 160K Internal HD |      |
| 26-4157 Model 2 1/2 160K Installation Kit for 26-4155    | 420  |
| 26-4161 Model 2 1/2 160K Installation Kit for 26-4156    | 420  |
| 26-5112 Model 2000 VM 1 Monochrome Monitor               | 212  |
| 26-5113 Model 2000 CM 1 Color Monitor                    | 679  |

### PRINTERS & ACCESSORIES

|                                                  |      |
|--------------------------------------------------|------|
| 26-1158 Datasheet II                             | 1165 |
| 26-1190 Plotter                                  | 440  |
| 26-1192 GCP 115 Color Graphics Printer           | 1069 |
| 26-1193 Flatbed Printer/Printer                  | 849  |
| 26-1250 DWP 410 Datasheet Printer                | 685  |
| 26-1252 DWP 600 200dpi Printer                   | 1099 |
| 26-1254 LMP 200 120dpi Printer                   | 594  |
| 26-1255 DMP 120 120dpi Dual Mode Printer         | 624  |
| 26-1256 DMP 2100 160dpi Dual Mode Printer        | 1895 |
| 26-1257 DWP 210 Datasheet Printer                | 697  |
| 26-1261 TP 10 Thermal Matrix Printer             | 845  |
| 26-1266 CR-510 Computer Card Reader              | 1440 |
| 26-1498 DMP 2100 160dpi Color Matrix Printer     | 6440 |
| 26-1268 COP 220 Color Ink Jet Printer            | 594  |
| 26-1269 PTC 44 64K Printer Controller (Buffer)   | 212  |
| 26-1271 DMP 110 500dpi Triple Mode Printer       | 339  |
| 26-1272 DMP 2150 Super High Resolution Printer   | 3299 |
| Single Bin Sheet Feeder for DWP 2100             | 849  |
| 26-1443 B-Directional Tractor for DWP 2100       | 144  |
| 26-1447 B-Directional Tractor for DWP 2100       | 144  |
| 26-1448 B-Directional Tractor for DWP 2100       | 144  |
| 26-1449 Single Bin Sheet Feeder for Datasheet II | 672  |
| 26-1455 Acoustic Cover                           | 339  |
| 26-1458 B-Directional Tractor for DWP 410        | 204  |
| 26-1461 Model 12 1/4 HP Printer Cable            | 29   |
| 26-1468 RS-232C Cable                            | 16   |
| 26-1409 Model 100 Printer Cable                  | 19   |
| 26-4401 Model 2 1/2 160/2000 Printer Cable       | 29   |
| 26-1488 RS-232C Cable for Model 1                | 25   |
| 26-1491 26 RS-232C Cable                         | 33   |
| 26-1492 30 RS-232C Cable                         | 33   |
| 26-1493 100 RS-232C Cable                        | 26   |
| 26-1494 RS-232C Cable 3/4 Printer                | 25   |
| 26-1496 RS-232C Null Modem Adapter               | 35   |
| 26-1498 SW 302 Parallel Printer Switch           | 102  |
| 26-1499 SW 303 RS-232C Selector Switch           | 102  |
| PC 1 Printer Cable                               | 102  |
| 26-3591 PC 3 Printer                             | 102  |
| 26-3605 PC 2 Printer                             | 102  |
| 26-3652 PC 4 Printer                             | 68   |
| 85104P PowerMate 1200cps Tractor/Parallet        | 349  |
| 85109P Same as above but IBM PC Compatible       | 410  |
| 85105P Hot Dot 180cps Real Fast                  | 495  |
| 85105CP Color High Speed printer                 | 549  |

|                                                |      |
|------------------------------------------------|------|
| 86008P New Letter Quality 1800cps 2 color      | 750  |
| 1500P Printer 2 120cps for Wide Paper Parallet | 589  |
| 1505CP Hot Dot 180cps Real Fast & Wide         | 875  |
| 1140U Starliner 40cps Datasheet                | 990  |
| F10-55P PrinterMate 55cps Datasheet FAST       | 1299 |
| F10 B-Directional Tractor with Planch Cover    | 210  |
| F10 Mechanical Single Bin Sheet Feeder         | 773  |
| F10 Color Gamma Beam 50cps                     | 199  |

### ANADK

|                                           |      |      |
|-------------------------------------------|------|------|
| LP 3028B 240cps Printer                   | 84   | 1099 |
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### SOFTWARE

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|                                                                                                         |     |
|---------------------------------------------------------------------------------------------------------|-----|
| <b>NEW CP/M 2.2</b> by Montezuma Micro for The Model 4. Rated best by actual test. Call for price list. | 192 |
| 26-0310 TRSDOS 2.3 for The Model 1                                                                      | 18  |
| 26-0312 TRSDOS 1.3 for The Model 4                                                                      | 12  |
| 26-0313 TRSDOS 1.3 for The Model 4                                                                      | 12  |
| 26-0314 TRSDOS 1.3 for The Model 4                                                                      | 26  |
| <b>NEW!</b> Disk Drive Analyzer. Why pay more?                                                          | 26  |
| 26-1507 Model 1 3 stickpack                                                                             | 85  |
| 26-1510 Model 1 3 Terabyte                                                                              | 85  |
| 26-1511 <b>NEW!</b> Model 3 Home Accountant                                                             | 169 |
| 26-1521 Model 1 3 Budget Planner/LN                                                                     | 85  |
| 26-1514 <b>NEW!</b> Model 3 Postman Manager                                                             | 169 |
| 26-1515 pts fee for Model 3                                                                             | 85  |
| 26-1516 pts fee for Model 3                                                                             | 85  |
| 26-1517 pts fee for Model 4                                                                             | 85  |
| 26-1518 pts fee for Model 4                                                                             | 107 |
| 26-1520 Model 4 1/2 Vidas/Can                                                                           | 212 |
| 26-1521 Model 3 Vidas/Can Business Forecast                                                             | 85  |
| 26-1527 <b>NEW!</b> Model 3 4 Formations                                                                | 169 |
| 26-1530 Model 1 Multiplex                                                                               | 85  |
| 26-1539 <b>NEW!</b> Model 3 4 W/In                                                                      | 85  |
| 26-1540 Model 3 4 Accounts Payable                                                                      | 169 |
| 26-1542 Model 3 4 Accounts Receivable                                                                   | 169 |
| 26-1543 Model 3 4 Payroll                                                                               | 169 |
| <b>NEW!</b> Model 3 4 Invoice Writer                                                                    | 169 |
| 26-1553 Model 1 3 Inventory Control                                                                     | 85  |
| 26-1554 Model 1 3 Inventory Pad                                                                         | 128 |
| 26-1556 Model 1 3 Disk Payroll                                                                          | 75  |
| Concrete Base CP                                                                                        | 85  |
| 26-1558 Model 1 3 Business Making List                                                                  | 85  |
| 26-1559 Model 1 3 Manufacturing Inventory Control                                                       | 169 |
| 26-1560 Fast Reports                                                                                    | 85  |
| 26-1562 Model 1 3 Budget                                                                                | 85  |
| 26-1563 Model 1 3 SCRIPST                                                                               | 14  |
| 26-1564 Model 1 3 Mailgram                                                                              | 20  |
| 26-1565 Model 1 3 Memo                                                                                  | 20  |
| 26-1566 Model 1 3 Marks 4 Office Systems                                                                | 258 |
| 26-1569 Model 3 Vidas/Can. Ethical Version                                                              | 169 |
| 26-1570 Model 1 3 Surveying                                                                             | 85  |
| 26-1579 Model 1 3 Real Estate                                                                           | 85  |
| 26-1581 Model 3 Project Manager                                                                         | 85  |
| 26-1582 Model 1 3 Personnel Manager                                                                     | 85  |
| 26-1583 Model 1 3 Time Manager                                                                          | 85  |
| 26-1584 Model 3 Check Writer                                                                            | 85  |
| 26-1585 Model 3 Business Check writer                                                                   | 127 |
| 26-1588 Model 1 3 Vidas/Can                                                                             | 82  |
| 26-1589 Model 1 3 MICRO                                                                                 | 127 |
| 26-1590 Model 1 3 SuperSCRIPST                                                                          | 169 |
| 26-1591 Model 1 3 SuperSCRIPST                                                                          | 127 |
| 26-1592 Model 3 Desktop/Printer 80                                                                      | 169 |
| 26-1593 Model 3 Printer Plus LDDOS/H/D                                                                  | 294 |
| 26-1594 Model 3 Desktop/Printer 80                                                                      | 169 |
| 26-1600 Dictionary for the Model 4                                                                      | 89  |
| 26-1596 SCRIPST for The Model 4                                                                         | 85  |
| 26-1597 Model 3 Business Graph's Pak                                                                    | 148 |
| 26-1598 Model 4 Vidas/Can                                                                               | 212 |
| 26-1600 Dictionary for the Model 4                                                                      | 89  |
| 26-1922 Model 4 CD Orchestra 90                                                                         | 25  |
| 26-2011 Model 1 3/FDAS Data Version                                                                     | 29  |
| 26-2012 3A Assembly Language Development Course                                                         | 125 |
| 26-2013 EDAS Data Version Model 1/3                                                                     | 131 |
| 26-2014 Model 3 Disk Course                                                                             | 29  |
| 26-2015 Model 3 Instruction Tapes                                                                       | 29  |
| 26-2017 Model 3 Assembly Language Course Tape                                                           | 34  |
| 26-2018 Model 3 Assembly Language Course Disk                                                           | 34  |
| 26-2019 <b>NEW!</b> HDOS 6.1 Training Course                                                            | 64  |
| 26-2022 Power Tool for the Model 1/3                                                                    | 43  |
| 26-2023 Dot Plot for the Model 1/3                                                                      | 108 |
| 26-2150 Introduction to the Model 4                                                                     | 199 |
| 26-2190 Model 4 CURBOL                                                                                  | 199 |
| 26-2191 Model 4 CURBOL Runtime Disk                                                                     | 85  |
| 26-2200 Model 3/FORTRAN                                                                                 | 85  |
| 26-2201 Model 1 3 FORTRAN                                                                               | 85  |
| 26-2203 Model 1 3 FORTRAN                                                                               | 126 |
| 26-2204 Model 3 Compiler BASIC                                                                          | 126 |
| 26-2205 Micro Plot                                                                                      | 17  |
| 26-2206 CURBOL Runtime Disk                                                                             | 23  |
| 26-2210 Model 3 BASCOM                                                                                  | 199 |
| 26-2211 Model 3 PASCAL                                                                                  | 212 |
| 26-2212 PASCAL for The Model 4                                                                          | 212 |
| 26-2213 Model 1 LDOS (LSI version)                                                                      | 60  |
| 26-2214 Model 3 LDOS (LSI version)                                                                      | 60  |
| 26-2216 CP/M 2.2 for the Model 4                                                                        | 108 |
| 26-2217 The Good CP/M for the Model 4/MI                                                                | 199 |
| 26-2217 CBASIC for the Model 4 (Requires CP/M)                                                          | 199 |
| 26-2218 <b>NEW!</b> BASCOM for the Model 4                                                              | 120 |
| 26-2219 <b>NEW!</b> FORTRAN for the Model 4                                                             | 85  |
| 26-2220 2 Vidas/Can                                                                                     | 29  |
| 26-2224 Computer (Down Jones Sign-up Kit)                                                               | 17  |
| 26-2619 Model 3 Compiler                                                                                | 42  |
| 26-2710 Color Computer PILOT Disk                                                                       | 88  |

|                                                     |     |
|-----------------------------------------------------|-----|
| 26-2718 PILOT III                                   | 101 |
| Color Computer LOGO Disk                            | 85  |
| 26-2721 Color Computer LOGO ROM Pack                | 85  |
| 26-3030 OS 4 for The Color Computer                 | 85  |
| 26-3032 BASIC 99 for The Color Computer             | 85  |
| 26-3038 <b>NEW!</b> Compiler for the Color Computer | 85  |
| 26-3821 Model 100 Learning Labs                     | 25  |

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| 26-4503 Payroll                                   | 339  |
| 26-4504 Accounts Receivable                       | 254  |
| 26-4505 Accounts Payable                          | 254  |
| 26-4506 Making List                               | 101  |
| 26-4507 Making List II                            | 637  |
| 26-4508 Medical Office Systems                    | 637  |
| 26-4509 Manufacturing Inventory Control           | 319  |
| 26-4510 Vidas/Can                                 | 254  |
| 26-4511 Vidas/Can                                 | 152  |
| 26-4512 Job Copying                               | 120  |
| 26-4513 Odeur Editor                              | 169  |
| 26-4513 Profile Plus                              | 294  |
| 26-4516 Preplay Training Guide                    | 50   |
| 26-4517 Profile Plus Upgrading                    | 294  |
| 26-4520 Times                                     | 254  |
| 26-4521 Vidas/Can                                 | 850  |
| 26-4522 Electronic Brewer                         | 850  |
| 26-4526 Vidas/Can Business Forecasting            | 85   |
| 26-4527 MMSPT 2.0                                 | 339  |
| 26-4532 SCRIPST Utility Disk                      | 109  |
| 26-4534 SCRIPST Dictionary                        | 169  |
| 26-4536 SCRIPST Program Driver                    | 85   |
| 26-4540 Statistical Analysis                      | 254  |
| 26-4541 Ligation Support                          | 254  |
| 26-4550 Business Lab's Analysis Pak               | 212  |
| 26-4554 Accounts Payable                          | 107  |
| 26-4555 Menu Writer                               | 33   |
| 26-4556 Profile Forms                             | 106  |
| 26-4557 Profile Archive                           | 42   |
| 26-4558 Profile Present                           | 169  |
| 26-4559 Profile                                   | 169  |
| 26-4560 WESTLAB                                   | 211  |
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### ALL NEW MODEL 2000 GOODIES

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| <b>NEW!</b> Accounts Payable         | 420 |
| <b>NEW!</b> Accounts Receivable      | 420 |
| <b>NEW!</b> Inventory Control System | 420 |
| <b>NEW!</b> Inventory Control System | 420 |
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| <b>NEW!</b> Softhem                  | 42  |

### 8000 SOFTWARE

|                                         |     |
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| 26-6212 Vidas/Can Development System    | 637 |

Draw has limitations; you must use the DOS commands Dump and Load to save and load your designs. To save a design, press the zero key to return to the command mode, then press the enter key to return to DOS.

If you're saving a single-sided design, save from 8000 hexadecimal (hex) to A000 hex, using a command such as DUMP PCB/CIM:0(START=8000, END=A000). To save a double-sided board, save from 8000 hex to C000 hex, using the same command format.

To work on a design you've saved to disk, you must load it into memory before you run the program. For example, to load the program saved above, type LOAD PCB/CIM, press the enter key, then load Draw.

Making a printed circuit board from your printout is similar to developing a photograph. If you don't have a darkroom and experience developing film, ask someone who does to help you.

Since you photograph your printout, it must be of high quality. Most printers mentioned earlier in the article produce satisfactory printouts, but you should avoid using the Radio Shack DMP-100

and -120. I use a DMP-200. It helps if your printer can print in boldface, because dark printouts make better negatives.

Before you begin the negative, check your printout for breaks or omissions in the printing, such as where a line feed occurs, and touch them up with a pen or dark pencil.

Making a negative isn't easy—it requires lots of experimentation. First, lay your printout flat on a piece of high-contrast ortho film, such as Kodalith. Then place a clear glass or plastic cover

over the printout, pressing it tightly against the film.

To make a test print, place a piece of cardboard over the glass, covering the whole pattern to prevent light from reaching the film. Then expose the film by sliding the cardboard off the pattern about 1/2 inch every three or four seconds and continue until it's uncovered. This creates a range of uniformly decreasing exposures.

Develop the test print to determine which exposure time produced the best negative, and use that exposure to develop your final negative. Don't be discouraged if you have to try several times before you get it right.

## Making the Boards

Making the PC board is easier than printing the negative, but it takes longer to expose and develop. You'll also need special printed circuit board etching and developing chemicals. I started with a photo-sensitive PC board kit that contained all the necessary materials and instructions. I suggest you find something similar.

| Keys  | Function                           |
|-------|------------------------------------|
| P1    | Print PC board side 1              |
| P2    | Print PC board side 2              |
| PA    | Print PC board sides 1 and 2       |
| CL    | Clear all drawings from memory     |
| DR    | Set printer for boldface mode      |
| LI    | Set printer for single-strike mode |
| Sn    | Set drawing speed (n = 1-9)        |
| Enter | Return to DOS                      |

Table 2. Command-mode commands.

| Keys                  | Function                               |
|-----------------------|----------------------------------------|
| Up arrow              | Draw up                                |
| Down arrow            | Draw down                              |
| Left arrow            | Draw left                              |
| Right arrow           | Draw right                             |
| Enter/up arrow        | Erase up                               |
| Enter/down arrow      | Erase down                             |
| Enter/left arrow      | Erase left                             |
| Enter/right arrow     | Erase right                            |
| Space bar/up arrow    | Scroll screen up                       |
| Space bar/down arrow  | Scroll screen down                     |
| Space bar/left arrow  | Scroll screen left                     |
| Space bar/right arrow | Scroll screen right                    |
| Clear                 | Clear screen                           |
| Shift                 | Display PC board's opposite side       |
| A                     | 10-pin connector type A (narrow)       |
| B                     | 10-pin connector type B (wide)         |
| C                     | Copy and store pattern                 |
| D                     | Display pattern stored with C          |
| E                     | 8-pin socket                           |
| 1                     | 14-pin socket                          |
| 2                     | 16-pin socket                          |
| 3                     | 20-pin socket                          |
| 4                     | 24-pin socket                          |
| 5                     | 40-pin socket                          |
| 6                     | 1-pin socket                           |
| 7                     | Remove changes or mistakes from screen |
| 0                     | Enter command mode                     |

Table 1. Draw's special commands.

| Subroutine                 | Function                                                                                                     |
|----------------------------|--------------------------------------------------------------------------------------------------------------|
| GETAD                      | Returns with cursor's video address.                                                                         |
| MOV                        | Scrolls screen stored in direction A: 0=up, 1=down, 2=left, 3=right.                                         |
| OFFSC                      | Checks if (X,Y) is off screen, scrolls screen in opposite direction.                                         |
| MCHECK                     | (DE) register set must equal (X1,Y1) screen position. Stops at edge if (X1,Y1) is past edge of drawing area. |
| MTSC                       | Copies (X1,Y1) memory location to screen.                                                                    |
| SCTM                       | Copies screen to (X1,Y1) memory location.                                                                    |
| CLR                        | Clears screen.                                                                                               |
| SCRPT                      | Copies drawing to printer (in graphics mode).                                                                |
| Print                      | Sends register B to printer.                                                                                 |
| Delay                      | Delays for duration stored at (SPD)*FF hex.                                                                  |
| Intro                      | Prints introduction on screen, pauses, returns.                                                              |
| Keys                       | Scans arrow and function keys, performs function if pressed.                                                 |
| Set                        | Puts or sets (X,Y) on screen if register (B)=0, reset (X,Y) if register (B)=1.                               |
| P1,P14,P16,<br>P20,P24,P40 | Prints socket at (X,Y) of nn pins.                                                                           |
| COMM                       | Clears screen and asks for special command.                                                                  |
| ERR1                       | Prints error message and asks for input again.                                                               |
| Input                      | Asks for two characters, returns (register B = first character, register C = second)                         |
| SCN                        | Inputs one character from keyboard and prints it on screen (character X cancels routine).                    |
| CLP                        | Clears drawings from memory.                                                                                 |
| Speed                      | Sets speed or delay to (register C-30 hex)*FF hex                                                            |

Note: X,Y are coordinates of cursor on screen  
X1,Y1 are coordinates of cursor in memory

Table 3. Draw's subroutines.



I got the kit at a store that carried both electronic and photographic supplies, but you might have to get your supplies from stores that specialize in each. Radio Shack carries PC board materials, and a good photographic

expose the photo-sensitive board—not enough light will get through.)

Making a PC board is similar to developing a picture, but you use longer exposures and add several steps. First, you must put the developed PC board in etchant, such as ferric chloride (FeCl<sub>3</sub>), to remove excess copper. Then rinse the board in water, strip off any remaining etch-resist from the copper, and tin-plate the board if you want to. Don't bother to plate your first project; it adds to the confusion of a new process and doesn't affect the board's operation. ■

*Editor's note: The MX-80 prints 960 dots across—not the 800 for which the printing scale was designed. Though MX-80 users can't print in correct scale, they can still use the program.*

Contact Jim Clark at Mt. Philo Road, Box 181, Charlotte, VT 05445.

|                             |                   |
|-----------------------------|-------------------|
| Stack                       | 6000 hex          |
| Side 1                      | 8000-9FFF hex     |
| Side 2                      | A000-BFFF hex     |
| Program                     | 7000-7600 hex     |
| Pointers and program status | 7FFF hex-7FFF hex |

Figure 3. Memory map of Draw.

supply house should carry the proper film and developing materials.

If you use a positive PC board kit, you should make a positive of your pattern by making a negative of your negative. (Don't use your paper pattern to

Listing continued

|           |       |     |        |           |
|-----------|-------|-----|--------|-----------|
| 7086 4F   | 00860 | LD  | C,A    |           |
| 7087 E608 | 00870 | AND | 8H     |           |
| 7089 FE00 | 00880 | CP  | 8H     |           |
| 708B 2001 | 00890 | JR  | NZ, DN |           |
| 708D 1D   | 00900 | DEC | E      | ; Y1=Y1-1 |
| 708E 79   | 00910 | LD  | A,C    |           |
| 708F E610 | 00920 | AND | 10H    |           |
| 7091 FE10 | 00930 | CP  | 10H    |           |
| 7093 2001 | 00940 | JR  | NZ, LF |           |
| 7095 1C   | 00950 | INC | E      | ; Y1=Y1+1 |
| 7096 79   | 00960 | LD  | A,C    |           |
| 7097 E620 | 00970 | AND | 20H    |           |
| 7099 FE20 | 00980 | CP  | 20H    |           |
| 709B 2001 | 00990 | JR  | NZ, RT |           |
| 709D 15   | 01000 | DEC | D      | ; X1=X1-1 |
| 709E 79   | 01010 | LD  | A,C    |           |
| 709F 0E00 | 01020 | LD  | C, 0H  |           |
| 70A1 E640 | 01030 | AND | 40H    |           |
| 70A3 FE40 | 01040 | CP  | 40H    |           |

Listing continued

03100 ; PRINTER DRIVER CHANGES FOR THE MX-80.

```

03100 LD B,64
03200 LD B,27
03212 LD B,65
03214 CALL PRINT
03216 LD B,8
03218 CALL PRINT
03300 PUSH AF
03314 POP AF
03310 CALL Z,MX80 ; IF FINISHED LINE PUT IN GRAPHICS
03400 LD B,0
03600 STPR LD B,27
03612 LD B,64
03614 CALL PRINT
03650 SIDE1 LD B,0
03670 LD C,7
03710 LD C,56
03750 LD C,192
03790 SIDE2 LD B,0
03810 LD C,7
03850 LD C,56
03890 LD C,192
03902 RET
03903 MX80 LD B,27
03904 CALL PRINT
03905 LD B,76
03906 CALL PRINT
03907 LD B,0 ; THIS IS THE LSB OF 2 BYTE NUMBER
03908 ; THESE MSB AND LSB BYTES FORM A TOTAL GRAPHIC PRINT WIDTH NUMBER
03909 ; THE 2 AND 0 FORM THE NUMBER 512, MEANING 256 DOTS ACROSS ON EACH LINE
03910 CALL PRINT
03911 LD B,2 ; THIS IS THE MSB OF 2 BYTE NUMBER
03912 CALL PRINT
03913 RET

```

Figure 4. Program changes for Epson MX-80 printer.

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| 1000      | 179.6                | 3.5      | 98                  |
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Listing continued

|               |       |        |            |                                   |
|---------------|-------|--------|------------|-----------------------------------|
| 70A5 C0       | 01050 | RET    | NZ         |                                   |
| 70A6 14       | 01060 | INC    | D          | ; X1=X1+1                         |
| 70A7 C9       | 01070 | RET    |            |                                   |
| 70A8 79       | 01080 | MOVE   | A,C        |                                   |
| 70A9 E680     | 01090 | AND    | 80H        |                                   |
| 70AB FE80     | 01100 | CP     | 80H        |                                   |
| 70AD 20D4     | 01110 | JR     | NZ,UP      | ; IF SPACE BAR NOT HIT            |
| 70AF CDDF71   | 01120 | CALL   | SCMN       | ; SAVE SCREEN                     |
| 70B2 ED5BFC7F | 01130 | LD     | DE,(Y1)    | ; SCREEN LOCATION                 |
| 70B6 CD8370   | 01140 | CALL   | UP         | ; FIND DIRECTION TO MOVE          |
| 70B9 CDCA70   | 01150 | CALL   | SCHECK     | ; CHECK IF AT EDGE                |
| 70BC AF       | 01160 | XOR    | A          |                                   |
| 70BD 32F87F   | 01170 | LD     | (EDG),A    |                                   |
| 70C0 CDE671   | 01180 | CALL   | MTSC       | ; LOAD SCREEN WITH NEW DATA       |
| 70C3 ED5BFE7F | 01190 | LD     | DE,(Y)     |                                   |
| 70C7 0E01     | 01200 | LD     | C,1        | ; C-1 SO IT SKIPS THE SET ROUTINE |
| 70C9 C9       | 01210 | RET    |            |                                   |
| 70CA 7A       | 01220 | SCHECK | LD A,D     |                                   |
| 70CB B7       | 01230 | OR     | A          |                                   |
| 70CC 2004     | 01240 | JR     | NZ,CHECK   |                                   |
| 70CE 3C       | 01250 | INC    | A          | ; AT LEFT EDGE                    |
| 70CF CDF170   | 01260 | CALL   | ONEDGE     |                                   |
| 70D2 FE41     | 01270 | CHECK  | CP         | 41H                               |
| 70D4 3804     | 01280 | JR     | C,CHECK1   |                                   |
| 70D6 3D       | 01290 | DEC    | A          | ; AT RIGHT EDGE                   |
| 70D7 CDF170   | 01300 | CALL   | ONEDGE     |                                   |
| 70DA 57       | 01310 | CHECK1 | LD D,A     |                                   |
| 70DB 7B       | 01320 | LD     | A,E        |                                   |
| 70DC B7       | 01330 | OR     | A          |                                   |
| 70DD 2004     | 01340 | JR     | NZ,CHECK2  |                                   |
| 70DF 3C       | 01350 | INC    | A          | ; AT TOP EDGE                     |
| 70E0 CDF170   | 01360 | CALL   | ONEDGE     |                                   |
| 70E3 FE31     | 01370 | CHECK2 | CP         | 31H                               |
| 70E5 2004     | 01380 | JR     | NZ,FCHECK  | ; FINISHED CHECKING               |
| 70E7 3D       | 01390 | DEC    | A          | ; AT BOTTOM EDGE                  |
| 70E8 CDF170   | 01400 | CALL   | ONEDGE     |                                   |
| 70EB 5F       | 01410 | FCHECK | LD E,A     | ; FINISHED CHECKING               |
| 70EC ED53FC7F | 01420 | LD     | (Y1),DE    | ; STORE COORDINATE                |
| 70F0 C9       | 01430 | RET    |            |                                   |
| 70F1 F5       | 01440 | ONEDGE | PUSH AF    | ; ON EDGE                         |
| 70F2 3E01     | 01450 | LD     | A,1        |                                   |
| 70F4 32F87F   | 01460 | LD     | (EDG),A    |                                   |
| 70F7 F1       | 01470 | POP    | AF         |                                   |
| 70F8 C9       | 01480 | RET    |            |                                   |
|               | 01490 |        |            | ; CHECK IF X,Y IS OFF THE SCREEN. |
|               | 01500 |        |            | ; IF SO THEN SCROLL SCREEN        |
| 70F9 ED5BFC7F | 01510 | OFFSC  | LD DE,(Y1) |                                   |
| 70FD 3AFF7F   | 01520 | LD     | A,(X)      | ; CHECK IF X=0                    |
| 7100 B7       | 01530 | OR     | A          |                                   |
| 7101 2017     | 01540 | JR     | NZ,XGR     | ; X>0                             |
| 7103 3C       | 01550 | INC    | A          |                                   |
| 7104 3C       | 01560 | INC    | A          |                                   |
| 7105 32FF7F   | 01570 | LD     | (X),A      |                                   |
| 7108 3E03     | 01580 | LD     | A,3H       |                                   |
| 710A CD7771   | 01590 | CALL   | MOV        | ; SCROLL SCREEN RIGHT             |
| 710D 3AF87F   | 01600 | LD     | A,(EDG)    |                                   |
| 7110 B7       | 01610 | OR     | A          |                                   |
| 7111 2807     | 01620 | JR     | Z,XGR      |                                   |
| 7113 3AFF7F   | 01630 | LD     | A,(X)      |                                   |
| 7116 3D       | 01640 | DEC    | A          |                                   |
| 7117 32FF7F   | 01650 | LD     | (X),A      |                                   |
| 711A 3AFF7F   | 01660 | XGR    | LD A,(X)   |                                   |
| 711D FE00     | 01670 | CP     | 80H        |                                   |
| 711F 3017     | 01680 | JR     | C,YZRO     | ; Y=0                             |
| 7121 D602     | 01690 | SUB    | 2H         |                                   |
| 7123 32FF7F   | 01700 | LD     | (X),A      |                                   |
| 7126 3E02     | 01710 | LD     | A,2H       |                                   |
| 7128 CD7771   | 01720 | CALL   | MOV        | ; SCROLL SCREEN LEFT              |
| 712B 3AF87F   | 01730 | LD     | A,(EDG)    |                                   |
| 712E B7       | 01740 | OR     | A          |                                   |
| 712F 2807     | 01750 | JR     | Z,YZRO     |                                   |
| 7131 3AFF7F   | 01760 | LD     | A,(X)      |                                   |
| 7134 3C       | 01770 | INC    | A          |                                   |
| 7135 32FF7F   | 01780 | LD     | (X),A      |                                   |
| 7138 AF       | 01790 | YZRO   | XOR A      |                                   |
| 7139 32F87F   | 01800 | LD     | (EDG),A    |                                   |
| 713C 3AFE7F   | 01810 | LD     | A,(Y)      |                                   |
| 713F B7       | 01820 | OR     | A          |                                   |
| 7140 2018     | 01830 | JR     | NZ,YGR     |                                   |
| 7142 C603     | 01840 | ADD    | A,3H       |                                   |
| 7144 32FE7F   | 01850 | LD     | (Y),A      |                                   |
| 7147 3E01     | 01860 | LD     | A,1H       |                                   |
| 7149 CD7771   | 01870 | CALL   | MOV        | ; SCROLL SCREEN DOWN              |
| 714C 3AF87F   | 01880 | LD     | A,(EDG)    |                                   |
| 714F B7       | 01890 | OR     | A          |                                   |
| 7150 2808     | 01900 | JR     | Z,YGR      |                                   |
| 7152 3AFE7F   | 01910 | LD     | A,(Y)      |                                   |
| 7155 D602     | 01920 | SUB    | 2H         |                                   |
| 7157 32FE7F   | 01930 | LD     | (Y),A      |                                   |
| 715A 3AFE7F   | 01940 | YGR    | LD A,(Y)   |                                   |
| 715D FE30     | 01950 | CP     | 30H        |                                   |
| 715F DB       | 01960 | RET    | C          |                                   |
| 7160 D603     | 01970 | SUB    | 3H         |                                   |
| 7162 32FE7F   | 01980 | LD     | (Y),A      |                                   |
| 7165 AF       | 01990 | XOR    | A          |                                   |
| 7166 CD7771   | 02000 | CALL   | MOV        | ; SCROLL SCREEN UP                |
| 7169 3AF87F   | 02010 | LD     | A,(EDG)    |                                   |
| 716C B7       | 02020 | OR     | A          |                                   |
| 716D C8       | 02030 | RET    | Z          |                                   |
| 716E 3AFE7F   | 02040 | LD     | A,(Y)      |                                   |
| 7171 C602     | 02050 | ADD    | A,2H       |                                   |
| 7173 32FE7F   | 02060 | LD     | (Y),A      |                                   |
| 7176 C9       | 02070 | RET    |            |                                   |
| 7177 C5       | 02080 | MOV    | PUSH BC    | ; SCROLL SCREEN ROUTINE           |
| 7178 F5       | 02090 | PUSH   | AF         |                                   |
| 7179 AF       | 02100 | XOR    | A          |                                   |

Listing continued

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717A 32F87F 02110 LD (EDG),A ; RESET EDGE FLAG
717D CDDF71 02120 CALL SCTM
7180 F1 02130 POP AF
7181 FE01 02140 CP 1H
7183 2822 02150 JR Z,SDN
7185 B7 02160 OR A
7186 2816 02170 JR Z,SUP
7188 FEB2 02180 CP 2H
718A 2809 02190 JR Z,SLF
718C 3AFD7F 02200 SRT LD A,(X1) ; SCREEN RIGHT
718F 3D 02210 DEC A
7190 32FD7F 02220 LD (X1),A
7193 1819 02230 JR MOV1
7195 3AFD7F 02240 SLF LD A,(X1) ; SCREEN LEFT
7198 3C 02250 INC A
7199 32FD7F 02260 LD (X1),A
719C 1810 02270 JR MOV1
719E 3AFC7F 02280 SUP LD A,(Y1) ; SCREEN UP
71A1 3C 02290 INC A
71A2 32FC7F 02300 LD (Y1),A
71A5 1807 02310 JR MOV1
71A7 3AFC7F 02320 SDN LD A,(Y1) ; SCREEN DOWN
71AA 3D 02330 DEC A
71AB 32FC7F 02340 LD (Y1),A
71AE ED5BFC7F 02350 MOV1 LD DE,(Y1)
71B2 CDCA70 02360 CALL SCHECK ; CHECK IF AT EDGE
71B5 CDE671 02370 CALL MTSC
71B8 C1 02380 POP BC
71B9 C9 02390 RET
02400 ; SET X,Y ROUTINE
71BA C5 02410 SET PUSH BC
71BB 0680 02420 LD B,80H
71BD CDC471 02430 CALL SET1 ; RESET DOT THEN SET AGAIN
71C0 CDD371 02440 CALL DELAY ; THIS GIVES IT BETTER MOTION
71C3 C1 02450 POP BC
71C4 217E07 02460 SET1 LD HL,077EH
71C7 78 02470 LD A,B
71C8 F5 02480 PUSH AF
71C9 3AFF7F 02490 LD A,(X)
71CC F5 02500 PUSH AF
71CD 3AFE7F 02510 LD A,(Y)
71D0 C35001 02520 JF 150H
02530 ; DELAY ROUTINE
71D3 C5 02540 DELAY PUSH BC
71D4 0C00 02550 LD C,0H
71D6 3A97F 02560 LD A,(SPD)
71D9 47 02570 LD B,A
71DA CD6000 02580 CALL 60H ; CALL ROM DELAY ROUTINE
71DD C1 02590 POP BC
71DE C9 02600 RET
71DF AF 02610 SCTM XOR A ; MOVE SCREEN TO MEMORY
71E0 32FA7F 02620 LD (DIR),A
71E3 C36373 02630 JP PAGES
71E6 3E01 02640 MTSC LD A,1 ; MOVE MEMORY TO SCREEN
71E8 32FA7F 02650 LD (DIR),A
71EB C36373 02660 JP PAGES
71EE 3AFC7F 02670 SCREEN LD A,(Y1)
71F1 47 02680 LD B,A
71F2 110000 02690 LD DE,80H
71F5 19 02700 LOP ADD HL,DE
71F6 10FD 02710 DJNZ LOP
71F8 3AFD7F 02720 LD A,(X1) ; X AXIS
71FB 47 02730 LD B,A
71FC 23 02740 LOP1 INC HL
71FD 10FD 02750 DJNZ LOP1
02760 ;
02770 ; CHECK IF STM OR MTS
02780 ;
71FF 11003C 02790 LD DE,3C00H
7202 3AFA7F 02800 LD A,(DIR)
7205 B7 02810 OR A
7206 2811 02820 JR Z,STM ; SCREEN TO MEM
02830 ;
02840 ; MEMORY TO SCREEN
7208 11003C 02850 MTS LD DE,3C00H
720B 0610 02860 LD B,10H
720D C5 02870 LOOP2 PUSH BC
720E CD2972 02880 CALL LINE
7211 014000 02890 LD BC,40H
7214 09 02900 ADD HL,BC
7215 C1 02910 POP BC
7216 10F5 02920 DJNZ LOOP2
7218 C9 02930 RET
02940 ;
02950 ; SCREEN TO MEMORY
7219 EB 02960 STM EX DE,HL
721A 0610 02970 LD B,10H
721C C5 02980 LOOP3 PUSH BC
721D CD2972 02990 CALL LINE
7220 0640 03000 LD B,40H
7222 13 03010 LOOP4 INC DE
7223 10FD 03020 DJNZ LOOP4
7225 C1 03030 POP BC
7226 10F4 03040 DJNZ LOOP3
7228 C9 03050 RET
03060 ; COPY ONE LINE FROM (S TO M) OR (M TO S)
7229 014000 03070 LINE LD BC,40H
722C EDB0 03080 LDIR
722E C9 03090 RET
03100 ;
03110 ; SEND DRAWING TO PRINTER ROUTINE
722F E5 03120 SCRIPT PUSH HL
7230 C5 03130 PUSH BC
03140 ; PUT PRINTER IN CONDENSED MODE THEN
03150 ; PUT PRINTER IN GRAPHICS MODE
7231 061D 03160 LD B,27 ; PUT IN CTL MODE
7233 CDBE72 03170 CALL PRINT

```

Listing continued

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|             |       |                                                           |                       |                                              |
|-------------|-------|-----------------------------------------------------------|-----------------------|----------------------------------------------|
| 7236 0614   | 03180 | LD                                                        | B,20                  | ; SET TO CONDENCED PRINT                     |
| 7238 CDBE72 | 03190 | CALL                                                      | PRINT                 |                                              |
| 723B 0612   | 03200 | LD                                                        | B,18                  | ; PUT IN GRAPHICS MODE                       |
| 723D CDBE72 | 03210 | CALL                                                      | PRINT                 |                                              |
|             | 03220 | ; START                                                   | COPYING               | SCREEN TO PRINTER                            |
|             | 03230 | ;                                                         |                       |                                              |
| 7240 21     | 03240 | DEFB                                                      | 21H                   | ; LD HL,NNNN COMMAND                         |
| 7241 8000   | 03250 | PST                                                       | DEFW                  | 0080H ; LD HL,8000H                          |
| 7243 7D     | 03260 | LOOP                                                      | LD                    | A,L                                          |
| 7244 E680   | 03270 | AND                                                       | 80H                   |                                              |
| 7246 BD     | 03280 | CP                                                        | L                     |                                              |
| 7247 060D   | 03290 | LD                                                        | B,13                  |                                              |
|             | 03300 | ; IF END OF LINE OR SCREEN THEN SEND RETURN TO PRINTER    |                       |                                              |
| 7249 CCBE72 | 03310 | CALL                                                      | Z,PRINT               |                                              |
|             | 03320 | ; CHECK                                                   | FOR BREAK             |                                              |
| 724C 3A4038 | 03330 | LD                                                        | A,(KYB)               |                                              |
| 724F FE04   | 03340 | CP                                                        | 4H                    |                                              |
| 7251 282E   | 03350 | JR                                                        | Z,STPR                | ; STOP PRINT                                 |
| 7253 7E     | 03360 | LD                                                        | A,(HL)                |                                              |
| 7254 FE81   | 03370 | CP                                                        | 81H                   |                                              |
|             | 03380 | ; IF NOT GRAPHIC CHARACTER THEN SEND SPACE                |                       |                                              |
| 7256 3010   | 03390 | JR                                                        | NC,DOTS               |                                              |
| 7258 0680   | 03400 | LD                                                        | B,128                 |                                              |
| 725A CDBE72 | 03410 | CALL                                                      | PRINT                 | ; SEND 4 DOT SPACES                          |
| 725D CDBE72 | 03420 | CALL                                                      | PRINT                 |                                              |
| 7260 CDBE72 | 03430 | CALL                                                      | PRINT                 |                                              |
| 7263 CDBE72 | 03440 | CALL                                                      | PRINT                 |                                              |
| 7266 1813   | 03450 | JR                                                        | NEXT1                 |                                              |
| 7268 CD8972 | 03460 | DOTS                                                      | CALL                  | SIDE1                                        |
| 726B CDBE72 | 03470 | CALL                                                      | PRINT                 |                                              |
| 726E CDBE72 | 03480 | CALL                                                      | PRINT                 |                                              |
| 7271 7E     | 03490 | LD                                                        | A,(HL)                |                                              |
| 7272 CDA472 | 03500 | CALL                                                      | SIDE2                 |                                              |
| 7275 CDBE72 | 03510 | CALL                                                      | PRINT                 |                                              |
| 7278 CDBE72 | 03520 | CALL                                                      | PRINT                 |                                              |
| 727B 23     | 03530 | NEXT1                                                     | INC                   | HL                                           |
|             | 03540 | ; CHECK TO SEE IF AT END OF DRAWING SIDE (IF SO THEN END) |                       |                                              |
| 727C 7C     | 03550 | LD                                                        | A,H                   |                                              |
| 727D FE     | 03560 | DEFB                                                      | 0FEH                  | ; CP NN COMMAND                              |
| 727E A0     | 03570 | PND                                                       | DEFB                  | 0A0H ; CP 0A0H                               |
| 727F 20C2   | 03580 | JR                                                        | NZ,LOOP               |                                              |
|             | 03590 | ; PUT PRINTER BACK IN TEXT MODE                           |                       |                                              |
| 7281 061E   | 03600 | STPR                                                      | LD                    | B,30                                         |
| 7283 CDBE72 | 03610 | CALL                                                      | PRINT                 |                                              |
| 7286 C1     | 03620 | POP                                                       | BC                    |                                              |
| 7287 E1     | 03630 | POP                                                       | HL                    |                                              |
| 7288 C9     | 03640 | RET                                                       |                       |                                              |
| 7289 0680   | 03650 | SIDE1                                                     | LD                    | B,80H ; CALCULATE 1st SIDE OF GRAPHIC BLOCK  |
| 728B E610   | 03660 | AND                                                       | 10H                   |                                              |
| 728D 0E70   | 03670 | LD                                                        | C,112                 |                                              |
| 728F C4CE72 | 03680 | CALL                                                      | NZ,AD                 |                                              |
| 7292 7E     | 03690 | LD                                                        | A,(HL)                |                                              |
| 7293 E604   | 03700 | AND                                                       | 4H                    |                                              |
| 7295 0E0C   | 03710 | LD                                                        | C,12                  |                                              |
| 7297 C4CE72 | 03720 | CALL                                                      | NZ,AD                 |                                              |
| 729A 7E     | 03730 | LD                                                        | A,(HL)                |                                              |
| 729B E601   | 03740 | AND                                                       | 1H                    |                                              |
| 729D 0E03   | 03750 | LD                                                        | C,3H                  |                                              |
| 729F C4CE72 | 03760 | CALL                                                      | NZ,AD                 |                                              |
| 72A2 7E     | 03770 | LD                                                        | A,(HL)                |                                              |
| 72A3 C9     | 03780 | RET                                                       |                       |                                              |
| 72A4 0680   | 03790 | SIDE2                                                     | LD                    | B,80H ; CALCULATE 2nd SIDE OF GRAPHICS BLOCK |
| 72A6 E620   | 03800 | AND                                                       | 20H                   |                                              |
| 72A8 0E70   | 03810 | LD                                                        | C,112                 |                                              |
| 72AA C4CE72 | 03820 | CALL                                                      | NZ,AD                 |                                              |
| 72AD 7E     | 03830 | LD                                                        | A,(HL)                |                                              |
| 72AE E608   | 03840 | AND                                                       | 8H                    |                                              |
| 72B0 0E0C   | 03850 | LD                                                        | C,12                  |                                              |
| 72B2 C4CE72 | 03860 | CALL                                                      | NZ,AD                 |                                              |
| 72B5 7E     | 03870 | LD                                                        | A,(HL)                |                                              |
| 72B6 E602   | 03880 | AND                                                       | 2H                    |                                              |
| 72B8 0E03   | 03890 | LD                                                        | C,3                   |                                              |
| 72BA C4CE72 | 03900 | CALL                                                      | NZ,AD                 |                                              |
| 72BD C9     | 03910 | RET                                                       |                       |                                              |
| 72BE 3AE837 | 03920 | PRINT                                                     | LD                    | A,(37E8H) ; CHECK IF PRINTER READY           |
| 72C1 F6F0   | 03930 | AND                                                       | 0F0H                  |                                              |
| 72C3 FE30   | 03940 | CP                                                        | 30H                   |                                              |
| 72C5 20F7   | 03950 | JR                                                        | NZ,PRINT              |                                              |
| 72C7 78     | 03960 | LD                                                        | A,B                   |                                              |
| 72C8 32E837 | 03970 | MDL1                                                      | LD                    | (37E8H),A ; DELETE FOR MODEL 3,4             |
| 72CR D3F8   | 03980 | MDL3                                                      | OUT                   | (0F8H),A ; DELETE FOR MODEL 1                |
| 72CD C9     | 03990 | RET                                                       |                       |                                              |
| 72CE F5     | 04000 | AD                                                        | PUSH                  | AF                                           |
| 72CF 79     | 04010 | LD                                                        | A,C                   |                                              |
| 72D0 B0     | 04020 | OR                                                        | B                     |                                              |
| 72D1 47     | 04030 | LD                                                        | B,A                   |                                              |
| 72D2 F1     | 04040 | POP                                                       | AF                    |                                              |
| 72D3 C9     | 04050 | RET                                                       |                       |                                              |
|             | 04060 | ; CLEAR ALL PAGES                                         |                       |                                              |
| 72D4 E5     | 04070 | CLR                                                       | PUSH                  | HL                                           |
| 72D5 210080 | 04080 | LD                                                        | HL,8000H              |                                              |
| 72D8 3E80   | 04090 | LOOP1                                                     | LD                    | A,80H                                        |
| 72DA 77     | 04100 | LD                                                        | (HL),A                |                                              |
| 72DB 23     | 04110 | TNC                                                       | HL                    |                                              |
| 72DC 7C     | 04120 | LD                                                        | A,H                   |                                              |
| 72DD FEC2   | 04130 | CP                                                        | 0C2H                  |                                              |
| 72DF 20F7   | 04140 | JR                                                        | NZ,LOOP1              |                                              |
| 72E1 E1     | 04150 | POP                                                       | HL                    |                                              |
| 72E2 C9     | 04160 | RET                                                       |                       |                                              |
| 72E3 FE02   | 04170 | FUNCT2                                                    | CP                    | 2H                                           |
| 72E5 2813   | 04180 | JR                                                        | Z,CONNECT             |                                              |
| 72E7 FE04   | 04190 | CP                                                        | 4H                    |                                              |
| 72E9 282A   | 04200 | JR                                                        | Z,CONNECT             |                                              |
| 72EB FE08   | 04210 | CP                                                        | 8H                    |                                              |
| 72ED 2833   | 04220 | JR                                                        | Z,BLKON ; SAVE BLOCK  |                                              |
| 72EF FE10   | 04230 | CP                                                        | 10H                   |                                              |
| 72F1 283F   | 04240 | JR                                                        | Z,BLKOFF ; LOAD BLOCK |                                              |

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|               |       |             |                                  |
|---------------|-------|-------------|----------------------------------|
| 72F3 FE20     | 04250 | CP          | 20H                              |
| 72F5 204B     | 04260 | JR          | Z,P8 ; 8 PIN SOCKET              |
| 72F7 C33D70   | 04270 | JP          | KEYS                             |
| 72FA CDE974   | 04280 | CONECT CALL | GETAD ; FIND SCREEN LOCATION     |
| 72FD 0685     | 04290 | LD          | B,5H ; 10 CONECTIONS             |
| 72FF 0E85     | 04300 | LD          | C,5                              |
| 7301 21FC75   | 04310 | LD          | HL,CON1                          |
| 7304 E5       | 04320 | PUSH        | HL                               |
| 7305 E1       | 04330 | LOP13 POP   | HL ; CONECTOR TABLE              |
| 7306 E5       | 04340 | PUSH        | HL                               |
| 7307 C5       | 04350 | PUSH        | BC                               |
| 7308 41       | 04360 | LD          | B,C                              |
| 7309 CDC474   | 04370 | CALL        | PUT                              |
| 730C C1       | 04380 | POP         | BC                               |
| 730D 10F6     | 04390 | DJNZ        | LOP13                            |
| 730F ED5BFE7F | 04400 | LD          | DE,(Y)                           |
| 7313 E1       | 04410 | POP         | HL                               |
| 7314 C9       | 04420 | RET         |                                  |
| 7315 CDE974   | 04430 | CONEC2 CALL | GETAD                            |
| 7318 060A     | 04440 | LD          | D,10                             |
| 731A 0E04     | 04450 | LD          | C,4H                             |
| 731C 210176   | 04460 | LD          | HL,CON2                          |
| 731F E5       | 04470 | PUSH        | HL                               |
| 7320 18E3     | 04480 | JR          | LOP13                            |
| 7322 21003C   | 04490 | BLKON LD    | HL,VID                           |
| 7325 110078   | 04500 | LD          | DE,7800H                         |
| 7328 010004   | 04510 | LD          | BC,400H                          |
| 732B EDB0     | 04520 | LDIR        |                                  |
| 732D ED5BFE7F | 04530 | LD          | DE,(Y)                           |
| 7331 C9       | 04540 | RET         |                                  |
| 7332 210078   | 04550 | BLKOFF LD   | HL,7800H                         |
| 7335 11003C   | 04560 | LD          | DE,VID                           |
| 7338 010004   | 04570 | LD          | BC,400H                          |
| 733B EDB0     | 04580 | LDIR        |                                  |
| 733D ED5BFE7F | 04590 | LD          | DE,(Y)                           |
| 7341 C9       | 04600 | RET         |                                  |
| 7342 01010A   | 04610 | P8 LD       | BC,0A01H                         |
| 7345 21C000   | 04620 | LD          | HL,0C0H                          |
| 7348 C3B273   | 04630 | JP          | SOCKET                           |
| 734B CDDF71   | 04640 | SFLIP CALL  | SCFM ; FLIP PC BOARD SIDES       |
| 734E 3AF67F   | 04650 | LD          | A,(SID)                          |
| 7351 EE30     | 04660 | XOR         | 30H                              |
| 7353 32F67F   | 04670 | LD          | (SID),A                          |
| 7356 CDE671   | 04680 | CALL        | MTSC                             |
| 7359 3A8038   | 04690 | WAIT LD     | A,(3800H)                        |
| 735C B7       | 04700 | OR          | A                                |
| 735D 20FA     | 04710 | JR          | NZ,WAIT ; WAIT UNTILL KEY LET GO |
| 735F F1       | 04720 | POP         | AF                               |
| 7360 C32770   | 04730 | JP          | NEXT                             |
| 7363 3AF67F   | 04740 | PAGES LD    | A,(SID)                          |
| 7366 B7       | 04750 | OR          | A                                |
| 7367 2807     | 04760 | JR          | Z,SD1                            |
| 7369 2100A0   | 04770 | LD          | HL,0A00H ; PAGE 2                |
| 736C CDEE71   | 04780 | CALL        | SCREEN                           |
| 736F C9       | 04790 | RET         |                                  |
| 7370 210080   | 04800 | SD1 LD      | HL,8000H                         |
| 7373 CDEE71   | 04810 | CALL        | SCREEN                           |
| 7376 C9       | 04820 | RET         |                                  |
|               | 04830 |             | ; FUNCTION KEYS                  |
| 7377 FE01     | 04840 | FUNCT CP    | 1                                |
| 7379 2874     | 04850 | JR          | Z,COMM                           |
| 737B FE02     | 04860 | CP          | 2                                |
| 737D 282D     | 04870 | JR          | Z,P14                            |
| 737F FE04     | 04880 | CP          | 4                                |
| 7381 284C     | 04890 | JR          | Z,P16                            |
| 7383 FE08     | 04900 | CP          | 8                                |
| 7385 2850     | 04910 | JR          | Z,P20                            |
| 7387 FE10     | 04920 | CP          | 10H                              |
| 7389 2854     | 04930 | JR          | Z,P24                            |
| 738B FE20     | 04940 | CP          | 20H                              |
| 738D 2858     | 04950 | JR          | Z,P40                            |
| 738F FE40     | 04960 | CP          | 40H                              |
| 7391 2808     | 04970 | JR          | Z,P1                             |
|               | 04980 |             | ; KEY 7 = CLEAR                  |
| 7393 CDE671   | 04990 | CALL        | CHANGES ON PAGE                  |
| 7396 ED5BFE7F | 05000 | LD          | MTSC                             |
| 739A C9       | 05010 | RET         | DE,(Y)                           |
| 739B CDE974   | 05020 | PI CALL     | GETAD                            |
| 739E 21CB75   | 05030 | LD          | HL,PINS                          |
| 73A1 010102   | 05040 | LD          | BC,0201H                         |
| 73AA CDC474   | 05050 | CALL        | PUT                              |
| 73A7 ED5BFE7F | 05060 | LD          | DE,(Y)                           |
| 73AB C9       | 05070 | RET         |                                  |
| 73AC 010111   | 05080 | P14 LD      | BC,1101H                         |
| 73AF 21C000   | 05090 | LD          | HL,0C0H                          |
| 73B2 E5       | 05100 | SOCKET PUSH | HL                               |
| 73B3 CDE974   | 05110 | CALL        | GETAD                            |
| 73B6 21CB75   | 05120 | LD          | HL,PINS                          |
| 73B9 CDC474   | 05130 | CALL        | PUT                              |
| 73BC CDE974   | 05140 | CALL        | GETAD                            |
| 73BF E1       | 05150 | POP         | HL                               |
| 73C0 EB       | 05160 | EX          | DE,HL                            |
| 73C1 ED52     | 05170 | SBC         | HL,DE                            |
| 73C3 EB       | 05180 | EX          | DE,HL                            |
| 73C4 21CB75   | 05190 | LD          | HL,PINS                          |
| 73C7 CDC474   | 05200 | CALL        | PUT                              |
| 73CA ED5BFE7F | 05210 | LD          | DE,(Y)                           |
| 73CE C9       | 05220 | RET         |                                  |
| 73CF 010113   | 05230 | P16 LD      | BC,1301H                         |
| 73D2 21C000   | 05240 | LD          | HL,0C0H                          |
| 73D5 18DB     | 05250 | JR          | SOCKET                           |
| 73D7 010118   | 05260 | P20 LD      | DC,1801H                         |
| 73DA 21C000   | 05270 | LD          | HL,0C0H                          |
| 73DD 18D3     | 05280 | JR          | SOCKET                           |
| 73DF 01011D   | 05290 | P24 LD      | BC,1D01H                         |
| 73E2 210001   | 05300 | LD          | HL,180H                          |

Listing continued on p. 138

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Illustration by Janis Theodorou

# In the Marketplace

by Richard Earp

Test your investment skills  
with this commodities futures trading simulator.

**Y**ou've got to trust your intuition. Investing in commodities futures is speculative, and it requires keen market sense—quick decisions can make you a fortune or cost you your shirt.

Since the commodities market is so volatile, investors usually begin trading on paper. I wrote a commodities trading simulation program called *Trader* that lets you test your skills before you enter the real market (see the Program Listing). I designed *Trader* for a Model I or III with 32K RAM and Disk Basic or 16K RAM and Cassette Basic. You can delete the remarks if you need more memory space.

Commodities futures investments are highly leveraged—you need only a small portion of the purchase price to take a position in a market—and prices move quickly. For example, stock markets typically require 60–80 percent of the purchase price in cash to make a trade, but commodities markets often require only 10 percent. The amount required to take a position is called margin.

A trading scheme and a sense of timing are essential for commodities trading. It's not uncommon to know that a commodities shortage will drive prices up, but knowing when to buy and sell are skills you need time to develop.

I based *Trader* on the "trending" theory of market movement, which assumes that if a market moves in one direction, it tends to stay moving in that direction. Another popular theory of market movement assumes that markets move in a "random walk," following no discernible trend. *Trader's* markets might appear to move randomly in the short run, but they follow trends over periods of several days.

## Trading Prompts

When you run *Trader*, it displays a logo and instructions. A menu prompts you through all market maneuvers; simply press the appropriate key for alphabetic responses and press the enter key after typing numeric responses.

Brokers require a minimum amount of cash before you can begin trading, and you need at least \$10,000 before you can buy and sell in *Trader's* markets. Once you enter your amount, *Trader* displays a list of 12 commodities and their prices (see Fig. 1).

*Trader's* commodities include three grains (wheat, corn, and soybeans), three meats (pork bellies, live hogs, and live cattle), two metals (silver and copper), and four other, unrelated commodities (sugar, cocoa, cotton, and potatoes).

Beginning traders usually concentrate on a small number of commodities, such as one grain, one meat, one metal, and one or two others. You should diversify to protect your investments. Copper prices usually don't affect pork prices, and sugar won't affect corn; if one market collapses, the others will remain stable. Potatoes have fallen out of favor with some traders since I wrote *Trader*, but you can substitute another commodity, such as money futures or lumber.

The commodities list includes a current price, a price limit, and a margin for each commodity (see Fig. 1). Commodities markets have daily limits on price moves to prevent wild price fluctuations, but limits and margins vary considerably with time. To make your simulation as close to reality as possible, you should call a broker and get the latest figures.

*Trader* trades contracts one at a

time, but you can repeat the sequence to buy or sell several times. You can also reverse positions. *Trader* lets you place trades only after office hours, before the next day's trading begins. Figure 2 is a sample display reflecting several days' worth of trading.

When you quit the program, *Trader* closes you out of all positions—as in real life, you can't leave the market and resume trading where you were before you left.

If you're losing money and you get a margin call, the program automatically closes you out of that position; once you start, *Trader* won't let you add cash to your account.

*Trader* has no provision for commissions; brokers' fees vary too much to use an average figure for each commodity. I usually subtract an average figure for commissions based on the total number of trades.

## Monte Carlo Markets

*Trader* uses a Monte Carlo simulation to generate prices, following a normal, S-shaped cumulative distribution; prices are more likely not to change than to change an amount approaching the limit. The following example demonstrates *Trader's* price generation algorithm.

Suppose that at the end of the fourth day, the price of wheat was 3.85, corn cost 3.20, and the soybean price was 6.40. *Trader's* daily price calculation subroutine begins in line 8200. But before computing the new

---

### The Key Box



Models I and III  
16K RAM Cassette Basic  
32K RAM Disk Basic

---

INITIAL ACCOUNT BALANCE IS \$12000 ... THE MARKET FOLLOWS ..

| COMMODITY       | PRICE | LIMIT | MARGIN |
|-----------------|-------|-------|--------|
| 1 WHEAT         | 3.60  | 0.20  | 1300   |
| 2 CORN          | 3.20  | 0.10  | 800    |
| 3 SOYBEANS      | 6.40  | 0.30  | 2000   |
| 4 SILVER        | 10.87 | 0.50  | 1000   |
| 5 COPPER        | 77.50 | 5.00  | 1300   |
| 6 SUGAR         | 7.00  | 0.50  | 1000   |
| 7 COCOA         | 17.38 | 0.88  | 2500   |
| 8 COTTON        | 76.00 | 2.00  | 1500   |
| 9 POTATOES      | 5.60  | 0.50  | 800    |
| 10 LIVE HOGS    | 51.60 | 1.50  | 1200   |
| 11 PORK BELLIES | 68.65 | 2.00  | 2200   |
| 12 LIVE CATTLE  | 69.00 | 1.50  | 1200   |

DO YOU WANT TO CHANGE ANY OF THIS? YES (Y) NO (N)

Figure 1. Initial commodities list and prices.

| DAY                                                             | 12           | HIGH                | LOW   | LAST                  | PREV  | POS | AT    | PROFIT |
|-----------------------------------------------------------------|--------------|---------------------|-------|-----------------------|-------|-----|-------|--------|
| 1                                                               | WHEAT        | 3.62                | 3.48  | 3.48                  | 3.60  | L 1 | 3.52  | 200-   |
| 2                                                               | CORN         | 3.23                | 3.10  | 3.18                  | 3.13  |     |       |        |
| 3                                                               | SOYBEANS     | 5.80                | 5.59  | 5.80                  | 5.50  | L 1 | 5.72  | 400    |
| 4                                                               | SILVER       | 8.66                | 8.66  | 8.66                  | 9.16  |     |       |        |
| 5                                                               | COPPER       | 74.45               | 67.23 | 68.53                 | 72.23 |     |       |        |
| 6                                                               | SUGAR        | 6.06                | 5.40  | 6.00                  | 5.74  | L 3 | 5.94  | 202    |
| 7                                                               | COCOA        | 16.40               | 16.40 | 16.40                 | 16.53 |     |       |        |
| 8                                                               | COTTON       | 72.51               | 72.33 | 72.33                 | 74.33 |     |       |        |
| 9                                                               | POTATOES     | 5.73                | 5.73  | 5.73                  | 5.23  |     |       |        |
| 10                                                              | LIVE HOGS    | 54.56               | 54.39 | 54.52                 | 54.26 | L 1 | 53.86 | 198    |
| 11                                                              | PORK BELLIES | 69.28               | 68.76 | 68.81                 | 68.10 |     |       |        |
| 12                                                              | LIVE CATTLE  | 70.32               | 70.10 | 70.13                 | 69.21 |     |       |        |
| CASH \$ 1738                                                    |              | PAPER PROFIT \$ 600 |       | AVAIL.MARGINS \$ 2338 |       |     |       |        |
| CHOOSE TRANSACTION:HELP(H),BUY(B),SELL(S),DO NOTHING(X),QUIT(Q) |              |                     |       |                       |       |     |       |        |

Figure 2. Screen dump of several days' trading results.

Program Listing. Trader.

```

2 REM R. Earp - "Trader"
5 CLEAR 300
20 REM P = PRICE, RA = PRICE RANGE, MA = MARGIN, TI = TICK
40 REM YP=PREV. PRICE, PO = POSITIONS
60 GOSUB9000 :REM INITIALIZE
80 CLS
100 PRINT"INITIAL ACCOUNT BALANCE IS $";B;
120 PRINT "... THE MARKET FOLLOWS ...."
140 BH=B
160 NC=12
180 IA=0:BY=1
200 DIM RN(100),P(12),C$(12),RA(12),MA(12),TI(12),YP(12),PO(12)
220 DIM MO(12,3),MX(12),HI(12),LO(12),PX(12),CS(12),RP(12),MQ(12)
240 FOR I = 1 TO 50
260 READ RN(I)
280 RN(101-I)=RN(I):RN(I)=-RN(I)
300 NEXT I
320 FOR I = 1 TO NC
340 READ C$(I),P(I),RA(I),MA(I),TI(I),CS(I)
360 CS(I)=CS(I)*100
380 NEXT I
400 GOSUB3560
420 CLS:PRINT:PRINT:PRINT"THE FIRST 4 DAYS WILL NOW BE SIMUL
ATED - STAND BY"
440 N=0
460 N=N+1
480 ID=0
500 IF N<4 THEN920
520 GOSUB3000
540 IO=0:LQ=0
560 GOTO620
580 PRINT"CHOOSE TRANSACTION:HELP(H),BUY(B),SELL(S),DO NOTHING(X),
QUIT(Q)
600 GOTO780
620 FOR J=1TONC
640 IF MQ(J)>=MA(J)*ABS(PO(J))*-1 OR PO(J)=0 THEN740
660 REM ** PRINTJ,MQ(J),MA(J),PO(J);"X234"
680 PRINT"MARGIN CALL IN ";C$(J);" -- SORRY, POSITION LIQUIDATED":
LQ=1:NB=J:A$="B"

```

Listing continued

price for each commodity, Trader calculates each weighted moving average.

Trader stores the last three days' prices in array MO(i,j), where i is the commodity's number (1-12) and j denotes the day. AP is the weighted moving average price for each commodity. The program gives more weight to yesterday's price movement (3), or trend, and less weight to the previous two days' movements (2 and 1). Trade uses RP(i) for the new price and KA as an index of the commodities number in lines 8480-8560.

P(KA) is today's price of commodity KA, and RA(KA) is the limit on price movement for each day. PG is the difference between the weighted moving average, AP, and the current price. SG is the fraction of this difference relative to the range limit, RA(KA).

Trader uses a table of numbers for Monte Carlo simulation in array RN(i), where i equals 1-100. Line 8560 contains the value of tomorrow's price for commodities KA in RP(KA). A simple Monte Carlo simulation of commodities prices would stop at this point, but in line 8580 Trader enters a fraction of PG to correct the value of RP(KA) for the weighted moving average.

Continuing the above example, suppose that the three previous days' wheat prices were 3.88, 3.90, and 3.92, and that R = 10 and P(1) = 3.85. Given these figures, Trader produces RN(R) = 0.69. The first price indication Trader produces for wheat is 3.988, using the following calculations:

$$AP = ((3.88*3) + (3.90*2) + 3.92)/6 = 3.893$$

$$SG = (3.85 - 3.893)/0.2 = -0.215$$

$$RP(1) = 3.85 + (0.69*0.2) = 3.988$$

The program corrects this figure for the moving average trend factor proportional to the daily limit of wheat, SG = -0.215. Trader generated a very bullish random number 10 for wheat, and since the trend was down, Trader tempered the bull move to 3.988 with SG. Had the trend been up, Trader would have reinforced the strong move to 3.988 with the value of SG, which would have been positive. Trader performs this first-price, trend-correcting procedure for all commodities in the portfolio.

When it completes the loop in line 8600, Trader corrects prices for group action, and computes GQ, the average price difference for the grains (line 8640).

Suppose that the new prices, RP(i), of commodities 1 (wheat), 2 (corn), and 3 (soybeans), are 3.96, 3.19, and 6.35 at the beginning of the correction. Wheat

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```

700 IFPO(J)>0THENA$="S"
720 GOTO920
740 NEXT J
760 GOTO580
780 A$=INKEY$:IF A$=""THEN 780
800 PRINT" YOU PUSHED ... ";A$;" ... PLEASE STAND BY"
820 IF A$="H" THEN GOTO 6000
840 IF A$="B"ORAS="S"ORAS="X"THEN920
860 IF A$="Q" THEN 2000
880 PRINT "YOU HAVE TO ENTER H,B,S,X,OR Q
900 GOTO 780
920 IF ID=1 THEN 960
940 FOR I=1 TO NC:YP(I)=P(I):NEXT I
960 IF N<4 THEN 1460
980 IF A$="X"THEN1460
1000 IF ID=1 THEN 1040
1020 GOSUB5000
1040 REM ** PRINT"HOW MANY CONTRACTS?"
1060 CLS
1080 PRINT"TRADING 1 CONTRACT AT A TIME"
1100 NA=1
1120 F$="BUY"
1140 IFA$="S"THENF$="SELL"
1160 IFLQ=1THEN1300
1180 PRINTF$;" WHICH COMMODITY ? (ENTER A NUMBER) (FOR HELP, ENTE
R 0)"
1200 INPUT NB
1220 IF NB>0ANDNB<NC+1 THEN 1300
1240 PRINT"YOU HAVE TO CHOOSE A COMMODITY BY NUMBER"
1260 GOSUB 3500
1280 GOTO 1180
1300 GOSUB4000
1320 IFLQ=1THEN1400
1340 PRINT"MORE TRANSACTIONS ? YES(Y) NO(PUNCH ANYTHING) "
1360 D$=INKEY$:IF D$="" THEN 1360
1380 IF D$<>"Y"GOTO 1480 : REM YOU ALREADY DID NEXT DAY PRICES
1400 ID=1
1420 LQ=0:NB=0
1440 GOTO 580
1460 GOSUB5000 :REM PRODUCE NEXT DAY'S PRICES
1480 REM **GOSUB 1000
1500 IO=0
1520 IF BY<0 THEN 1560
1540 GOTO1620
1560 CLS:PRINT"YOUR ACCOUNT WORTH LESS THAN $0, IT WILL HAVE TO BE
LIQUIDATED"
1580 GOSUB11000
1600 PRINT:GOTO2080
1620 GOTO460
2000 CLS:PRINT:PRINT" SIMULATION STOPPED ..":
2080 PRINT" ALL CONTRACTS WILL NOW BE CLOSED OUT"
2100 GOSUB11000
2120 FOR I=1 TO NC
2140 IF PO(I)=0 THEN 2360
2160 IF PO(I)<0 THEN 2220
2180 A$="S"
2200 GOTO 2240
2220 A$="B"
2240 PQ=P(I)
2260 GOSUB 8000
2280 GOSUB11000
2300 IF A$="B" THEN PO(I)=PO(I)+1
2320 IF A$="S" THEN PO(I)=PO(I)-1
2340 GOTO 2140
2360 NEXT I
2380 PRINT"FINAL TOTAL - LIQUIDATED ACCOUNT $";USING"#,###,###";B
2400 BH=B-BH
2420 PRINT:PRINT"YOUR TOTAL PROFIT $";USING"#,###,###";BH
2440 END
2460 PRINT"INSERT A BLANK TAPE IN THE RECORDER AND PREPARE TO RECO
RD";PRINT" (PUSH RECORD AND PLAY ON THE RECORDER)"
2480 PRINT"NOT YET IMPLEMENTED"
2500 END
3000 CLS:REM PRINT PAGE ***** 3000
3010 BT=0
3020 PRINT "DAY ";N;
3030 PRINTTAB(18)"HIGH";TAB(26)"LOW";TAB(32)"LAST";TAB(39)"PREV";
3040 PRINTTAB(45)"POS AT PROFIT"
3050 FOR I=1 TO NC
3060 PRINT USING"###";I;
3070 PRINT " ";C$(I);
3080 PRINTTAB(15)"";
3090 B$="####.##"
3100 PRINT USING B$;HI(I);LO(I);P(I);YP(I);
3110 IF PO(I)=0 THEN 3250
3120 E$="S"

```

Listing continued

is up 11 cents, corn down 1 cent, and soybeans down 5 cents. The average grain change, GQ is +1.66. Trader corrects the value of RP(i) in line 8660.

RP(KA) is the suggested new price—what will be tomorrow's price—for commodities KA. The program determines the latest price for commodity KA using 50 percent of the computed price from before line 8660, plus 50 percent of the price difference of all grains added to today's price. Admittedly, 50 percent is an arbitrary number, but grain prices tend to stick together. A big demand in one grain usually spills over into the others. For example, a bearish situation in wheat exerts downward pressure on corn and soybeans.

The group correction for other commodities is similar. Trader gives metals an 80 percent correction because metals follow one another closely (see line 8700). The correction for meats is 60 percent (see line 8740). Finally, to get a correction for the unrelated commodities—cocoa, sugar, potatoes, and cotton—Trader uses the average changes of grains (GQ), meats (MQ), and metals (TQ). Trader assigns the change for unrelated commodities to AQ and sets market influence at 30 percent (see line 8780).

## Daily Changes

When Trader completes the price-change subroutine, it returns to line 5000 and starts computing daily information (see line 8200). First, the program generates P(i) as the truncated version of RP(i), setting tomorrow's prices as today's.

Trader computes high and low prices in lines 5240–5720 as random offsets based on P(i). If the high is lower than the low price, Trader reverses them. After Trader establishes high and low values, it recomputes P(i) as another random offset from the daily range of  $DR = HI(I) - LO(I)$  in line 5460. If a price exceeds the established limit, the program brings the high, low, and closing prices into the acceptable range. Trader sets the price for the next day in line 5740.

The subroutine that handles your position-taking begins in line 4000. The array PO(i) tracks the number of positions held in each commodity and BY determines the amount of cash available. Trader sets the price of a transaction (PQ) in line 4440, and monitors multiple contracts in lines 4640–4740. ■

Contact Richard Earp at the University of West Florida, 12-128, Pensacola, FL 32514.

```

3130 IF PO(I)>0 THEN ES="L"
3140 PRINT " ";ES;
3150 NR=ABS(PO(I)):PRINT NR;
3160 IF IO=1 THEN 3250
3170 PRINT USING"###.##";PX(I);
3180 BA=0
3190 BA=(P(I)-PX(I))*CS(I)*ABS(PO(I))
3200 IF ES="S" THEN BA=-BA
3210 PRINT USING"#####-";BA
3220 MQ(I)=BA
3230 BT=BT+BA
3240 GOTO 3260
3250 PRINT ""
3260 NEXT I
3270 PRINT"CASH ";USING"$#####-";B;
3280 PRINT" PAPER PROFIT ";USING"$#####-";BT;
3290 BY=B+BT
3300 PRINT " AVAIL.MARGIN";USING"$#####-";BY
3310 RETURN
3500 PRINT"THE COMMODITY NUMBERS ARE ..":REM HELP **** 3500
3510 FOR I=1 TO NC STEP 3
3520 PRINT I;" ";C$(I);TAB(22)I+1;C$(I+1);TAB(44)I+2;C$(I+2)
3530 NEXT I
3540 PRINT:PRINT:IO=1
3550 RETURN
3560 PRINT " COMMODITY";TAB(20)"PRICE";TAB(27)"LIMIT";TAB(34)"HA
      RGIN"
3570 FOR I=1 TO 12
3580 PRINT USING"##";I;
3590 PRINT " ";C$(I);TAB(19)USING"###.##";P(I);
3600 PRINTTAB(26)USING"###.##";RA(I);
3610 PRINTTAB(35)USING"#####";MA(I)
3620 NEXT I
3630 IF IA=2 THEN 3690
3640 IF IA<>0 THEN 3680
3650 PRINT"DO YOU WANT TO CHANGE ANY OF THIS? YES(Y) NO(N)"
3660 GS=INKEY$:IF GS=" " THEN 3660
3670 IF GS="Y" THEN 3690
3675 IF GS="N" THEN 3680:ELSE 3660
3680 RETURN
3690 PRINT"WHICH COMMODITY ? (ENTER COMMODITY NUMBER)"
3700 I=0:INPUT I
3701 IF I>0 AND I<13 THEN 3710:ELSE PRINT"WHAT?":GOTO 3700
3710 PRINT C$(I);" IS THAT RIGHT? YES(Y) NO(N)"
3720 GS=INKEY$:IF GS=" " THEN 3720
3730 IF GS="Y" THEN 3750
3733 IF GS="N" THEN 3690:ELSE 3720
3740 GOTO 3690
3750 PRINT"CHANGE PRICE(P) LIMIT(L) MARGIN(M) NO CHANGES,GO ON (Q)
      "
3760 GS=INKEY$:IF GS=" " THEN 3760
3770 IF GS="P" THEN 3820
3780 IF GS="L" THEN 3850
3790 IF GS="M" THEN 3880
3800 IF GS="O" THEN 3940
3810 PRINT"YOU HAVE TO PUSH P,L,M OR Q":GOTO 3750
3820 PRINT"ENTER NEW PRICE FOR";C$(I)
3830 INPUT P(I)
3840 GOTO 3900

```

```

3850 PRINT"ENTER NEW LIMIT FOR";C$(I)
3860 INPUT RA(I)
3870 GOTO 3900
3880 PRINT"ENTER NEW MARGIN FOR ";C$(I)
3890 INPUT MA(I)
3900 PRINT"MORE CHANGES ? (Y/N)"
3910 IA=2
3920 GS=INKEY$:IF GS=" " THEN 3920
3930 IF GS="Y" THEN 3560
3933 IF GS="N" THEN 3940:ELSE 3920
3940 RETURN
4000 I=NB:HP=PO(I):IO=1:REM ESTABLISH A POSITION ***** 4000
4020 PRINT:PRINTFS;"ING";NA;" CONTRACT(S) OF ";C$(I)
4040 IFLO=1 THEN 4160
4060 PRINT"RIGHT ?? IF NOT PUSH N, OTHERWISE PUSH (ANYKEY)":V$=""
4080 V$=INKEY$:IF V$=" " THEN 4080
4100 IF V$<>"N" THEN 4160
4120 PRINT:PRINT"TRANSACTION CANCELLED"
4140 RETURN
4160 IF PO(I)=0 THEN 4240
4180 IF PO(I)<0 AND A$="S" THEN 4240
4200 IF PO(I)>0 AND A$="B" THEN 4240
4220 GOTO 4380
4240 AM=BY-MA(I)*NA
4260 IF AM>0 THEN 4360
4280 IF BY<0 THEN RETURN
4300 PRINT"YOU CANNOT TRADE THIS COMMODITY - INSUFFICIENT MARGIN"
4320 PRINT" MARGIN REQUIRED ";MA(I)*NA;" YOU HAVE ONLY $";USING"
      #####";BY
4340 RETURN
4360 B=B-MA(I)*NA:BY=BY-MA(I)*NA
4380 IF A$="S" THEN PO(I)=PO(I)-NA
4400 IF A$="B" THEN PO(I)=PO(I)+NA
4420 REM NOW ESTABLISH THE PRICE
4440 PQ=LO(I)+((HI(I)-LO(I))*RND(0))
4460 PQ=(INT(PQ*100))/100
4480 REM ** PRINT"PRICE OF TRANSACTION ";USING"###.##";PO
      (I);LO(I);P(I)
4500 REM ** PRINT"HIGH,LOW,CLOSE FOR TODAY WAS ";USING"###.##";HI
      (I);LO(I);P(I)
4520 IF ABS(HP)<=ABS(PO(I)) THEN 4580
4540 GOSUB 8000:REM CLOSE OUT A CONTRACT
4560 GOTO 4800
4580 IF ABS(PO(I))=1 THEN 4720
4600 IF PO(I)<0 THEN 4640
4620 PQ=0:GOTO 4720
4640 PZ=ABS(PO(I))-1
4650 PX(I)=PX(I)*PZ
4660 PX(I)=(PX(I)+PQ)/ABS(PO(I))
4680 REM ** PRINT"AVERAGE PRICE OF COMMODITY ";PX(I)
4700 GOTO 4760
4720 PX(I)=PQ
4740 PX(I)=(INT(PX(I)*100))/100
4760 PRINT"AVAILABLE MARGIN ";
4780 PRINT USING"###.##";BY;
4800 RETURN
5000 GOSUB 8200:REM MOVING AVERAGES ***** 5000
5020 FOR I=1 TO NC
5040 P(I)=(INT(RP(I)*100))/100
5060 REM LATEST DAY IS 1 OLDEST IS 3

```



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```

5080 MO(I,3)=MO(I,2)
5100 MO(I,2)=MO(I,1)
5120 MO(I,1)=YP(I)
5140 IF N<3 THEN 5180
5160 MX(I)=(MO(I,1)+MO(I,2)+MO(I,3))/3
5180 NEXT I
5200 IF N<3 THEN 5740
5220 FOR I=1 TO NC
5240 R=RND(100)
5260 HI(I)=P(I)+(RN(R)*RA(I))
5280 R=RND(100):LO(I)=P(I)-(RN(R)*RA(I))
5300 IF HI(I)>LO(I) THEN 5340
5320 H=HI(I):HI(I)=LO(I):LO(I)=H
5340 IF P(I)>MX(I) THEN 5400
5360 C=-RND(0)
5380 GOTO 5440
5400 C=RND(0)
5420 HI(I)=(INT(HI(I)*100))/100:LO(I)=(INT(LO(I)*100))/100
5440 DR=HI(I)-LO(I)
5460 P(I)=LO(I)+DR*RND(0)
5480 P(I)=(INT(P(I)*100))/100
5500 REM CORRECT FOR MOVING AVERAGE ??
5520 IF ABS(P(I)-YP(I))<RA(I) THEN 5580
5540 IF P(I)>YP(I) THEN P(I)=YP(I)+RA(I)
5560 P(I)=YP(I)-RA(I)
5580 IF ABS(HI(I)-YP(I))<RA(I) THEN 5640
5600 IF HI(I)>YP(I) THEN HI(I)=YP(I)+RA(I):GOTO 5640
5620 HI(I)=YP(I)-RA(I)
5640 IF ABS(LO(I)-YP(I))<RA(I) THEN 5700
5660 IF LO(I)>YP(I) THEN LO(I)=YP(I)+RA(I):GOTO 5700
5680 LO(I)=YP(I)-RA(I)
5700 REM ** PRINT I,P(I),HI(I),LO(I)
5720 NEXT I
5740 RETURN
6000 CLS:REM HELP ***** 6000
6010 PRINT"DO YOU WANT INSTRUCTIONS (I) OR"
6020 PRINT " HELP WITH A COMMODITY (C) ?"
6030 GS=INKEY$:IFGS=" "THEN6030
6040 IFGS="I"THEN6070
6050 IFGS="C"THEN6180
6060 PRINT"YOU MUST PUSH I OR C":GOTO 6010
6070 CLS:PRINT"YOU ARE CONTEMPORATING A TRADE. YOU HAVE THE FOLLOWI
NG OPTIONS:"
6080 PRINT" X .. PASS, DO NOT TRADE TODAY, GO ON TO NEXT DAY
6090 PRINT" C .. MORE INFORMATION ABOUT A PARTICULAR COMMODITY"
6100 PRINT" B .. BUY A COMMODITY"
6110 PRINT" S .. SELL A COMMODITY"
6120 PRINT" O .. END THE SIMULATION"
6130 PRINT:PRINT" FOR COMMODITY INFO, PUSH C"
6140 PRINT" TO RETURN TO THE TRADING BOARD, PUSH (ANY KEY)"
6150 GS=INKEY$:IF GS=" "THEN6150
6160 IF GS="C"THEN 6180
6170 GOTO 500
6180 CLS
6190 PRINT"INFORMATION ABOUT WHICH COMMODITY ? (ENTER NUMBER)"
6200 IA=1:GOSUB3500:IA=0
6210 PRINT"MARKET COMMENT .. ENTER 88 TO RETURN .. 0"
6220 INPUT NF
6230 IF NF=0THEN500

```

```

6240 IF NF>0 AND NF<NC+1 THEN 6270
6250 IF NF=88 THEN GOSUB10000
6260 PRINT"YOU MUST ENTER A NUMBER BETWEEN 1 AND ";NC:GOTO6190
6270 CLS
6280 PRINT C$(NF);" MARGIN IS $";MA(NF)
6290 PRINT"YOUR TRADING MARGIN IS $";BY
6300 PRINT"LAST 4 DAYS PRICES .."
6310 PRINT "TODAY ",P(NF)
6320 FOR IB=1 TO 3
6330 PRINT -IB,MO(NF,IB)
6340 NEXT IB
6350 PRINT:PRINT"YOUR TRANSACTION WILL BE TOMORROW"
6360 PRINT:PRINT" FOR GENERAL INFORMATION PUSH I"
6370 PRINT" FOR INFORMATION ABOUT ANOTHER COMMODITY PUSH C"
6380 PRINT" ANY OTHER KEY WILL RETURN YOU TO THE TRADING BOARD"
6390 GS=INKEY$:IFGS=" "THEN6390
6400 IF GS="I"THEN 6000
6410 IF GS="C"THEN 6180
6420 GOTO 500
7000 DATA .99,.96,.93,.90,.86,.84,.77,.75,.72,.69
7010 DATA .67,.65,.63,.61,.59,.57,.55,.53,.51,.49
7020 DATA .47,.45,.43,.41,.39,.37,.35,.33,.31,.29
7030 DATA .28,.27,.26,.25,.24,.23,.22,.21,.20,.19
7040 DATA .18,.16,.14,.12,.10,.08,.06,.04,.02,.0
7050 DATA WHEAT,3.6,.2,1300,.0025,50
7060 DATA CORN,3.2,.1,800,.0025,50
7070 DATA SOYBEANS,6.4,.3,2000,.0025,50
7080 DATA SILVER,10.87,.5,1000,.1,10
7090 DATA COPPER,77.5,5,1300,.2,2.5
7100 DATA SUGAR,7.5,1000,.01,11.2
7110 DATA COCOA,17.38,.88,2500,.01,10
7120 DATA COTTON,76.2,1500,.05,5
7130 DATA POTATOES,5.6,5,800,.01,5
7140 DATA LIVE HOGS,51.6,1.5,1200,.025,3
7150 DATA PORK BELLIES,68.65,2,2200,.025,3.8
7160 DATA LIVE CATTLE,69,1.5,1200,.025,4
8000 REM ROUTINE FOR CLOSING OUT A CONTRACT ***** 8000
8020 PF=(PO-PX(I))*CS(I)
8040 IF A$="B" THEN PF=-PF
8060 B=B+PF+MA(I)
8080 PRINT"YOU CLOSED OUT A POSITION IN ";C$(I);" AT ";PQ
8100 PRINT" YOU MADE ";USING "$####-";PF;
8120 PRINT" ON THE TRANSACTION"
8140 IFPO(I)=0THEN8180
8160 MO(I)=(P(I)-PX(I))*CS(I)*ABS(FO(I))
8180 RETURN
8200 REM COMPUTE RQ, THE PRICE CHANGE FOR THE GROUP-DAY
8220 REM PRINT MEM;"LINE 7005"
8240 REM CALCULATE TREND IN GRAINS
8260 FOR KA=1TO12
8280 IF N<4 THEN 8520
8300 AP=MO(KA,1)*3+MO(KA,2)*2+MO(KA,3):AP=AP/6
8320 SP=MO(KA,1):LP=MO(KA,1)
8340 IF MO(KA,2)<SP THEN SP=MO(KA,2)
8360 IF MO(KA,2)>LP THEN LP=MO(KA,2)
8380 IF MO(KA,3)<SP THEN SP=MO(KA,3)
8400 IF MO(KA,3)>LP THEN LP=MO(KA,3)
8420 RG=LP-SP
8440 SG=0

```

1. save continued

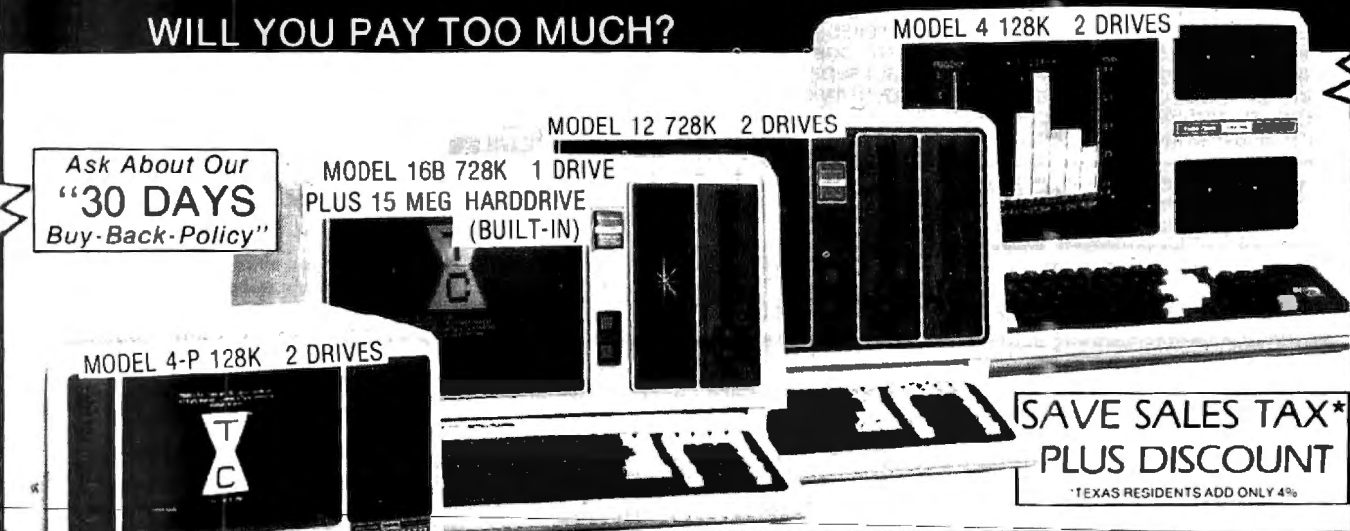
```

8460 IF RG=0 OR N<3 THEN8500
8480 PG=P(KA)-AP:SG-PG/RA(KA)
8500 REN ** PRINT USING"###.#";KA:P(KA);MO(KA,1);MO(KA,2);MO(KA
,3);PRINTUSING"###.#";AP:RG,PG,SG
8520 R=RND(100)
8540 REM ** PRINT"SUGGESTED CHANGE ";SG
8560 RP(KA)=P(KA)+(RN(R)*RA(KA))
8580 RP(KA)=RP(KA)+(RN(R)*RA(KA)*SG)
8600 NEXT KA
8620 REM NOW, YOU HAVE PRICES BASED ON INDIVIDUAL TREND - CORRECT
FOR GROUPS
8640 GQ=RP(1)-P(1)+RP(2)-P(2)+RP(3)-P(3):GQ=GQ/3
8660 FOR KA=1 TO 3:RP(KA)=.5*RP(KA)+.5*(P(KA)+GQ):NEXT KA
8680 TQ=RP(4)-P(4)+RP(5)-P(5):TQ=TQ/2
8700 FOR KA=4 TO 5:RP(KA)=.2*RP(KA)+.8*(P(KA)+TQ):NEXT KA
8720 MQ=RP(10)-P(10)+RP(11)+RP(12)-P(12):MQ=MQ/3
8740 FOR KA=10TOL2:RP(KA)=.4*RP(KA)+.6*(P(KA)+MQ):NEXT KA
8760 AQ=(MQ+TQ+GQ)/3
8780 FOR KA=6TO9:RP(KA)=.7*RP(KA)+.3*(P(KA)+AQ):NEXT KA
8800 RETURN
9000 REM INITIALIZE ***** 9000
9010 CLS
9020 PRINT CHR$(23);
9030 FOR I=1 TO 15:PRINT" COMMODITY SIMULATION":NEXT I
9040 FOR I=1 TO 2000:NEXT I
9050 CLS:PRINT CHR$(28)
9060 PRINT"GENERAL INSTRUCTIONS ... "
9070 PRINT"YOU WILL BE ASKED TO MAKE CHOICES"
9080 PRINT" LETTER ANSWERS REQUIRE THAT YOU TOUCH A LETTER"
9090 PRINT" BUT NOT PUSH ENTER"
9100 PRINT" NUMERIC ANSWERS REQUIRE YOU TO PUSH ENTER AFTER THE N
UMBER"
9110 PRINT"PLEASE DON'T BE IN A HURRY TO PUSH A KEY AND"
9120 PRINT"PLEASE DON'T PUSH A KEY UNLESS ASKED"
9130 PRINT"PRESS ANY KEY TO START"
9150 V$=INKEY$:IFV$=""THEN9150
9160 CLS:PRINT"NOW, CHOOSE STARTING CAPITAL .. ";
9170 PRINT"NO LESS THAN $10000"
9180 PRINT" (ENTER JUST THE NUMBER, NO $ OR COMMA)"
9190 INPUT B
9200 IF B<10000 THEN 9160
9210 RETURN
10000 CLS:REM MARKET COMMENT ***** 10000
10010 PRINT"MARKET COMMENT .. "
10020 Z$="":Z$="GRAINS ARE "
10030 IF GQ>0 THEN Z$=Z$+"UP. "
10040 IF GQ<0 THEN Z$=Z$+"DOWN. "
10050 IF TQ>0 THEN Z$=Z$+"METALS ARE DOWN. "
10060 IF TQ<0 THEN Z$=Z$+"METALS ARE UP. "
10070 IF MQ>0 THEN Z$=Z$+"MEATS ARE UP. "
10080 IF MQ<0 THEN Z$=Z$+"MEATS ARE DOWN. "
10090 PRINT Z$
10100 PRINT" AVERAGE MARKET PRICES ARE ";
10110 IF AQ<0 THEN PRINT"DOWN"
10120 IF AQ>0 THEN PRINT"UP"
10130 PRINT:PRINT"WHEN READY, PUSH (ANY KEY)"
10140 GS=INKEY$:IFGS=""THEN10140
10150 CLS:PRINT
10160 RETURN
11000 REM A PAUSE
11010 FOR IW=1TO1000:NEXTIW
11020 RETURN
    
```

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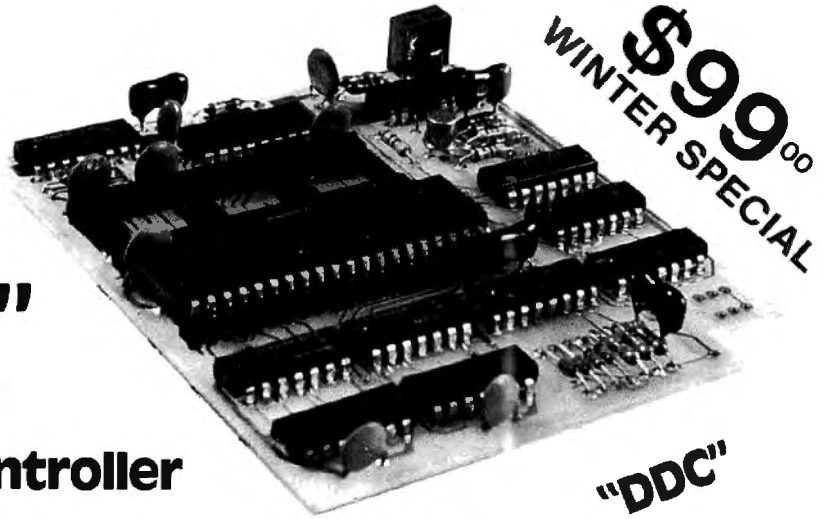
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# Aerocomp's Proven Best-By Test! The "DDC"



## Double Density Controller

### ★ Technical Superiority

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### ★ Test Proven

Tests were conducted on AEROCOMP'S "DDC", Percom's "Doubler A" and "Doubler II" and LNW's "LNDOUBLER" using a Radio Shack TRS80 Model I, Level 2, 48 K with TRS80 Expansion Interface and a Percom TFD100 disk drive (Siemens Model 82). Diskette was Memorex 3401. The test diskette chosen was a well used piece of media to determine performance under adverse conditions. The various double density adapters were installed sequentially in the expansion interface.

The test consisted of formatting 40 tracks on the diskette and writing a 6DB6 data pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as a "worst case" test by manufacturers of drives and diskettes. An attempt was then made to read each sector on the disk once - no retrys. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were totalled and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

### ★ Features

TRS80 Model I owners who are ready for reliable double density operation will get (1) 80% more storage per diskette, (2) single and double density data separation with far fewer disk I/O errors, (3) single density compatibility and (4) simple plug-in installation. Compatible with all existing double density software.

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for the Best DD Controller on the market.

"DDC" and LDOS **\$169.95**

"DDC" and Newdos 80 **\$179.95**

### ★ TEST RESULTS ★

| MFR & PRODUCT       | SECTORS LOCKED OUT (AVG) |
|---------------------|--------------------------|
| AEROCOMP "DDC"      | 0                        |
| PERCOM "DOUBLER II" | 18                       |
| PERCOM "DOUBLER A"  | 250                      |
| LNW "LNDOUBLER"     | 202                      |

Note: test results available upon written request. All tests conducted prior to 8-25-81

Aerocomp's 14 day money back guarantee applies to hardware only. Specials will be prorated. Shipping \$2.00 in Cont. U.S. See opposite page for details. Add \$4.00 shipping & handling for DDC & DOS.

## Data Separators

The advances that make the "DDC" great are incorporated in the new AEROCOMP Single Density Data Separator ("SDS") and Double Density Data Separator ("DDS").

### ★ Has your original manufacturer left you holding the bag?

If you already own a Percom "Doubler A", "Doubler II" or LNW "LNDOUBLER" or Superbrain, the AEROCOMP "DDS" will make it right. Look at the test results:

| MFR. & PRODUCT      | SECTORS LOCKED OUT |            |
|---------------------|--------------------|------------|
|                     | WITHOUT "DDS"      | WITH "DDS" |
| PERCOM "DOUBLER II" | 18                 | 1          |
| PERCOM "DOUBLER A"  | 250                | 0          |
| LNW "LNDOUBLER"     | 202                | 0          |

Note: Same test procedures as "DDC".  
\* Trademark of Percom Data Co.  
\*\* Trademark of LNW  
\*\*\* Trademark of Tandy Corporation

**Plugs directly into your existing  
Double Density Controller.**

★ "DDS" ..... **\$49.95**  
(Use 1791 chip from your DD Controller)

★ "DDS" with disk controller  
chip included ..... **\$79.95**

★ Disk controller  
chip ..... **\$34.95**

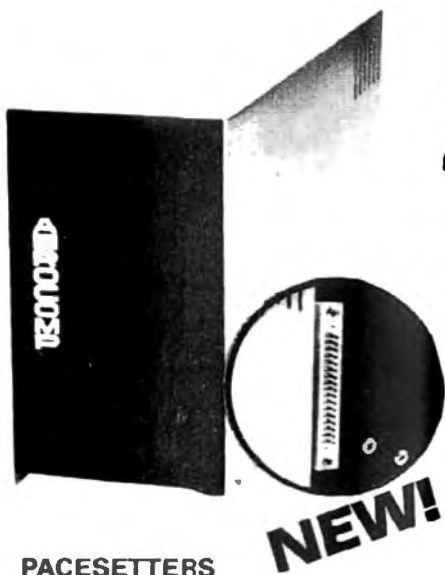
(Shipping \$2.00 Cont. US - see opposite page for details)

### Do you need a Single Density Data Separator?

The internal data separator in the WD1771 chip (R/S Expansion Interface) is NOT recommended by WD for reliable data transfer. Do you have any of these problems: Lost data, tracks locked out, CRC errors, disk retry? YOU NEED ONE!

★ "SDS" ..... **\$29.95**  
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**See opposite  
page** ▶▶▶▶▶



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| *40tk DS full size, MPI 52.....          | 255 |
| *40tk SS half high, TEAC FD55-A.....     | 159 |
| *40tk DS half high, TEAC FD55-B.....     | 219 |
| *80tk SS full size, MPI 91.....          | 289 |
| *80tk DS full size, Tandon TM101-4.....  | 329 |
| *80tk DS full size, MPI 92.....          | 349 |
| *80tk DS half high, TEAC FD55-F.....     | 259 |
| *8" SS half high, Tandon TM848-1E.....   | 280 |
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# *A Better Breed* *of* **BASIC**

by Gregory E. Lobdell

GW-Basic gives the Model 2000 new capabilities over standard Microsoft Basic in graphics, communications, and more.

If you've been using the Microsoft Basics available on the older TRS-80 machines, the advantages of the Model 2000's GW-Basic will be obvious. Its core is the same, but it has extras that let you pack your programs with interesting new features.

GW- (or Gee Whiz-) Basic uses the 2000's special hardware capabilities. Its four principal extensions are in graphics, music, event-trapping, and communications support. I'll look at these enhancements in more detail, but first I'll give you some background on GW-Basic.

## **No Ordinary Basic**

When IBM decided to enter the personal computer market with the PC, they wanted a language that would take advantage of that machine's hardware. Thus was GW-Basic born. Microsoft quickly realized that this version of Basic was going to be a success, and so added it to the family of Microsoft Basic implementations.

The standard Microsoft Basic Interpreter is a RAM-based version that is considered the core of all other Microsoft versions. This core is the basis for nonstandard versions of Basic, such as Model 100 Basic and Level II Basic.

Nonstandard versions are adapted for specific machines, such as Tandy's. They're usually defined as 8K, Extended, and Standalone (or Disk) Basic. They often have hardware-specific features such as graphics, device input/output, and

music. Figure 1 shows the Microsoft family of standard and nonstandard Basic interpreters and compilers.

Table 1 shows the 8K and Extended keywords, while Table 2 lists some of their important features. Owners of the Model 100 will note that Model 100 Basic and 8K Basic are similar. Models II, 4, 12, and 16 Basics, on the other hand, more closely resemble Extended.

## **Integrating the Language**

How does an original equipment manufacturer (OEM) like Tandy adapt so-called standard software like GW-Basic to a specific machine? Essentially, Microsoft virtualizes the interface between the hardware-specific (so-called low-level) routines and the rest of the GW-Basic interpreter. This is done by separating the hardware-specific functions into a small set of well-defined modules. GW-Basic's high-level routines (written by Microsoft) can then call hardware-specific routines (written by the OEM) to invoke a specific function in accordance with parameters you indicate. For example, if the interpreter determines that a program requested a point be drawn on the screen at coordinates X,Y then the high-level code calls the appropriate hardware-specific routine to do this. It's the responsibility of the hardware-specific code to carry out this action.

The OEM tells Microsoft what it wants, and Microsoft develops the high-level object modules. At the same time, Microsoft gives the OEM specifications that define the

1984



*John Pirman*

Illustration by John Pirman

| 8K Basic            |                      |
|---------------------|----------------------|
| ABS                 | New                  |
| ASC                 | Null                 |
| ATN                 | On...GOSUB/On...GOTO |
| Clear               | Option Base          |
| CLOAD               | PEEK                 |
| CONT                | POKE                 |
| CSAVE               | POS                  |
| Data                | Print                |
| DEF FN              | Read                 |
| DIM                 | REM                  |
| End                 | Restore              |
| ERR/ERL             | RIGHTS               |
| EXP                 | RND                  |
| For...Next          | Run                  |
| GOSUB...Return      | SPC                  |
| GOTO                | SQR                  |
| If...Then/If...GOTO | Stop                 |
| INT                 | STR\$                |
| Input               | Tab                  |
| LEFT\$              | TAN                  |
| Let                 | USR                  |
| Line Input          | VAL                  |
| List                | VALPTR               |
| Log                 | Wait                 |
| MID\$               |                      |
| Extended Basic      |                      |
| ABS                 | Log                  |
| ASC                 | LPOS                 |
| ATN                 | LPRINT/LPRINT Using  |
| Auto                | MID\$                |
| Call                | New                  |
| CDBL                | Null                 |
| CHR\$               | OCT\$                |
| CINT                | On Error GOTO        |
| Clear               | On...GOSUB/On...GOTO |
| CLOAD               | Option Base          |
| CONT                | PEEK                 |
| COS                 | POKE                 |
| CSNG                | POS                  |
| CSAVE               | Print/Print Using    |
| Data                | Randomize            |
| DEF FN              | Read                 |
| DEF USR             | REM                  |
| Delete              | RENUM                |
| DIM                 | Restore              |
| Edit                | Resume               |
| End                 | RIGHTS               |
| Erase               | RND                  |
| ERR/ERL             | Run                  |
| Error               | SGN                  |
| EXP                 | SIN                  |
| Fix                 | Space                |
| For...Next          | SPC                  |
| FRE                 | SQR                  |
| GOSUB...Return      | Stop                 |
| GOTO                | Swap                 |
| HEX\$               | Tab                  |
| If...Then/If...GOTO | TAN                  |
| If...Then...Else    | TRON/TROFF           |
| INT                 | USR                  |
| Input               | VAL                  |
| INSTR               | VALPTR               |
| LEN                 | Wait                 |
| Let                 | WEND While           |
| List                | Width                |
| LLIST               |                      |

Table 1. 8K and Extended Basic keywords.

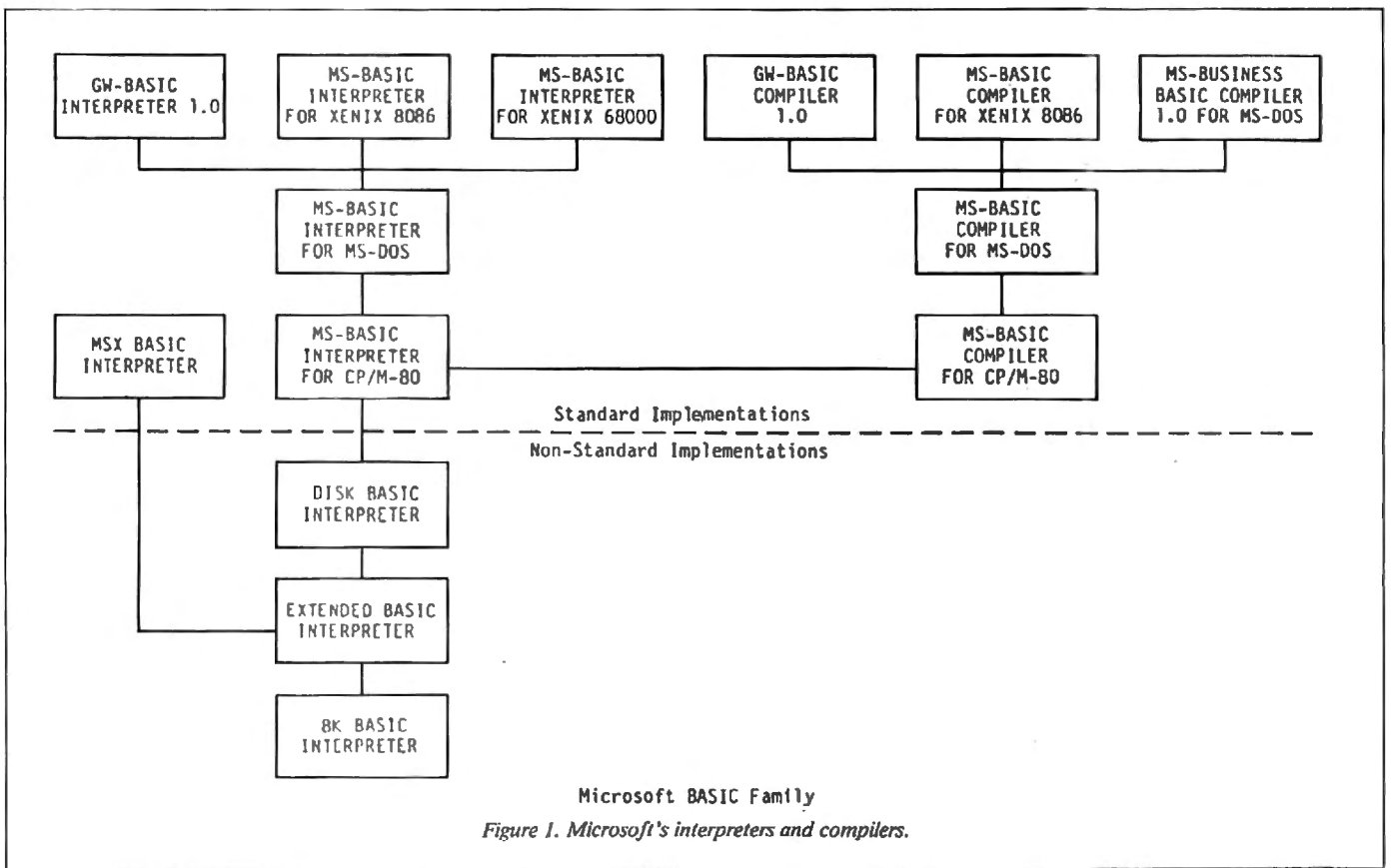
|                                   | 8K                                                                                                                      | Extended                                                                                                                             |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Program line length               | 72 characters                                                                                                           | 255 characters                                                                                                                       |
| Numeric precision                 | Single precision<br>(seven digits [six printed]) (Some versions can have nine digits)                                   | Single/double precision<br>(16 digits)                                                                                               |
| Variable names                    | First two characters                                                                                                    | First 40 characters                                                                                                                  |
| Significant characters            | First 16 characters for 680X versions                                                                                   |                                                                                                                                      |
| Embedded reserved words permitted | No                                                                                                                      | Yes                                                                                                                                  |
| Variable declaration              | \$ String                                                                                                               | \$ String<br>% Integer<br>! Single precision<br># Double precision<br>DEFINT, DEFSTR, DEFSNG, DEFDBL                                 |
| <b>Operators</b>                  |                                                                                                                         |                                                                                                                                      |
| Arithmetic                        | ^ Exponentiation<br>- Negation<br>* Multiplication<br>/ Division<br>+ Addition<br>- Subtraction                         | ^ Exponentiation<br>- Negation<br>* Multiplication<br>/ Division<br>+ Addition<br>- Subtraction<br>\ Integer division<br>MOD Modulus |
| Relation/string                   | = Equality<br><> Inequality<br>< Less than<br>> Greater than<br><= Less than or equal to<br>>= Greater than or equal to | = Equality<br><> Inequality<br>< Less than<br>> Greater than<br><= Less than or equal to<br>>= Greater than or equal to              |
| Logical                           | Not<br>And<br>Or                                                                                                        | Not<br>And<br>Or<br>XOR<br>IMP<br>EQV                                                                                                |
| Error messages                    | Error code<br>(two character)                                                                                           | Error message                                                                                                                        |

Table 2. 8K and Extended Basic features.

|    |        |                                                                             |
|----|--------|-----------------------------------------------------------------------------|
| a) | U <n>  | Move up                                                                     |
|    | D <n>  | Move down                                                                   |
|    | L <n>  | Move left                                                                   |
|    | E <n>  | Move diagonally up & right                                                  |
|    | F <n>  | Move diagonally down & right                                                |
|    | G <n>  | Move diagonally down & left                                                 |
|    | H <n>  | Move diagonally up & left                                                   |
|    | M x, y | Move relative if x or y is preceded by + or -; otherwise, move is absolute. |
| b) | B      | Move, but do not plot any points                                            |
|    | N      | Move, but return to the original position when done                         |
| c) | A <n>  | Set angle n                                                                 |
|    | C <n>  | Set color n                                                                 |
|    | S <n>  | Set scale factor                                                            |
|    | X <s>  | Execute substring s                                                         |

Table 3. a) The movement commands. <n> indicates the distance to move. You move <n> times the scaling factor (set with the S command). b) Prefixes that may precede any of the movement commands in 3a. c) Other commands available.





hardware-level interface that GW-Basic expects to see. The OEM must then develop the low-level (hardware-dependent) object modules that the specs define.

The OEM gets the high-level modules in a kit that also includes the documentation and special linkers, and interfaces these modules with the low-level modules. The result should be a GW-Basic interpreter with features specific to the hardware.

GW-Basic is versatile enough to let the OEM adapt the language to support such features as more colors, higher graphics resolution, and different printer and communications protocols.

Now that I've explained GW-Basic's background, I'll look at some of the specific features the Model 2000 uses.

## Graphics

GW-Basic is a descendant of the Microsoft Basic that debuted on the MITS Altair in 1975. In those days, there wasn't much need for graphics support—the hardware was expensive and graphics tools were few. But all that changed with the 16-bit microprocessor, cheaper and larger RAM, and better graphics software. Consumers now expect graphics and other extended features in even the least expensive micros.

GW-Basic's graphics capabilities

aren't meant to be all-encompassing. They're designed to provide a foundation for the applications developer.

Here are some of the graphics commands available to the Model 2000 programmer:

**Draw.** The Draw command draws an object on the screen. It is the mechanism for implementing the Graphics Definition Language, which lets you define macros of Draw commands and store them as strings. This way, you can store complex figures for future use.

Table 3a lists the movement commands, while Table 3b lists the prefixes you can append to these commands. Table 3c indicates other commands available.

Program Listing 1 demonstrates the Graphics Definition Language. Line 60 creates a star and stores it in the string STARON\$. The Draw command in line 120 calls the string and puts the star on the screen, at the location specified in line 110.

**Circle.** This statement lets you draw a circle with its center at location  $x,y$  and a radius of  $r$ . You can also designate a color, the starting and ending points, and the aspect of the  $x$  axis relative to the  $y$  axis.

**Line.** The Line command lets you draw lines from  $(x1,y1)$  to  $(x2,y2)$ , with an optional color (see line 130 in Listing

1). You can also create a rectangle using the point pairs as upper-right and lower-left corners respectively.

Three GW-Basic graphics commands set up the foreground, background, and size—Screen, Color, and Width.

**Screen.** This statement sets the screen mode and attributes. The mode is either text, medium resolution, or high resolution. Burst enables and disables color and black and white. APAGE sets the active page to be written to. VPAGE sets the visual page to be displayed. The latter two are only valid in the text mode.

**Color.** The Color statement operates in two modes: text, in which it sets the foreground, background, and border colors, and graphics, in which it sets the background color and the palette from which it is taken. Two palettes are available.

**Width.** This command sets the width of the output line in number of characters. The width may apply to a file or a device, as well as to the screen.

**Get and Put.** These are two of GW-Basic's most useful (and fun) statements. Get transfers an image into an array while Put puts it back on the screen. You can use five action verbs with Put:

PSET transfers the points from the array (exactly as they were read in with

the Get statement) to a position you specify.

Preset puts the points on the screen in a negative image.

And transfers the image from the array only if an image already exists at those points, and places the new image over the existing one.

Or superimposes the image in the array over the existing one.

XOR inverts the points on the screen where a point exists in the array image.

Animation is one of the most interesting uses of Get and Put. The general method to animate is as follows:

1. Put the object on the screen (with XOR).
2. Recalculate the new position of the object.
3. Put the object at the old location (with XOR) to remove it.
4. Go to step 1, this time putting the object at the new location.

Program Listing 2 demonstrates simple program animation. Lines 90-130 draw a rocket. Line 140 places the rocket in the array X%. Lines 180 and 190, respectively, erase the old image and draw the new one.

## Music

GW-Basic's music abilities are unique. GW uses a Music Definition Language, similar to the Graphics Definition Language, in which the key statement is Play.

**Play.** This statement takes a given string and creates musical notes as defined by the commands in Table 4.

**Sound.** This statement gives you another way to create audible tones. It has only two parameters: frequency (in hertz) and duration (in system clock ticks).

Program Listing 3 demonstrates the Music Definition Language, using the Play statement, with the opening passage of Beethoven's Fifth Symphony. Program Listing 4 is a combined graphics and sound demonstration.

## Event-Trapping

Event-trapping is a novel feature of GW-Basic. It's roughly equivalent to having direct access to interrupt service routines. The general syntax is ON <EVENT> GOSUB NNNN, where EVENT is COM(1), KEY, or STRIG.

Figure 2 shows how you can use event-trapping to trap one of the buttons on the mouse.

## Communications Support

The Model 2000 lets you program communications with an asynchronous RS-232C channel from within Basic. Any applications designer who has ever

|             |                                                                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| A-G         | Play the indicated note in the current octave (see below). You can also include #, +, or - symbols to indicate a sharp, sharp, or flat, respectively. |
| O <n>       | Sets the current octave to n, where n is 0-6.                                                                                                         |
| N <n>       | Plays note n where n is 0-84, as there are 84 notes in seven possible octaves. N=0 indicates a rest.                                                  |
| L <n>       | Sets the length of the note to 1/n beats of a four-beat measure. N=4 produces a quarter note, n=1 produces a whole note. n is 1-64.                   |
| MN          | Sets "music normal" so that each note is 1/4 of the length.                                                                                           |
| ML          | Sets "music legato" so that each note plays its full period.                                                                                          |
| MS          | Sets "music staccato" so that each note plays 1/2 of the length.                                                                                      |
| P <n>       | Sets up a pause for length calculated as with the L <n> command.                                                                                      |
| T <n>       | Sets the tempo to n where there are n (L 4)'s in one minute.                                                                                          |
| MF          | Music foreground. This causes the music to play until finished before executing the next GW-Basic command.                                            |
| MB          | Music background. This allows the user to place a series of notes and commands in a buffer and play them while the program continues executing.       |
| X substring | This command executes the substring of commands as described above.                                                                                   |

Table 4. Commands that define music created by the Play statement.

The following example shows the use of event trapping on the Model 2000 to trap the pressing of one of the buttons on the mouse, which is available for the Model 2000.

```

10 ON STRIG(0) GOSUB 1000
20 ON STRIG(1) GOSUB 2000
30
   :
   : (MAIN BODY OF PROGRAM)
   :
1000 REM This routine takes over when the left button is
1010 REM pushed.
1020
   :
1999 RETURN
2000 REM This routine takes over when the right button is
2010 REM pushed.
2020
   :
2999 RETURN

```

Figure 2. This program template recognizes when you press a button on the Model 2000's mouse.

### Program Listing 1. Star.

```

2 REM *****
3 REM * Star *
4 REM * This example is designed to show the use of the *
5 REM * Graphics Definition Language to draw a random *
6 REM * pattern of stars, joining each star to the last *
7 REM * star put on the screen. *
8 REM *****
10 DEFINT A-Z
20 CLS:SCREEN 1: KEY OFF
30 '
60 STARON$="C1NU8ND8NL8NR8NE8NF8NG8NH8": REM define star
70 STAROFF$="C0NU8ND8NL8NR8NE8NF8NG8NH8": REM star off
75 '
80 FOR I=1 TO 100: REM LOOP 100 TIMES
85 IF I>1 THEN X1=X:Y1=Y ELSE X1=160:Y1=100
90 X=INT(RND*320)+1: REM SET UP x and y values
100 Y=INT(RND*200)+1
110 PSET(X,Y),0: REM set the origin of the star
120 DRAW STARON$: REM draw the star
130 LINE(X,Y)-(X1,Y1),1: REM draw the line to previous point
140 PSET(X,Y),0: REM set the origin of the star
160 DRAW STAROFF$: REM erase it
170 NEXT I
999 END

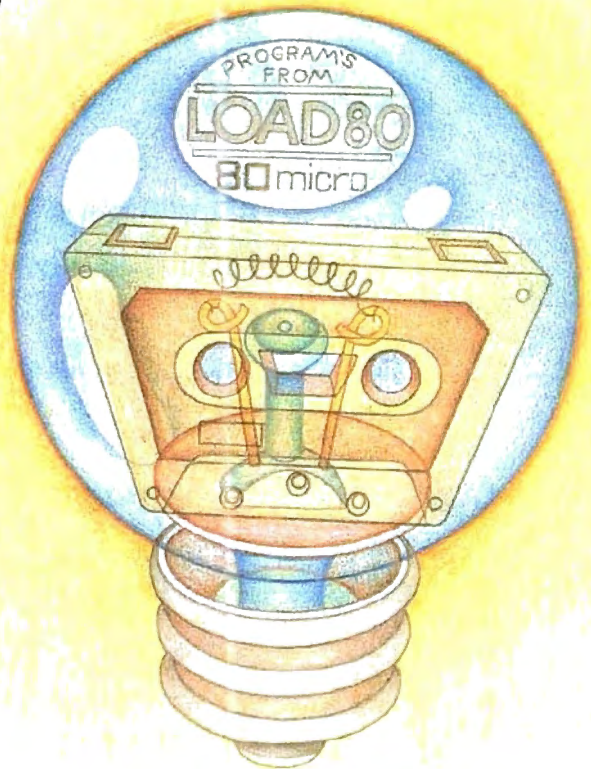
```

End

tried to write the Assembly-language routines to do this job will appreciate the convenience of this feature. You access it with a special case of the Open command, the form of which is  
OPEN "COM1:[speed],[parity],[data],[stop],[RS]  
[.CS[n],[DS[n]],[CD[n]],[LF],[PE]] AS [#]  
filenum[LEN=number]

where speed is the baud rate (75-9,600); parity is space, odd, mark, even, or none; data is the number of data bits; stop is the number of stop bits; filenum is the file number; number is the maximum number of bytes that can be read from the buffer; and RS, CS, DS, CD, LF, and PE refer to the line signals.

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## Conclusions

If you're a TRS-80 programmer, I hope you at least get a chance to experiment with the Model 2000. GW-Basic's features will give you a much more flexible and powerful environment in which to program. It will give your work a new and exciting dimension. ■

*Gregory E. Lobdell is the assistant product marketing manager of business languages at Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004.*

## Face Off

How fast is fast? The 80186's raw speed is what gives the Model 2000 a distinct performance edge over the first-generation 16-bit processors and previous TRS-80 machines.

Below, for example, is a benchmark program that takes the standard mathematical operators (addition, subtraction, multiplication, division, and exponentiation) and loops through them 1,000 times, performing each operation one time per loop (see Program Listing 5). Here are the times, in seconds, for some popular systems:

| System          | Language        | Secs  |
|-----------------|-----------------|-------|
| Model 4         | Model III Basic | 75.3  |
| Apple II*       | MS-Basic        | 70.2  |
| Model 100       | M100 Basic      | 65.22 |
| IBM PC          | GW-Basic        | 17.77 |
| Model 4P        | Model 4 Basic   | 16.89 |
| Compaq          | GW-Basic        | 15.30 |
| TI Professional | GW-Basic        | 14.02 |
| Model 2000      | GW-Basic        | 6.58  |

\*The Apple II was configured to run with the Microsoft Softcard and CP/M 80.

As you can see, the brute power of the 80186 can make a noticeable difference in software performance. ■

### Program Listing 5. Numerical benchmarks.

```
20 REM Numerical Benchmarks
+, -, *, /, ^
30 DEFINT I
40 A = 3.14159
50 B = 5.5
55 FOR I = 1 TO 500: NEXT I: REM WAIT
A BIT
60 PRINT "START..."
100 FOR I = 1 TO 1000
110 X = A + B
120 X = A - B
130 X = A * B
140 X = A / B
150 X = AA3
160 NEXT I
999 PRINT "END...": END
```

End

### Program Listing 2. Rocket.

```
10 REM *****
20 REM ROCKET
30 REM This program is designed to demonstrate the
40 REM use of PUT and GET for animation purposes.
50 REM It also uses the LINE statement.
60 REM *****
65 DEFINT A-Z
70 CLS: SCREEN 3
80 DIM X%(8000): REM dimension the array for the image
90 LINE(110,10)-(120,30),1,B: REM draw the rocket
100 LINE(110,10)-(115,5),1
110 LINE(120,10)-(115,5),1
120 LINE(110,30)-(105,35),1
130 LINE(120,30)-(125,35),1
140 GET(100,0)-(140,40),X%: REM get rocket we just drew into x%
170 FOR Y2=10 TO 155 STEP 10
180 PUT (100,Y2-10),X%,XOR: REM erase the old one
190 PUT (100,Y2),X%,XOR: REM draw the new one
200 NEXT Y2
999 END
```

End

### Program Listing 3. Beethoven's Fifth Symphony.

```
10 REM *****
20 REM Beethoven's 5th Symphony
30 REM
40 REM This program is designed to play the opening
50 REM passage from this piece. It demonstrates the
60 REM PLAY statement.
70 REM
80 REM *****
90 REM
100 REM N$ is an array of strings containing the Music
110 REM Definition Language.
120 DIM N$(15)
130 REM S$ is the setup string for Octave and Tempo
140 S$="T200 O2"
150 REM Set up N$ with the first passage of the piece
160 N$(1)="P2 P8 L8 GGG"
170 N$(2)="L1 E-"
180 N$(3)="P8 L8 FFF"
190 N$(4)="L1 D"
200 N$(5)="P8 L8 GGGE-A-A-A-G O3 E-E-E-"
210 N$(6)="L2 C O2 L8 P8 GGG"
220 N$(7)="DA-A-A-G O3 FFF"
230 N$(8)="L2 D L8 P8 GGF"
240 N$(9)="T140 L4 E- T200 L8 C O2 B O3 GGF"
250 N$(10)="T140L4 E- T200 L8 C O2 B O3 GGF"
260 N$(11)="L2 E- C"
270 N$(12)="L2 G L8 P8 A-A-A-"
280 N$(13)="T140 L1 F"
290 PLAY S$: REM initialize Octave and Tempo
300 FOR I=1 TO 13: REM Play the piece
310 PLAY N$(I)
320 NEXT I
330 END
```

End

### Program Listing 4. Flag and national anthem program by Mindy Wells.

```
1 Flag and Anthem program
by Mindy Wells, 20 W. Main St., Mendham, NJ 07945
5 SCREEN 3
10 CLS
15 DIM A(20)
20 LINE (0,0)-(640,400),3,BF
30 LINE (0,0)-(300,210),6,BF
40 LINE (300,0)-(640,30),4,BF
50 LINE (300,60)-(640,90),4,BF
60 LINE (300,120)-(640,150),4,BF
70 LINE (300,180)-(640,200),4,BF
80 LINE (300,200)-(640,210),4,BF
90 LINE (0,240)-(640,270),4,BF
100 LINE (0,300)-(640,330),4,BF
110 LINE (0,370)-(640,400),4,BF
115 DRAW"BM 20,32 C3M+4,-10 M+4,+10 M-10,-6 M+12,0 M-10,+6"
117 PAINT (23,27),3,3
118 GET(20,22)-(32,32),A
120 FOR X=0 TO 4
130 FOR Z=0 TO 5
140 PUT(Z*50+19,X*36+40),A,OR
160 NEXT Z, X
170 FOR X=0 TO 3
180 FOR Z=0 TO 4
190 PUT(Z*50+44,X*36+22),A,OR
210 NEXT Z, X
220 PLAY"O3F8D802B-403D4F4B-204D8C803B-4D4E4F2F8F804"
221 PLAY"O4D4.C803B-4A2G8A8B-4B-4F4D402B-403F8D802B
-403D4F4"
222 PLAY"B-204D8C803B-4D4E4F2F8F804D4.C803B-4A2G8A8"
223 PLAY"B-4B-4F4D402B-404D8D8D4E-4F4F2E-8D8C4D4E-4E-2"
224 PLAY"O4E-4D4.C803B-4A2G8A8B-4D4E4F2F4B-4B-4B-8A8G4G4G4O
4C4E-8D8C803B-8B-4.A4.F8F8B-4.O4C8D8E-8F203B-804C8D4.E-4C403
B-2
```

End

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# Bugs from Outer Space

After installing these modules, you're ready to go head to head against the bugs from outer space.

**T**his is the article you've been waiting for: the final, full-tilt version of our arcade game. Except for next month's snazzy scoreboard, the following modules complete the game program.

By now you're probably feeling ready to write your own games, but first let's see if you're ready to fight off the lethal space bugs in all their fury. You see, this is what they've been waiting for, too.

## The Bugs Have the Bomb

Program Listing 1 (TEXT5A) begins with ADDBOMB, the Add Bomb routine. It compares a random number with the bomb parameter; if the parameter is less than the number, control returns to the main program. Otherwise, the routine adds a bomb to the bomb table.

The MBOMB routine moves the bombs. Each time a bomb reaches the bottom of the screen, the routine tests

to see whether it hit your base. If it did, a call to the Killed routine sends you up in smoke.

Finally, SOUND4 makes a brief sound when bombs are dropped, bug language for "Bombs away." TEST6 triggers more frequent attacks as time passes.

## Level After Level

To clear the screen between levels, the main program calls the Flash routine in Program Listing 2 (TEXT5B). Flash also makes a sound for a new level and increments the level number.

The Start module initializes all the parameters to start a level, displaying the level number and storing it in A. This routine ANDs the A register with 7, giving a value of between zero and 7 and adds an offset (generated by multiplying A by two) to the address of the level table, pointing HL at the level parameters' address. Start then loads the

address into DE and swaps DE and HL.

Each level means a new squadron of bugs, with each bug's number transferred from the level parameter table to the main parameter table. Start updates the attack and bomb parameters and the bug speeds, moves the random entry point and Bug 2 first flags to the main parameter table, sets the add bug flag for the first enemy to enter, and increases the bug's speed.

## Bugs Behind the Scenes

Now we can see how the game works as a whole. Program Listing 3, MAIN5, calls the introductory subroutine and initializes the parameter table, score, level number, and number of bases. It sets IX to point at the parameter table, and displays the base, score, number of bases, and high score.

Next, the program stores the bug speeds and sets the New Level flag. Each new level zeroes the bug, bomb,

*Editor's note: "Bugs from Outer Space" is a six-part tutorial on writing machine-language arcade games for the Models I and III. The first installment appeared in March 1984 and the last will appear in next month's annual games issue.*

## The Key Box

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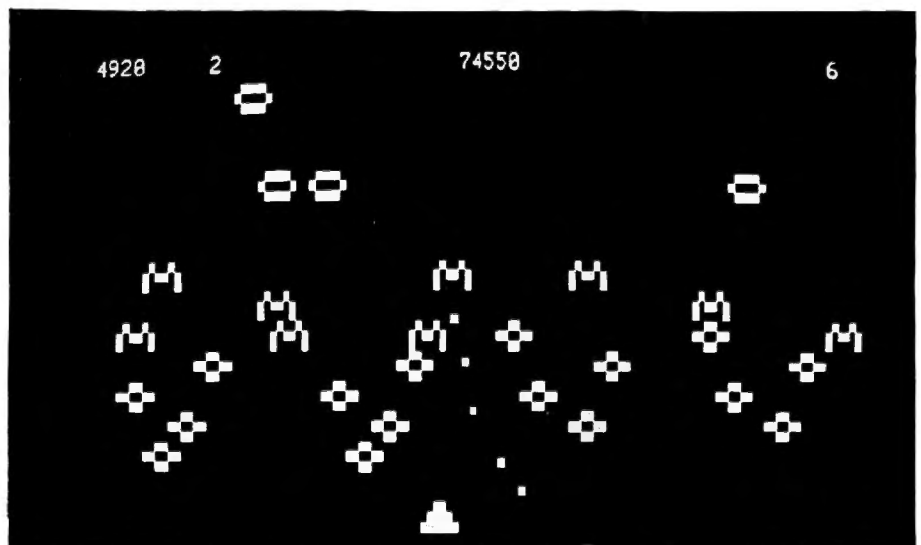


Photo. At last, the bugs are shooting back.

Program Listing 1. TEXTSA, bomb and attack acceleration module.

```

00100 ;**** PART 5A
6BFB 00110 ORG 6BFBH
6719 00120 RND EQU 6719H
6257 00130 BASE EQU 6257H
6359 00140 BUG1 EQU 6359H
6389 00150 BUG2 EQU 6389H
63EB 00160 BOMBS EQU 63EBH
6752 00170 KILLED EQU 6752H
618A 00180 SOUNDX EQU 618AH
00190 ;**** ADDBMB ROUTINE ADD BOMBS
6BFB CD1967 00200 ADDBMB CALL RND ;A=RND
6BFE DDBE1D 00210 CP (IX+29) ;COMPARE TO BOMB PARAM
6C01 D0 00220 RET NC ;RETURN IF A IS LARGER
6C02 CD1967 00230 CALL RND ;TEST AGAIN
6C05 DDBE1D 00240 CP (IX+29)
6C08 D0 00250 RET NC
6C09 CD1967 00260 CALL RND ;A=RND
6C0C E601 00270 AND 1 ;MASK BIT 0
6C0E FD215963 00280 LD IY,BUG1 ;IY==>BUG1 TABLE
00290 ;NOTE FLAGS NOT CHANGED BY LD
6C12 280B 00300 JR Z,ADDB10 ;JUMP IF ZERO
6C14 FD218963 00310 LD IY,BUG2 ;IY==>BUG2 TABLE
6C18 DD7E1F 00320 LD A,(IX+31) ;IF ADDING BUG 1
6C1B DDB8620 00330 OR (IX+32) ; OR ADDING BUG 2
6C1E C0 00340 RET NZ ;THEN RETURN
6C1F 0620 00350 ADDB10 LD B,32 ;B=NUM OF BUGS
6C21 FD7E01 00360 ADDB20 LD A,(IX+1) ;GET MSB
6C24 FE3C 00370 CP 3CH ;3C?
6C26 2026 00380 JR NZ,ADDB50 ;SKIP IF NOT
6C28 67 00390 LD H,A ;H=MSB
6C29 FD6E00 00400 LD L,(IY) ;L=LSB
6C2C 114100 00410 LD DE,65 ;DE=65
6C2F 19 00420 ADD HL,DE ;HL=HL+65
6C30 0610 00430 LD B,16 ;MAX # OF BOMBS
6C32 FD21EB63 00440 LD IY,BOMBS ;IY==>BOMB TABLE
6C36 FD7E01 00450 ADDB30 LD A,(IX+1) ;MSB OF BOMB LOC
6C39 B7 00460 OR A ;0?
6C3A 200B 00470 JR NZ,ADDB40 ;SKIP IF NOT
6C3C FD7500 00480 LD (IY),L ;STORE BOMB LSB
6C3F FD7401 00490 LD (IY+1),H ;STORE BOMB MSB
6C42 DD363108 00500 LD (IX+49),8 ;SET BOMB DROPPED FLAG
6C46 C9 00510 RET
6C47 FD23 00520 ADDB40 INC IY ;IY=IY+2
6C49 FD23 00530 INC IY
6C4B 10E9 00540 DJNZ ADDB30 ;LOOP
6C4D C9 00550 RET
6C4E FD23 00560 ADDB50 INC IY ;IY=IY+3
6C50 FD23 00570 INC IY
6C52 FD23 00580 INC IY
6C54 10CB 00590 DJNZ ADDB20 ;LOOP
6C56 C9 00600 RET
00610 ;**** MBOMB ROUTINE MOVES BOMBS
6C57 DD3513 00620 MBOMB DEC (IX+19) ;DECREMENT COUNTER
6C5A C0 00630 RET NZ ;RETURN IF NOT Z
6C5B DD7E14 00640 LD A,(IX+20) ;RESTORE COUNTER
6C5E DD7713 00650 LD (IX+19),A
6C61 0610 00660 LD B,16
6C63 FD21EB63 00670 LD IY,BOMBS ;B=MAX. # OF BOMBS
6C67 FD7E01 00680 LOOPC1 LD A,(IX+1) ;IY==>BOMB TABLE
6C6A B7 00690 OR A ;TEST MSB
6C6B 2837 00700 JR Z,SKIPC1 ;SKIP IF 0
6C6D 67 00710 LD H,A ;H=MSB
6C6E FD6E00 00720 LD L,(IY) ;GET LSB
6C71 7C 00730 LD A,H ;LAST LINE?
6C72 FE3F 00740 CP 3FH
6C74 2026 00750 JR NZ,SKIPC2 ;JUMP IF NOT
6C76 7D 00760 LD A,L ;A,L
6C77 FE00 00770 CP 0C0H
6C79 381B 00780 JR C,SKIPC2 ;JUMP IF NOT
6C7B 3680 00790 LD (HL),80H ;ERASE SHOT
6C7D DD7E1E 00800 LD A,(IX+30) ;BASE HIT ALREADY?
6C80 B7 00810 OR A
6C81 2021 00820 JR NZ,SKIPC1 ;SKIP IF SO
6C83 FD360100 00830 LD (IY+1),0 ;KILL BOMB
6C87 ED5B5762 00840 LD DE,(BASE) ;DE=BASE LOCATION
6C8B 7D 00850 LD A,L ;A=LSB OF SHOT LOC
6C8C 93 00860 SUB E ;SUBTRACT BASE LSB
6C8D FE03 00870 CP 3 ;HIT?
6C8F 3013 00880 JR NC,SKIPC1 ;SKIP IF NOT
6C91 CD5267 00890 CALL KILLED ;KILLED
6C94 100E 00900 JR SKIPC1 ;CALL BASE HIT SUB
6C96 3680 00910 SKIPC2 LD (HL),80H ;ERASE SHOT
6C98 114000 00920 LD DE,64 ;MOVE SHOT
6C9B 19 00930 ADD HL,DE
6C9C 3688 00940 LD (HL),88H ;DISPLAY SHOT
6C9E FD7500 00950 LD (IY),L ;STORE LSB
6CA1 FD7401 00960 LD (IY+1),H ;STORE MSB
6CA4 FD23 00970 SKIPC1 INC IY ;IY=IY+2
6CA6 FD23 00980 INC IY
6CA8 10BD 00990 DJNZ LOOPC1 ;LOOP UNTIL B=0
6CAA C9 01000 RET
01010 ;**** SOUND4 ROUTINE IS BOMB DROPPED SOUND
6CAB DD7E31 01020 SOUND4 LD A,(IX+49) ;BOMB DROPPED?
6CAE B7 01030 OR A
6CAF C8 01040 RET Z ;RETURN IF NOT
6CB0 DD3531 01050 DEC (IX+49) ;DECREMENT COUNT
6CB3 C38A61 01060 JP SOUNDX ;SOUND
01070 ;**** TEST6 CAUSES ATTACKS TO INCREASE WITH TIME
6CB6 DD7E07 01080 TEST6 LD A,(IX+7) ;TIME TO MOVE BUG 2
6CB9 DDBE00 01090 CP (IX+8) ;IY=XTIME TO MOVE BUG 2?
6CBC C0 01100 RET NZ ;RETURN IF NOT
6CBD CD1967 01110 CALL RND ;A=RND
6CC0 DDBE1D 01120 CP (IX+29) ;COMPARE TO BOMB PARAM
6CC3 D0 01130 RET NC ;RETURN ON NOT CARRY

```

Listing 1 continued

and explosion tables, resets some flags and erases any leftover shots.

Flash and Start clear the screen and initialize the level, after which the program calls the various routines inside the main loop (LOOPMN). When you conquer one level, the game jumps to Next; if you inadvertently let the bugs destroy your base, it jumps to CONT and then to Next to start the level again if you still have bases.

When you lose your last base, the "Game Over" message appears and the program loops until you press the clear key to begin anew. Throughout the game, the main loop tests for the F (pause) key, which freezes the action until you hit the clear key.

## The Final Conflict

If you're ready to play—you've had fair warning; this isn't like Part II when the bugs didn't swoop down on you. Shoot back—enter and assemble the new listings, then modify last month's main program to match Listing 3 and

*After a little while, the bugs start diving to attack—which doubles their value if you can hit them.*

assemble it. Be sure to load B with 4 in the line labeled LOOPMN.

Then load all the modules' and the newest main program's object code files and execute the code. After you start the game, spider and star bugs appear from either side of the screen and begin climbing to attack altitude, where saucer bugs await.

When the bugs near the top of the screen, they begin to drop bombs. After a little while, they start diving to attack—which doubles their value (otherwise 10 points for spiders, 25 for stars and 100 for saucers) if you can hit them. To do that, you have to stay alive yourself.

I hope you enjoy the game. Next month, you'll get a bug graduates' diploma—a permanent disk scoreboard. ■

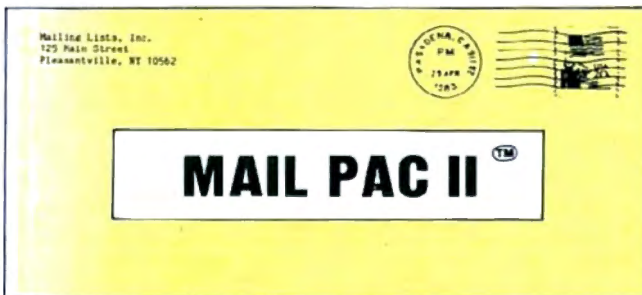
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Listing 1 continued

```

6CC4 DD7E18 01140 LD A,(IX+24) ;GET ATTACK PARAM
6CC7 3C 01150 INC A ;A=A+1
6CC8 D8 01160 RET C ;RETURN IF CARRY
6CC9 DD7718 01170 LD (IX+24),A ;STORE ATTACK PARAM
6CCC C9 01180 RET
6CCD 01190 NEXT1 EQU $
0000 01200 END
00000 TOTAL ERRORS
31663 TEXT AREA BYTES LEFT

ADDB10 6C1F 00350 00300
ADDB20 6C21 00360 00590
ADDB30 6C36 00450 00540
ADDB40 6C47 00520 00470
ADDB50 6C4E 00560 00380
ADDBMB 6BF8 00200
BASE 6257 00130 00840
BOMBS 63EB 00160 00440 00670
BUG1 6359 00140 00280
BUG2 6389 00150 00310
KILLED 6752 00170 00890
LOOPC1 6C67 00680 00990
MBOMB 6C57 00620
NEXT1 6CCD 01190
RND 6719 00120 00200 00230 00260 01110
SKIPC1 6CA4 00970 00700 00820 00880 00900
SKIPC2 6C96 00910 00750 00780
SOUND4 6CAB 01020
SOUNDX 618A 00180 01060
TEST6 6CB6 01080
    
```

End

Program Listing 2. TEXT5B, screen flash and level initialization module.

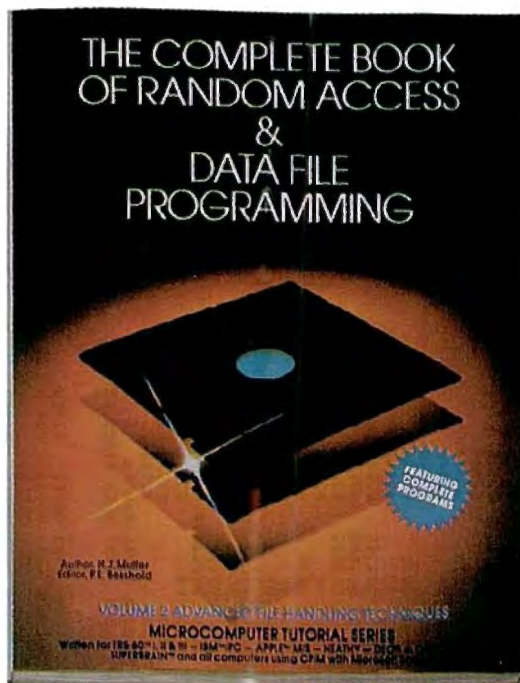
```

00010 ;**** PART 5B
6CCD 00011 ORG 6CCDH
6463 00012 BASEM EQU 6463H
6A50 00013 LEVEL EQU 6A50H
6AB4 00014 ONE EQU 6AB4H
6235 00015 INCSCR EQU 6235H
6203 00016 DISSCR EQU 6203H
6AA4 00017 LEVTAB EQU 6AA4H
00018 ;**** FLASH SUB CLEARS SCREEN
6CCD 21403C 01210 FLASH LD HL,3C40H ;FLASH & CLEAR
6CD0 0E0F 01230 LD C,15 ;15 LINES
6CD2 0640 01240 LOOPZ1 LD B,64 ;64 CHARACTERS
6CD4 E5 01250 PUSH HL ;SAVE HL
6CD5 36BF 01260 LOOPZ2 LD (HL),191 ;STORE WHITE BLOCK
6CD7 23 01270 INC HL
6CD8 10FB 01280 DJNZ LOOPZ2 ;CONTINUE UNTIL B=0
6CDA E1 01290 POP HL
6CDB C5 01300 PUSH BC
6CDC 010002 01310 LD BC,200H ;DELAY
6CDF CD6000 01320 CALL 60H
6CE2 C1 01330 POP BC
6CE3 0640 01340 LD B,64 ;64 CHARACTERS
6CE5 3680 01350 LOOPZ3 LD (HL),128 ;STORE BLANK
6CE7 23 01360 INC HL
6CE8 10FB 01370 DJNZ LOOPZ3 ;LOOP UNTIL B=0
6CEA 0D 01380 DEC C ;C=C-1
6CEB 20E5 01390 JR NZ,LOOPZ1 ;LOOP UNTIL C=0
6CED 110000 01410 LD DE,0
6CF0 CD6364 01420 CALL BASEM ;DISPLAY BASE
6CF3 C9 01430 RET
01431 ;**** NEW LEVEL SOUND
6CF4 DD7E30 01440 SOUND1 LD A,(IX+48) ;RET IF BASE HIT
6CF7 B7 01450 OR A
6CF8 C0 01460 RET NZ
6CF9 E002 01470 LD C,2 ;DURATION
6CFB 79 01480 LOOPY1 LD A,C ;A=C
6CFC E618 01490 AND 18H ;MASK BITS 3 & 4
6CFE 0F 01500 RRCA
6CF7 0F 01510 RRCA
6D00 0F 01520 RRCA
6D01 D3FF 01530 OUT (255),A ;ALIGN BITS
6D03 41 01540 LD B,C ;SEND TO CASSETTE
6D04 10FE 01550 DJNZ $ ;B=C
6D06 41 01560 LD B,C ;DELAY
6D07 79 01570 LD A,C ;B=C
6D08 E603 01580 AND 3 ;A=C
6D0A D3FF 01590 OUT (255),A ;MASK LOWER 2 BITS
6D0C 10FE 01600 DJNZ $ ;SEND TO CASSETTE
6D0E 0C 01610 INC C ;DELAY
6D0F 20EA 01620 JR NZ,LOOPY1 ;C=C+1
6D11 21506A 01640 LD HL,LEVEL ;LOOP UNTIL C=0
6D14 11B46A 01650 LD DE,ONE ;ADD ONE TO LEVEL
6D17 CD3562 01660 CALL INCSCR
6D1A C9 01661 RET
01662 ;**** START INITIALIZES LEVEL
6D1B 21506A 01670 START LD HL,LEVEL ;DISPLAY LEVEL
6D1E 11303C 01680 LD DE,3C30H
6D21 CD0362 01690 CALL DISSCR
6D24 DD7E23 01700 LD A,(IX+35) ;GET LEVEL
6D27 DD3423 01710 INC (IX+35) ;INCREMENT LEVEL
6D2A E607 01720 AND 7 ;A=MOD(LEVEL,8)
6D2C 07 01730 RLCA ;A=A*2
6D2D 4F 01740 LD C,A
6D2E 0600 01750 LD B,0 ;BC=A
6D30 21A46A 01760 LD HL,LEVTAB ;HL=>LEVEL TABLE
6D33 09 01770 ADD HL,BC ;ADD OFFSET
    
```

Listing 2 continued

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- The writing of a Menu to summarize program functions
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- Changing or editing stored records
- The LPRINT capability from disk using three different formats
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## Listing 2 continued

```

6D34 5E      01780    LD      E,(HL)
6D35 23      01790    INC     HL
6D36 56      01800    LD      D,(HL) ;DE=(HL)
6D37 EB      01810    EX      DE,HL ;HL=>LEVEL TABLE
6D38 7E      01820    LD      A,(HL) ;GET # OF BUG 1
6D39 DD7700  01830    LD      (IX),A ;STORE IT
6D3C 23      01840    INC     HL
6D3D 7E      01850    LD      A,(HL) ;# OF BUG 2
6D3E DD7701  01860    LD      (IX+1),A
6D41 23      01870    INC     HL
6D42 7E      01880    LD      A,(HL) ;# OF BUG 3
6D43 DD7702  01890    LD      (IX+2),A
6D46 23      01900    INC     HL
6D47 DD7E30  01910    LD      A,(IX+48) ;BASE HIT?
6D4A B7      01920    OR      A
6D4B 2806    01930    JR      Z,SKIPJ1 ;SKIP IF NOT
6D4D 23      01940    INC     HL
6D4E 23      01950    INC     HL
6D4F 23      01960    INC     HL
6D50 23      01970    INC     HL ;BUMP POINTER
6D51 183A    01980    JR      SKIPG ;SKIP
6D53 7E      01990    LD      A,(HL) ;INC TO ATTACK PARAM
6D54 DD8618  02000    ADD     A,(IX+24)
6D57 3803    02010    JR      C,SKIPA ;SKIP ON CARRY
6D59 DD7718  02020    LD      (IX+24),A ;ELSE STORE
6D5C 23      02030    SKIPA  INC     HL
6D5D 7E      02040    LD      A,(HL) ;INC TO BOMB PARAM
6D5E DD861D  02050    ADD     A,(IX+29)
6D61 3803    02060    JR      C,SKIPB ;SKIP ON CARRY
6D63 DD771D  02070    LD      (IX+29),A
6D66 23      02080    SKIPB  INC     HL
6D67 46      02090    LD      B,(HL) ;DEC TO MOVE BUG 1
6D68 DD7E06  02100    LD      A,(IX+6)
6D6B 90      02110    SUB     B
6D6C 3805    02120    JR      C,SKIPC
6D6E 2803    02130    JR      Z,SKIPC
6D70 DD7706  02140    LD      (IX+6),A
6D73 23      02150    SKIPC  INC     HL
6D74 46      02160    LD      B,(HL) ;DEC TO MOVE BUG 2
6D75 DD7E08  02170    LD      A,(IX+8)
6D78 90      02180    SUB     B
6D79 3805    02190    JR      C,SKIPD
6D7B 2803    02200    JR      Z,SKIPD
6D7D DD7708  02210    LD      (IX+8),A
6D80 23      02220    SKIPD  INC     HL
6D81 46      02230    LD      B,(HL) ;DEC TO MOVE BUG 3
6D82 DD7E0A  02240    LD      A,(IX+10)
6D85 90      02250    SUB     B
6D86 3805    02260    JR      C,SKIPG
6D88 2803    02270    JR      Z,SKIPG
6D8A DD770A  02280    LD      (IX+10),A
6D8D 23      02290    SKIPG  INC     HL
6D8E 7E      02300    LD      A,(HL) ;RANDOM ENTRY POINTS
6D8F DD7725  02310    LD      (IX+37),A
6D92 23      02320    INC     HL
6D93 7E      02330    LD      A,(HL) ;BUG 2 FIRST FLAG
6D94 DD7724  02340    LD      (IX+36),A
6D97 B7      02350    OR      A
6D98 200F    02360    JR      NZ,SKIPE ;BUG 2 FIRST?
6D9A DD7E00  02370    LD      A,(IX) ;SKIP IF SO
6D9D 07      02380    RLCA   ;SET ADD BUG 1 FLAG
6D9E 07      02390    RLCA
6D9F 07      02400    RLCA
6DA0 2002    02410    JR      NZ,SKIPX1 ;A=A*16
6DA2 3E20    02420    LD      A,20H ;SKIP IF NOT 0
6DA4 DD771F  02430    LD      (IX+31),A ;A=32
6DA7 180D    02440    JR      SKIPF ;SKIP
6DA9 DD7E01  02450    SKIPE  LD      A,(IX+1) ;SET ADD BUG 2 FLAG
6DAC 07      02460    RLCA
6DAD 07      02470    RLCA
6DAE 07      02480    RLCA
6DAF 2002    02490    JR      NZ,SKIPX2 ;SKIP IF NOT 0
6DB1 3E20    02500    LD      A,20H ;A=32
6DB3 DD7720  02510    LD      (IX+32),A

```

```

6DB6 DD7E06  02520    SKIPF  LD      A,(IX+6) ;SAVE TIME TO MOVE BUG1
6DB9 DD7721  02530    LD      (IX+33),A
6DBC 0F      02540    RRCA   ;A=A/2
6DBD 867E   02550    AND    7EH
6DBF 0F      02560    RRCA   ;A=A/4
6DC0 B7      02570    OR     A ;0?
6DC1 2001    02580    JR      NZ,SKIPH ;SKIP IF NOT
6DC3 3C      02590    INC     A ;A=1
6DC4 DD7706  02600    SKIPH  LD      (IX+6),A ;SET SPEED
6DC7 DD7E08  02610    LD      A,(IX+8) ;SAVE TIME TO MOVE BUG2
6DCA DD7722  02620    LD      (IX+34),A
6DCD 0F      02630    RRCA   ;A=A/2
6DCE E67E   02640    AND    7EH
6DD0 0F      02650    RRCA   ;A=A/4
6DD1 B7      02660    OR     A
6DD2 2001    02670    JR      NZ,SKIPI ;SKIP IF NOT 0
6DD4 3C      02680    INC     A ;A=1
6DD5 DD7708  02690    SKIPI  LD      (IX+8),A ;SET NEW SPEED
6DD8 DD363000 02700    LD      (IX+48),0 ;RESET BASE HIT FLAG
6DDC C9      02701    RET
6DDD 0F      02702    EQU    $
0000 0F      02703    END
000000 TOTAL ERRORS
31025 TEXT AREA BYTES LEFT

```

```

BASEM 6463 00012 01420
DISSCR 6203 00016 01690
FLASH 6CCD 01210
INCSCR 6235 00015 01660
LEVEL 6A50 00013 01640 01670
LEVTAB 6AA4 00017 01760
LOOPY1 6CFB 01480 01620
LOOPZ1 6CD2 01240 01390
LOOPZ2 6CD5 01260 01280
LOOPZ3 6CE5 01350 01370
NEXT1 6DDD 02702
ONE 6AB4 00014 01650
SKIPA 6D5C 02030 02010
SKIPB 6D66 02080 02060
SKIPC 6D73 02150 02120 02130
SKIPD 6D80 02220 02190 02200
SKIPE 6DA9 02450 02360
SKIPF 6DB6 02520 02440
SKIPG 6D8D 02290 01980 02260 02270
SKIPH 6DC4 02600 02580
SKIPI 6DD5 02690 02670
SKIPJ1 6D53 01990 01930
SKIPX1 6DA4 02430 02410
SKIPX2 6DB3 02510 02490
SOUND1 6CF4 01440
START 6D1B 01670

```

## Program Listing 3. MAIN5, this month's main program.

```

00100 ;***** MAIN PROGRAM
00110 ; VERSION 5
6DD0 00120 ORG 6DDDH
65C0 00130 ADD1 EQU 65C0H
663A 00140 ADD2 EQU 663AH
66B4 00150 ADD3 EQU 66B4H
6BFB 00160 ADDBMB EQU 6BFBH
6AB8 00170 ATTACK EQU 6AB8H
6463 00180 BASEM EQU 6463H
63EB 00190 BOMBS EQU 63EBH
69E9 00200 BOOM EQU 69E9H
6359 00210 BUG1 EQU 6359H
6389 00220 BUG2 EQU 6389H
63B9 00230 BUG3 EQU 63B9H
6203 00240 DISSCR EQU 6203H

```

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#### 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  | BREAKEYN   | Break-even 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 | REQWITH    | Equal withdrawals from investment to leave 0 over      |
| 24 | SIMPDISK   | Simple discount analysis                               |
| 25 | DATEVAL    | Equivalent & non-equivalent 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 | DFPLETE    | Depletion analysis                                     |
| 31 | BLACKSH    | Bloch 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 | FPSFST     | 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    | Defines utility function                               |
| 45 | SIMPLEX    | Linear programming solution by simplex method          |
| 46 | TRANS      | Transportation method for linear programming           |
| 47 | EQQ        | 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 | FQJQJQ     | Fixed quantity economic order quantity model           |
| 53 | FQEQOWSH   | As above but with shortages permitted                  |
| 54 | FQEQGPB    | As above but with quantity price breaks                |
| 55 | QEQUECB    | 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  | LOANAFD  | 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 convertible bond       |
| 100 | PORTVAL9 | Stock market portfolio storage-valuation program    |

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## Listing 3 continued

```

690D 00250 DRAW EQU 690DH
6590 00260 EXPTAB EQU 6590H
624F 00270 HIGH EQU 624FH
6235 00280 INCSCR EQU 6235H
62D9 00290 INIT EQU 62D9H
61BC 00300 INTRO EQU 61BCH
6A50 00310 LEVEL EQU 6A50H
6AA4 00320 LEVTAB EQU 6AA4H
640D 00330 NBASE EQU 640DH
6C57 00340 MBOMB EQU 6C57H
656C 00350 MINUS1 EQU 656CH
695D 00360 NOVEB1 EQU 695DH
6970 00370 NOVEB2 EQU 6970H
6983 00380 NOVEB3 EQU 6983H
6494 00390 NSHOT EQU 6494H
6AB4 00400 ONE EQU 6AB4H
6259 00410 PARAMS EQU 6259H
6253 00420 SCORE EQU 6253H
6568 00430 SHIPS EQU 6568H
63E9 00440 SHOT EQU 63E9H
6487 00450 SOUND1 EQU 6487H
6B56 00460 SOUND2 EQU 6B56H
6BE4 00470 SOUND3 EQU 6BE4H
6CAB 00480 SOUND4 EQU 6CABH
618A 00490 SOUNDX EQU 618AH
640B 00500 TEMPW EQU 640BH
6B20 00510 TEST EQU 6B20H
6B74 00520 TEST2 EQU 6B74H
6B9B 00530 TEST3 EQU 6B9BH
6BC1 00540 TEST5 EQU 6BC1H
6CB6 00550 TEST6 EQU 6CB6H
64DF 00560 TEST7 EQU 64DFH
6CCD 00570 FLASH EQU 6CCDH
6CF4 00580 SOUNDI EQU 6CF4H
6D1B 00590 START EQU 6D1BH
00600 ;***** ENTRY POINT
6DDC CDBC61 00610 ENTRY CALL INTRO ;INTRODUCTION
6DE0 21D962 00620 GAME LD HL,INIT ;INITIALIZE PARAMETERS
6DE3 115962 00630 LD DE,PARAMS
6DE6 017F00 00640 LD BC,127
6DE9 EDB0 00650 LDIR
6DEB 210000 00660 LD HL,0
6DEE 22506A 00670 LD (LEVEL),HL ;LEVEL = 0
6DF1 22526A 00680 LD (LEVEL+2),HL
6DF4 225362 00690 LD (SCORE),HL ;SCORE = 0
6DF7 225562 00700 LD (SCORE+2),HL
6DFA 226A65 00710 LD (SHIPS+2),HL
6DFD 210500 00720 LD HL,5
6E00 226865 00730 LD (SHIPS),HL ;BASES = 5
6E03 DD215962 00740 LD IX,PARAMS ;IX==>PARAMETER TABLE
6E07 110000 00750 LD DE,0
6E0A CD6364 00760 CALL BASEM ;DISPLAY BASE
6E0D 11003C 00770 LD DE,3C00H
6E10 215362 00780 LD HL,SCORE
6E13 CD0362 00790 CALL DISSCR ;DISPLAY SCORE
6E16 11063C 00800 LD DE,3C06H
6E19 216865 00810 LD HL,SHIPS
6E1C CD0362 00820 CALL DISSCR ;DISPLAY BASES LEFT
6E1F 111E3C 00830 LD DE,3CLEH
6E22 214F62 00840 LD HL,HIGH
6E25 CD0362 00850 CALL DISSCR ;DISPLAY HIGH SCORE
6E28 DD7E06 00860 LD A,(IX+6) ;STORE SPEEDS
6E2B DD7721 00870 LD (IX+33),A
6E2E DD7E08 00880 LD A,(IX+8)
6E31 DD7722 00890 LD (IX+34),A
6E34 DD363000 00900 LD (IX+48),0 ;NEW LEVEL FLAG
6E38 215963 00910 LD HL,BUG1 ;CLEAR BUG TABLE
6E3B 115A63 00920 LD DE,BUG1+1
6E3E 018F00 00930 LD EC,48+48+48-1
6E41 3600 00940 LD (HL),0
6E43 EDB0 00950 LDIR
6E45 219065 00960 LD HL,EXP TAB ;CLEAR EXPLOSION TABLE
6E48 119165 00970 LD DE,EXP TAB+1
6E4B 012F00 00980 LD BC,47
6E4E 3600 00990 LD (HL),0
6E50 EDB0 01000 LDIR
6E52 21EB63 01010 LD HL,BOMBS ;CLEAR BOMBS TABLE
6E55 11EC63 01020 LD DE,BOMBS+1
6E58 011F00 01030 LD BC,31
6E5B 3600 01040 LD (HL),0
6E5D EDB0 01050 LDIR
6E5F 210000 01060 LD HL,0
6E62 22E963 01070 LD (SHOT),HL ;CLEAR SHOT LOCATION
6E65 220B64 01080 LD (TEMPW),HL
6E68 DD362900 01090 LD (IX+41),0 ;RESET FLAGS
6E6C DD362A00 01100 LD (IX+42),0
6E70 DD361F00 01110 LD (IX+31),0
6E74 DD362000 01120 LD (IX+32),0
6E78 DD362F00 01130 LD (IX+47),0
6E7C DD7E21 01140 LD A,(IX+33) ;RESTORE SPEEDS
6E7F DD7706 01150 LD (IX+6),A
6E82 DD7E22 01160 LD A,(IX+34)
6E85 DD7708 01170 LD (IX+8),A
6E88 CDCD6C 01180 CALL FLASH ;FLASH AND CLS
6E8B CDF46C 01190 CALL SOUNDI ;SOUND AND INC LEVEL
6E8E CD186D 01200 CALL START ;INITIALIZE
6E91 0604 01210 LD B,4 ;***** CHANGE TO 4 !!!!!
6E93 C5 01220 LOOPWM LOOPX0 PUSH BC
6E94 CD5D69 01230 CALL MOVEB1
6E97 CD7069 01240 CALL MOVEB2
6E9A CD8369 01250 CALL MOVEB3
6E9D CD0D69 01260 CALL DRAW
6EA0 CD596F 01270 CALL TEST0
6EA3 CD576C 01280 CALL MBOMB
6EA6 DD7E1E 01290 LD A,(IX+30) ;BASE HIT?
6EA9 B7 01300 OR A
6EAA CD0D64 01310 CALL Z,MBASE ;MOVE IT IF NOT
6EAD CDFB6B 01320 CALL ADDBMB
6EB0 CDAB6C 01330 CALL SOUND4
6EB3 CD9464 01340 CALL NSHOT
6EB6 CD8764 01350 CALL SOUND1
6EB9 CD206B 01360 CALL TEST
6EBC CD566B 01370 CALL SOUND2
6EBF CDE969 01380 CALL BOOM
6EC2 CD746B 01390 CALL TEST2
6EC5 CD9B6B 01400 CALL TEST3
6EC8 CDE46B 01410 CALL SOUND3
6ECB CDC16B 01420 CALL TEST5
6ECE CDB66C 01430 CALL TEST6
6ED1 C1 01440 POP BC
6ED2 DD7E2A 01450 LD A,(IX+42) ;NEXT LEVEL?
6ED5 B7 01460 OR A
6ED6 C2386E 01470 JP NZ,NEXT
6ED9 DD7E29 01480 LD A,(IX+41)
6EDC B7 01490 OR A
6EDD C2F86E 01500 JP NZ,CONT ;JP IF BASE HIT
6EE0 10B1 01510 DJNZ LOOPX0
6EE2 CDB86A 01520 CALL ATTACK
6EE5 DD342B 01530 INC (IX+43)
6EE8 CDC065 01540 CALL ADD1
6EEB CD3A66 01550 CALL ADD2
6EEE CDB466 01560 CALL ADD3
6EF1 3A0438 01570 LD A,(3004H) ;CHECK FOR 'P'
6EF4 E601 01580 AND 1
6EF6 C46A6F 01590 CALL NZ,PAUSE ;PAUSE IF SO
6EF9 1896 01600 JR LOOPM ;LOOP
6EFB DD3523 01610 CONT DEC (IX+35) ;DECREMENT LEVEL
6EFE DD363001 01620 LD DE,(IX+48),1 ;SET FLAG
6F02 216865 01630 LD HL,SHIPS ;TEST IF 0 LEFT
6F05 0603 01640 LD B,3
6F07 AF 01650 XOR A
6F08 B6 01660 CONT10 OR (HL) ;OR # SHIPS
6F09 23 01670 INC HL
6F0A 10FC 01680 DJNZ CONT10 ;LOOP UNTIL B=0
6F0C C2386E 01690 JP NZ,NEXT ;JP IF NOT GAME OVER
6F0F 214370 01700 LD HL,MESS10 ;DISPLAY MESSAGE
6F12 119B3C 01710 LD DE,3CA0H-5
6F15 010B00 01720 LD BC,11
6F18 EDB0 01730 LDIR
6F1A 214E70 01740 LD HL,MESS20 ;DISPLAY SECOND LINE
6F1D 11D33C 01750 LD DE,3CE0H-13
6F20 011D00 01760 LD BC,29
6F23 EDB0 01770 LDIR

```

Listing 3 continued

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Listing 3 continued

```

6F25 1E0A 01780 LD E,0AH ;SOUND
6F27 0E19 01790 OVER05 LD C,10H
6F29 0640 01800 OVER10 LD B,40H
6F2B C5 01810 OVER20 PUSH BC
6F2C 10FE 01820 DJNZ $
6F2E C1 01830 POP BC
6F2F CD8A61 01840 CALL SOUNDX
6F32 10F7 01850 DJNZ OVER20
6F34 0D 01860 DEC C
6F35 20F2 01870 JR NZ,OVER10
6F37 010003 01880 LD BC,300H
6F3A CD6000 01890 CALL 60H
6F3D 1D 01900 DEC E
6F3E 20E7 01910 JR NZ,OVER05
6F40 3A4038 01920 OVER30 LD A,(3840H)
6F43 10FE 01930 DJNZ $
6F45 E602 01940 AND 2
6F47 28F7 01950 JR Z,OVER30 ;LOOP UNTIL <CLEAR>
6F49 21003C 01960 LD HL,3C00H ;CLEAR SCREEN
6F4C 11013C 01970 LD DE,3C01H
6F4F 3600 01980 LD (HL),120
6F51 01FF03 01990 LD BC,1023
6F54 EDB0 02000 LDIR
6F56 C3E06D 02010 JP GAME ;DO IT
6F59 DD7E2F 02020 TEST8 LD A,(IX+47) ;BUG HIT?
6F5C B7 02030 OR A
6F5D C8 02040 RET Z ;RETURN IF NOT
6F5E DD362F00 02050 LD (IX+47),0 ;RESET FLAG
6F62 3A0C64 02060 LD A,(TENPW+1) ;SHOT FIRED?
6F65 B7 02070 OR A
6F66 C8 02080 RET Z ;RETURN IF NOT
6F67 C3DF64 02090 JP TEST7 ;BUG HIT SUB
6F6A 1E20 02100 PAUSE LD E,20H
6F6C 0E40 02110 PAUSEA LD C,40H ;SOUND
6F6E 43 02120 PAUSEB LD B,E
6F6F CD8A61 02130 CALL SOUNDX
6F72 10FE 02140 DJNZ $
6F74 0D 02150 DEC C
6F75 20F7 02160 JR NZ,PAUSEB
6F77 43 02170 LD B,E
6F78 10FE 02180 DJNZ $
6F7A 1D 02190 DEC E
6F7B 20EF 02200 JR NZ,PAUSEA
6F7D 21003C 02210 LD HL,3C00H ;STORE LINE
6F80 11C46F 02220 LD DE,BUFFER
6F83 014000 02230 LD BC,64
6F86 EDB0 02240 LDIR
6F88 210470 02250 LD HL,MESS ;DISPLAY MESSAGE
6F8B 11803C 02260 LD DE,3C00H
6F8E 014000 02270 LD BC,64
6F91 EDB0 02280 LDIR
6F93 3A4038 02290 PAUSE1 LD A,(3840H)
6F96 10FE 02300 DJNZ $
6F98 E602 02310 AND 2
6F9A 28F7 02320 JR Z,PAUSE1 ;LOOP UNTIL <CLEAR>
6F9C 21C46F 02330 LD HL,BUFFER ;RESTORE LINE
6F9F 11003C 02340 LD DE,3C00H
6FA2 014000 02350 LD BC,64
6FA5 EDB0 02360 LDIR
6FA7 010020 02370 LD BC,2000H ;DELAY
6FAA CD6000 02380 CALL 60H
6FAD 1E20 02390 LD E,20H ;MORE SOUND
6FAF 0E20 02400 PAUSE2 LD C,20H
6FB1 7B 02410 PAUSE3 LD A,E
6FB2 ED44 02420 NEG
6FB4 47 02430 LD B,A
6FB5 CD8A61 02440 CALL SOUNDX
6FB8 10FE 02450 DJNZ $
6FBA 0D 02460 DEC C
6FBB 20F4 02470 JR NZ,PAUSE3
6FBD 43 02480 LD B,E
6FBE 10FE 02490 DJNZ $
6FC0 1D 02500 DEC E
6FC1 20EC 02510 JR NZ,PAUSE2
6FC3 C9 02520 RET
0040 02530 BUFFER DEFS 64

```

```

7004 2A 02540 MESS DEFM '***** PAUSE --- Press
<CLEAR> to play *****'
7043 20 02550 MESS10 DEFM ' GAME OVER '
704E 20 02560 MESS20 DEFM ' Press <CLEAR> to play again '
6DDD 02570 END ENTRY

00000 TOTAL ERRORS
29367 TEXT AREA BYTES LEFT
ADD1 65C0 00130 01540
ADD2 663A 00140 01550
ADD3 66B4 00150 01560
ADDBMB 66FB 00160 01320
ATTACK 6AB8 00170 01520
BASEM 6463 00180 00760
BOMBS 63EB 00190 01010 01020
BOOM 69E9 00200 01380
BUFFER 6FC4 02530 02220 02330
BUG1 6359 00210 00910 00920
BUG2 6389 00220
BUG3 63B9 00230
CNT 6E6B 01610 01500
CONT10 6F08 01660 01680
DISSCR 6203 00240 00790 00820 00850
DRAW 690D 00250 01260
ENTRY 6DDD 00610 02570
EXPTAB 6590 00260 00960 00970
FLASH 6CCD 00570 01180
GAME 6DE0 00620 02010
HIGH 624F 00270 00840
INCSCR 6235 00280
INIT 62D9 00290 00620
INTRO 61BC 00300 00610
LEVEL 6A50 00310 00670 00680
LEVTAB 6AA4 00320
LOOPNN 6E91 01210 01600
LOOPX0 6E93 01220 01510
MBASE 640D 00330 01310
MBOMB 6C57 00340 01280
MESS 7004 02540 02250
MESS10 7043 02550 01700
MESS20 704E 02560 01740
MINUS1 656C 00350
MOVEB1 695D 00360 01230
MOVEB2 6970 00370 01240
MOVEB3 6983 00380 01250
MSHOT 6494 00390 01340
NEXT 6E38 00910 01470 01690
ONE 6AB4 00400
OVER05 5F27 01790 01910
OVER10 5F29 01800 01870
OVER20 5F2B 01810 01850
OVER30 5F40 01920 01950
PARAMS 6259 00410 00630 00740
PAUSE 6FA 02100 01590
PAUSE1 6F93 02290 02320
PAUSE2 6FAF 02400 02510
PAUSE3 6FB1 02410 02470
PAUSEA 6F6C 02110 02200
PAUSEB 6F6E 02120 02160
SCORE 6253 00420 00690 00700 00780
SHIPS 6568 00430 00710 00730 00810 01630
SHOT 63E9 00440 01070
SOUND1 6487 00450 01350
SOUND2 6B56 00460 01370
SOUND3 6BE4 00470 01410
SOUND4 6CAB 00480 01330
SOUNDI 6CF4 00580 01190
SOUNDX 618A 00490 01840 02130 02440
START 6D1B 00590 01200
TEMPW 640E 00500 01080 02060
TEST 6B20 00510 01360
TEST2 6B74 00520 01390
TEST3 6B9D 00530 01400
TEST5 6BC1 00540 01420
TEST6 6CB6 00550 01430
TEST7 64DF 00560 02090
TEST8 5F59 02020 01270

```



# HERE IT IS!

## SUPERLOG 4

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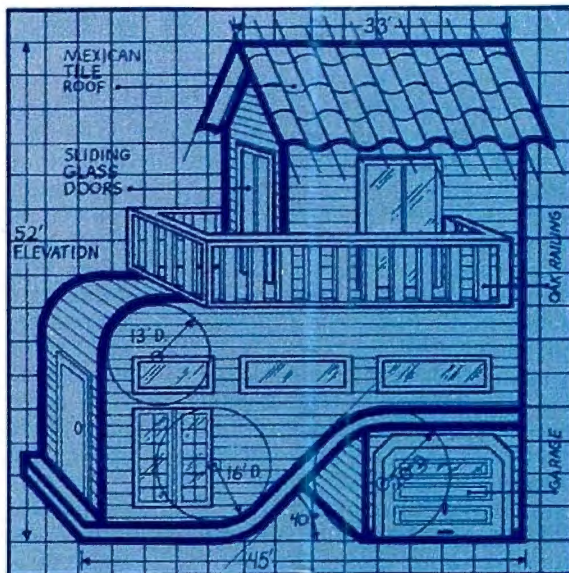
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410



# The Stripper

by Dan Robinson

If your commented Assembly-language program is too large to fit in memory and assemble, use this utility to remove program remarks.

**M**ost Assembly-language program code requires comments to keep the programmer from getting lost in a maze of arcane instructions and to help others keying in the code understand program flow. But all those remarks can make the program too large to fit in memory and assemble.

I wrote a program called Strip that lets you write source code with as many comments as you need and remove the remarks before program assembly (see the Program Listing, p. 116). You can write long programs in separate modules, remove the comments with Strip, and load the modules one on top of another for assembly.

Strip lets you remove comments line by line or from the entire program at once. It then writes the stripped source code to disk, using whatever file name you choose.

If a disk doesn't have enough room to store the stripped file, the program hangs up when it attempts to write to disk.

With Strip, you can create the best-commented source code around without memory worries. Now you have no excuse for "no comment." ■

*You can reach Dan Robinson at 1625 Higgins Way, Pacifica, CA 94044.*

*Illustration by Annie Gusman*

## The Key Box



**Models I and III  
32K RAM  
Editor/Assembler**

## Program Listing. Strip removes comment lines from Assembly-language programs.

```

00100 ; *****
00110 ; *
00120 ; *          STRIP
00130 ; *
00140 ; *    REMOVES COMMENTS FROM ASSEMBLY SOURCE FILES
00150 ; *
00160 ; *****
00170 ;

5200 00180          ORG      5200H
0100 00190 TBUF     DEFS    256      ; I/O Buffer
0032 00200 FCB      DEFS    50       ; File Control Block
0010 00210 NAME     DEFS    24       ; Store Filespec
534A CDC901      00220 START  CALL   01C9H ; Clear Screen
534D 21003C      00230 LD      HL,3C00H ; Display Background
5350 11013C      00240 LD      DE,3C01H
5353 017F01      00250 LD      BC,383
5356 36BF        00260 LD      (HL),191
5358 EDB0        00270          LDIR
535A 263C        00280 LOGO   LD      B,3CH      ; Display Logo
535C DD216E57    00290 LD      IX,LIST
5360 064D        00300 LD      B,77
5362 DD6E00      00310 LOGO1  LD      L,(IX)
5365 DD23        00320 INC     IX
5367 DD7E00      00330 LD      A,(IX)
536A DD23        00340 INC     IX
536C 77          00350 LD      (HL),A
536D 10F3        00360 DJNZ   LOGO1
536F 0615        00370 LD      B,21
5371 263D        00380 LD      H,3DH
5373 DD6E00      00390 LOGO2  LD      L,(IX)
5376 DD23        00400 INC     IX
5378 DD7E00      00410 LD      A,(IX)
537B DD23        00420 INC     IX
537D 77          00430 LD      (HL),A
537E 10F3        00440 DJNZ   LOGO2
5380 21003C      00450 LD      HL,3C00H ; Reverse Logo
5383 110001      00460 LD      DE,304
5386 010030      00470 LD      BC,3000H
5389 CD6000      00480 CALL   0060H
538C 7E          00490 LOGO3  LD      A,(HL)
538D 2F          00500 CPL
538E C640        00510 ADD    A,64
5390 77          00520 LD      (HL),A
5391 23          00530 INC     HL
5392 015002      00540 LD      BC,250H
5395 CD6000      00550 CALL   0060H
5398 1B          00560 DEC     DE
5399 7A          00570 LD      A,D
539A B3          00580 OR      E
539B 20EF        00590 JR      NZ,LOGO3
539D 211356      00600 LD      HL,MSG4 ; Display Select Message
53A0 CD5D56      00610 CALL   DISP
53A3 010020      00620 LD      BC,2000H ; Delay
53A6 CD6000      00630 CALL   0060H
53A9 3A4038      00640 START1 LD      A,(3040H) ; Gey Key Input
53AC FE04        00650 CP      04H ; = Auto-Erase
53AE 2007        00660 JR      Z,START2
53B0 FE01        00670 CP      01H ; = Selective Erase
53B2 20F5        00680 JR      NZ,START1
53B4 326D56      00690 LD      (FLAG),A ; Set Auto Flag
53B7 CD6555      00700 START2 CALL  CLEAR ; Clear Text Area
53BA 01C409      00710 LD      BC,2500H ; Delay
53BD CD6000      00720 CALL   0060H
53C0 217255      00730 LD      HL,MSG ; Ask for Filespec
53C3 CD5D56      00740 CALL   DISP
53C6 CD4E56      00750 CALL   INPT ; Get File Name
53C9 CD8954      00760 CALL   OPEN ; Open File
53CC 216E57      00770 LD      HL,BUF
53CF 0607        00780 LD      B,7 ; Load Leader
53D1 CD1300      00790 START3 CALL  0013H

53D4 77          00800 LD      (HL),A
53D5 23          00810 INC     HL
53D6 10F9        00820 DJNZ   START3
53D8 E5          00830 PUSH   HL ; Put Buffer Address in
53D9 DDE1        00840 POP    IX ; IX
53DB 216E56      00850 STRIP  LD      HL,STOR ; Read one line into
53DE CD1300      00860 STRIP0 CALL  0013H ; temporary buffer
53E1 77          00870 LD      (HL),A
53E2 23          00880 INC     HL
53E3 FE1A        00890 CP      1AH ; Check EOF
53E5 205F        00900 JR      Z,STRIP7
53E7 FE0D        00910 CP      0DH ; Check end of line
53E9 20F3        00920 JR      NZ,STRIP0
53EB 216E56      00930 LD      HL,STOR ; Display Line
53EE CD8A54      00940 CALL   DISPLN ; Delay for Keybounce
53F1 010015      00950 LD      BC,1500H
53F4 CD6000      00960 CALL   0060H
53F7 216E56      00970 LD      HL,STOR
53FA 3AD354      00980 LD      A,(COM) ; Check if there was a
53FD B7          00990 OR      A ; comment
53FE 2039        01000 JR      Z,STRIP5
5400 3A6D56      01010 LD      A,(FLAG) ; Check Auto Flag
5403 B7          01020 OR      A
5404 200E        01030 JR      Z,STRIP2
5406 CDD454      01040 CALL   DISPL0 ; Display Option Message
5409 3A4038      01050 STRIP1 LD      A,(3040H) ; Get Keypress
540C FE01        01060 CP      01H ; = Save Comments
540E 2029        01070 JR      Z,STRIP5
5410 FE02        01080 CP      02H ; = Delete Comments
5412 20F5        01090 JR      NZ,STRIP1
5414 7E          01100 LD      A,(HL) ; Load Line into Buffer
5415 DD7700      01110 LD      (IX),A
5418 23          01120 INC     HL
5419 DD23        01130 INC     IX
541B FE0D        01140 CP      0DH ; Check for EOL
541D 2006        01150 JR      Z,STRIP4
541F FE3B        01160 CP      3BH ; Check for Comments
5421 20F1        01170 JR      NZ,STRIP2
5423 DD2B        01180 DEC     IX ; Ignore Comments &
5425 DD2B        01190 STRIP4 DEC  IX ; bypass leading
5427 DD7E00      01200 LD      A,(IX) ; tabs
542A FE09        01210 CP      09H
542C 20F7        01220 JR      Z,STRIP4
542E DD23        01230 INC     IX
5430 3E0D        01240 LD      A,0DH ; Mark End of Line
5432 DD7700      01250 LD      (IX),A
5435 DD23        01260 INC     IX
5437 18A2        01270 JR      STRIP
5439 7E          01280 LD      A,(HL) ; Save Comments Routine
543A DD7700      01290 LD      (IX),A
543D 23          01300 INC     HL
543E DD23        01310 INC     IX
5440 FE0D        01320 CP      0DH ; Check EOL
5442 20F5        01330 JR      NZ,STRIP5
5444 1895        01340 STRIP6 JR      STRIP
5446 DD7700      01350 STRIP7 LD      (IX),A ; Save EOF Mark
5449 CD2844      01360 CALL   4428H ; Close File
544C CD6555      01370 CALL   CLEAR ; Clear Display
544F FD21003F    01380 LD      IY,3F00H ; Clear Option Line
5453 0630        01390 LD      B,56
5455 3E20        01400 LD      A,20H
5457 FD7700      01410 CLRX   LD      (IY),A
545A FD23        01420 INC     IY
545C 10F9        01430 DJNZ   CLRX
545E 218C55      01440 LD      HL,MSG1 ; Ask for Filespec
5461 CD5D56      01450 CALL   DISP
5464 010025      01460 LD      BC,2500H ; Delay
5467 CD6000      01470 CALL   0060H
546A CD4E56      01480 CALL   INPT ; Get Filespec
546D CD0E55      01490 CALL   OPEN4 ; Open New File

```

Listing continued

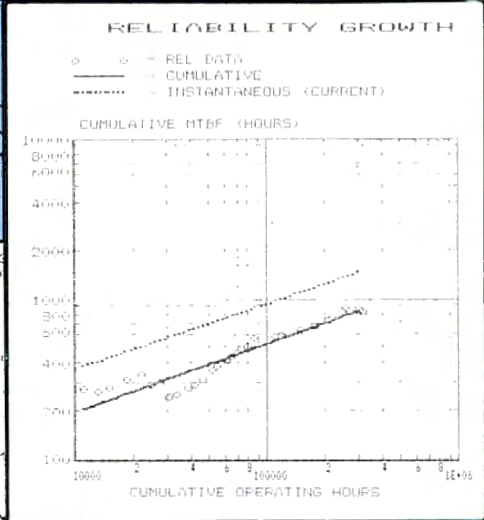
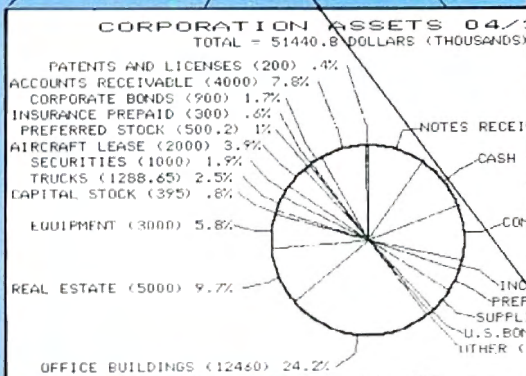
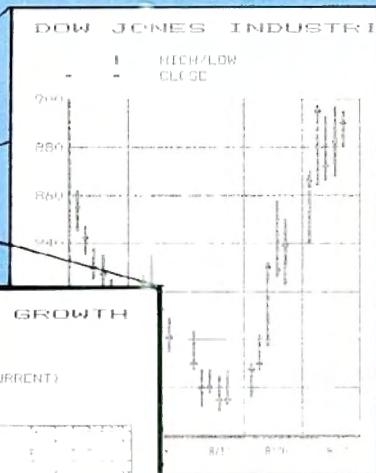
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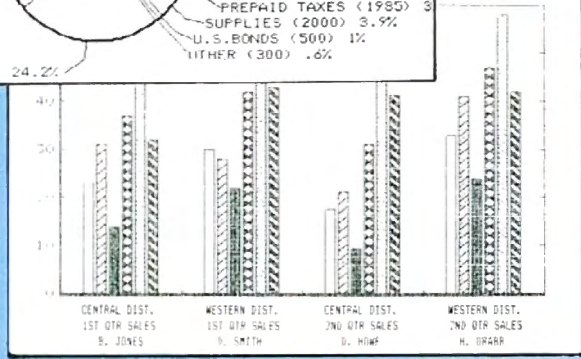
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Listing continued

```

5470 216E57 01500 LD HL,BUF
5473 7E 01510 STRIP8 LD A,(HL) ; Get Byte
5474 23 01520 INC HL
5475 FE1A 01530 CP LAH ; Check for EOF
5477 2005 01540 JR Z,STRIP9
5479 CD1B00 01550 CALL 001BH ; Write to Disk
547C 10F5 01560 JR STRIP8
547E CD1B00 01570 STRIP9 CALL 001BH ; Write EOF
5481 CD2044 01580 CALL 442BH ; Close File
5484 CDC901 01590 CALL 01C9H ; Clear Screen
5487 C32D40 01600 JP 402DH ; Exit to DOS
;
548A CD6555 01620 DISPLN CALL CLEAR ; Clear Screen
548D AF 01630 XOR A ; Zero Comment Flag
548E 32D354 01640 LD (COM),A
5491 0605 01650 LD B,5 ; Reset Line Number
5493 FD21C03D 01660 LD IX,3DC0H ; Display Location
5497 7E 01670 DISP2 LD A,(HL) ; Line Number
5498 CBBF 01680 RES 7,A ; Correct for Display
549A FD7700 01690 LD (Y),A
549D 23 01700 INC HL
549E FD23 01710 INC IY
54A0 10F5 01720 DJNZ DISP2
54A2 0608 01730 DISP3 LD B,8 ; Tab Value
54A4 7E 01740 DISP4 LD A,(HL) ; Get Character
54A5 05 01750 DEC B
54A6 FE09 01760 CP 09H ; Check for Tab
54A8 CCB854 01770 CALL Z,DISP6
54AB FE0D 01780 CP 0DH ; Check End of Line
54AD 2823 01790 JR Z,DISP9
54AF FD7700 01800 LD (Y),A ; Display Character
54B2 FE3B 01810 CP 3BH ; Check for Comment
54B4 2003 01820 JR NZ,DISP5 ; & Set Flag
54B6 32D354 01830 LD (COM),A
54B9 FD23 01840 DISP5 INC IY
54BB 23 01850 INC HL
54BC 18E6 01860 JR DISP4
54BE 7D 01870 DISP6 LD A,B ; Characters left in Tab
54BF 3D 01880 DEC A
54C0 E607 01890 AND 07H ; Zero Top Nibble
54C2 2002 01900 JR NZ,DISP7
54C4 3E07 01910 LD A,7 ; Default - 1
54C6 47 01920 DISP7 LD B,A ; Output spaces for Tab
54C7 3E20 01930 LD A,20H
54C9 FD7700 01940 DISP8 LD (Y),A
54CC FD23 01950 INC IY
54CE 10F9 01960 DJNZ DISP8
54D0 0608 01970 LD B,8 ; Reset Max Tabs
54D2 C9 01980 DISP9 RET
54D3 00 01990 COM DEFB 00H ; Store Comment Flag
;
54D4 E5 02010 DISP10 PUSH HL
54D5 21D855 02020 LD HL,MSG3 ; Display Option Message
54D8 FD21003F 02030 LD IX,3F00H
54DC 0638 02040 LD B,56
54DE 7E 02050 DISP11 LD A,(HL)
54DF FD7700 02060 LD (Y),A
54E2 23 02070 INC HL
54E3 FD23 02080 INC IY
54E5 10F7 02090 DJNZ DISP11
54E7 E1 02100 POP HL
54E8 C9 02110 RET
;
54E9 113253 02130 OPEN LD DE,NAME ; Move Filename to PCB
54EC 210053 02140 LD HL,FCB
54EF 1A 02150 OPEN1 LD A,(DE) ; Check for Upper Case
54F0 FE50 02160 CP 50H
54F2 3002 02170 JR C,OPEN2
54F4 E65F 02180 AND 5FH
54F6 77 02190 OPEN2 LD (HL),A
;
54F7 13 02200 INC DE
54F8 23 02210 INC HL
54F9 FE0D 02220 CP 0DH
54FB 20F2 02230 JR NZ,OPEN1
54FD 210052 02240 OPEN3 LD HL,5200H ; I/O Buffer
5500 110053 02250 LD DE,FCB ; File Control Block
5503 0600 02260 LD B,0 ; = 256 Byte Read
5505 CD2444 02270 CALL 4424H ; Open Existing File
5508 C8 02280 RET Z
5509 CD3355 02290 CALL ERROR ; If Disk Error
550C 18EF 02300 JR OPEN3
550E 113253 02310 OPEN4 LD DE,NAME ; Move Filename to FCB
5511 210053 02320 LD HL,FCB
5514 1A 02330 OPEN5 LD A,(DE) ; Check for Upper Case
5515 FE60 02340 CP 60H
5517 3002 02350 JR C,OPEN6
5519 E65F 02360 AND 5FH
551B 77 02370 OPEN6 LD (HL),A
551C 13 02380 INC DE
551D 23 02390 INC HL
551E FE0D 02400 CP 0DH
5520 20F2 02410 JR NZ,OPEN5
5522 210052 02420 OPEN7 LD HL,5200H ; I/O Buffer
5525 110053 02430 LD DE,FCB ; File Control Block
5528 0600 02440 LD B,0 ; = 256 Byte Read
552A CD2044 02450 CALL 4420H ; Open New File
552D C8 02460 RET Z
552E CD3355 02470 CALL ERROR
5531 18EF 02480 JR OPEN7
;
5533 F5 02500 ERROR PUSH AF ; Save DOS Error Code
5534 CD6555 02510 CALL CLEAR ; Clear Screen
5537 210053 02520 LD HL,FCB ; Display Filename
553A FD21C03D 02530 LD IY,3DC0H
553E CD6156 02540 CALL DISP1
5541 F1 02550 POP AF ; Get Error Code
5542 F680 02560 OR 80H
5544 21003E 02570 LD HL,3E00H ; Set Cursor Position
5547 222040 02580 LD (4020H),HL
554A CD0944 02590 CALL 4409H ; Display Error Message
554D 21A955 02600 LD HL,MSG2 ; Display Action Message
5550 FD21403E 02610 LD IY,3E40H
5554 CD6156 02620 CALL DISP1
5557 3A4038 02630 ERR1 LD A,(3040H) ; Check for <ENTER>
555A FE01 02640 CP 01H
555C C8 02650 RET Z
555D FE04 02660 CP 04H ; Check for <BREAK>
555F 20F6 02670 JR NZ,ERR1
5561 F1 02680 POP AF ; Fix Stack
5562 C34A53 02690 JP START
;
5565 E5 02710 CLEAR PUSH HL
5566 21C03D 02720 LD HL,3DC0H
5569 06C0 02730 LD B,192
556B 3620 02740 CLR1 LD (HL),20H
556D 23 02750 INC HL
556E 10FB 02760 DJNZ CLR1
5570 E1 02770 POP HL
5571 C9 02780 RET
5572 49 02790 MSG DEFM 'INPUT FILE TO BE STRIPPED'
5580 0D 02800 DEFB 0DH
558C 49 02810 MSG1 DEFM 'INPUT NAME FOR STRIPPED FILE'
55A8 0D 02820 DEFB 0DH
55A9 50 02830 MSG2 DEFM 'PRESS <ENTER> WHEN CORRECTED'
55C5 20 02840 DEFB ' - <BREAK> TO RESTART'
55DA 0D 02850 DEFB 0DH
55DB 20 02860 MSG3 DEFM ' PRESS <ENTER> TO KEEP REMARKS -'
5602 20 02870 DEFB ' <CLEAR> TO ERASE'
5613 50 02880 MSG4 DEFM 'PRESS <ENTER> FOR SELECTIVE '
562F 45 02890 DEFB 'ERASE - <BREAK> FOR AUTO ERASE'

```

Listing continued

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Listing continued

```

564D 0D 02900 DEFB 0DH
564E 21003E 02910 INPT LD HL,3E00H ; Load Cursor Position
5651 222040 02920 LD (4020H),HL
5654 0618 02930 LD B,24 ; Maximum Input
5656 213253 02940 LD HL,NAME ; Storage Location
5659 CDD905 02950 CALL 05D9H ; Keyboard Input Routine
565C C9 02960 RET
;
565D FD21C03D 02980 DISP LD IY,3DC0H ; DISPLAY ROUTINE
5661 7E 02990 DISPL LD A,(HL)
5662 FE0D 03000 CP 0DH
5664 C8 03010 RET Z
5665 FD7700 03020 LD (IY),A
5668 23 03030 INC HL
5669 FD23 03040 INC IY
566B 10F4 03050 JR DISPL
;
566D 00 03070 FLAG DEFB 00H
0100 03080 STOR DEFS 256
576E 03090 BUF EQU $ ; TEXT BUFFER
576E 44 03100 LIST DEFB 44H
576F 80 03110 DEFB 120
5770 45 03120 DEFB 45H
5771 BC 03130 DEFB 108
5772 46 03140 DEFB 46H
5773 BC 03150 DEFB 108
5774 47 03160 DEFB 47H
5775 BC 03170 DEFB 108
5776 48 03180 DEFB 48H
5777 BC 03190 DEFB 108
5778 49 03200 DEFB 49H
5779 BC 03210 DEFB 108
577A 4A 03220 DEFB 4AH
577B BC 03230 DEFB 108
577C 4B 03240 DEFB 4BH
577D B0 03250 DEFB 176
577E 50 03260 DEFB 50H
577F BC 03270 DEFB 108
5780 51 03280 DEFB 51H
5781 BC 03290 DEFB 108
5782 52 03300 DEFB 52H
5783 BC 03310 DEFB 108
5784 53 03320 DEFB 53H
5785 94 03330 DEFB 148
5786 54 03340 DEFB 54H
5787 A8 03350 DEFB 168
5788 55 03360 DEFB 55H
5789 BC 03370 DEFB 108
578A 56 03380 DEFB 56H
578B BC 03390 DEFB 108
578C 57 03400 DEFB 57H
578D BC 03410 DEFB 108
578E 5C 03420 DEFB 5CH
578F 80 03430 DEFB 128
5790 5D 03440 DEFB 5DH
5791 BC 03450 DEFB 108
5792 5E 03460 DEFB 5EH
5793 BC 03470 DEFB 108
5794 5F 03480 DEFB 5FH
5795 BC 03490 DEFB 108
5796 60 03500 DEFB 60H
5797 BC 03510 DEFB 108
5798 61 03520 DEFB 61H
5799 BC 03530 DEFB 108
579A 62 03540 DEFB 62H
579B B4 03550 DEFB 100
579C 63 03560 DEFB 63H
579D 82 03570 DEFB 130
579E 68 03580 DEFB 68H
579F BC 03590 DEFB 108

```

```

57A0 69 03600 DEFB 69H
57A1 BC 03610 DEFB 188
57A2 6A 03620 DEFB 6AH
57A3 BC 03630 DEFB 188
57A4 6B 03640 DEFB 6BH
57A5 94 03650 DEFB 148
57A6 6C 03660 DEFB 6CH
57A7 A8 03670 DEFB 168
57A8 6D 03680 DEFB 6DH
57A9 BC 03690 DEFB 188
57AA 6E 03700 DEFB 6EH
57AB BC 03710 DEFB 188
57AC 6F 03720 DEFB 6FH
57AD BC 03730 DEFB 188
57AE 74 03740 DEFB 74H
57AF 80 03750 DEFB 128
57B0 75 03760 DEFB 75H
57B1 BC 03770 DEFB 188
57B2 76 03780 DEFB 76H
57B3 BC 03790 DEFB 188
57B4 77 03800 DEFB 77H
57B5 BC 03810 DEFB 188
57B6 78 03820 DEFB 78H
57B7 BC 03830 DEFB 188
57B8 79 03840 DEFB 79H
57B9 BC 03850 DEFB 188
57BA 7A 03860 DEFB 7AH
57BB B4 03870 DEFB 180
57BC 7B 03880 DEFB 7BH
57BD 82 03890 DEFB 130
57BE 84 03900 DEFB 84H ; S
57BF 80 03910 DEFB 128
57C0 85 03920 DEFB 85H
57C1 8F 03930 DEFB 143
57C2 86 03940 DEFB 86H
57C3 8F 03950 DEFB 143
57C4 87 03960 DEFB 87H
57C5 8F 03970 DEFB 143
57C6 88 03980 DEFB 88H
57C7 8F 03990 DEFB 143
57C8 89 04000 DEFB 89H
57C9 8F 04010 DEFB 143
57CA 8A 04020 DEFB 8AH
57CB 8F 04030 DEFB 143
57CC 8B 04040 DEFB 8BH
57CD 8F 04050 DEFB 143
57CE 93 04060 DEFB 93H ; T
57CF 95 04070 DEFB 149
57D0 94 04080 DEFB 94H
57D1 AA 04090 DEFB 170
57D2 9C 04100 DEFB 9CH ; R
57D3 80 04110 DEFB 128
57D4 9D 04120 DEFB 9DH
57D5 8F 04130 DEFB 143
57D6 9E 04140 DEFB 9EH
57D7 8F 04150 DEFB 143
57D8 9F 04160 DEFB 9FH
57D9 8F 04170 DEFB 143
57DA A0 04180 DEFB 0A0H
57DB 8F 04190 DEFB 143
57DC A1 04200 DEFB 0A1H
57DD 8F 04210 DEFB 143
57DE A2 04220 DEFB 0A2H
57DF 8F 04230 DEFB 143
57E0 A3 04240 DEFB 0A3H
57E1 A0 04250 DEFB 160
57E2 AB 04260 DEFB 0ABH ; I
57E3 95 04270 DEFB 149
57E4 AC 04280 DEFB 0ACH
57E5 AA 04290 DEFB 170

```

Listing continued



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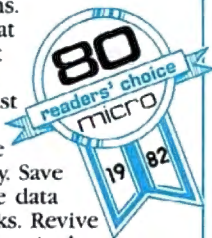
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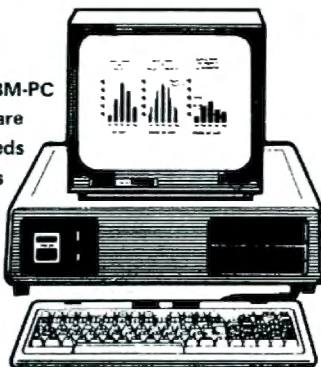
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|         |       |      |      |     |         |         |      |       |     |
|---------|-------|------|------|-----|---------|---------|------|-------|-----|
| 57E6 B4 | 04300 | DEFB | 0B4H | ; P | 580D 8F | 04690   | DEFB | 143   |     |
| 57E7 80 | 04310 | DEFB | 128  |     | 580E 07 | 04700   | DEFB | 07H   |     |
| 57E8 B5 | 04320 | DEFB | 0B5H |     | 580F 8F | 04710   | DEFB | 143   |     |
| 57E9 8F | 04330 | DEFB | 143  |     |         |         |      |       |     |
| 57EA B6 | 04340 | DEFB | 0B6H |     | 5810 08 | 04720   | DEFB | 08H   |     |
| 57EB 8F | 04350 | DEFB | 143  |     | 5811 8F | 04730   | DEFB | 143   |     |
| 57EC B7 | 04360 | DEFB | 0B7H |     | 5812 09 | 04740   | DEFB | 09H   |     |
| 57ED 8F | 04370 | DEFB | 143  |     | 5813 8F | 04750   | DEFB | 143   |     |
| 57EE B7 | 04380 | DEFB | 0B7H |     | 5814 0A | 04760   | DEFB | 0AH   |     |
| 57EF 8F | 04390 | DEFB | 143  |     |         |         |      |       |     |
| 57F0 B8 | 04400 | DEFB | 0B8H |     | 5815 8F | 04770   | DEFB | 143   |     |
| 57F1 8F | 04410 | DEFB | 143  |     | 5816 0B | 04780   | DEFB | 0BH   |     |
| 57F2 B9 | 04420 | DEFB | 0B9H |     | 5817 80 | 04790   | DEFB | 128   |     |
| 57F3 87 | 04430 | DEFB | 135  |     | 5818 13 | 04800   | DEFB | 13H   | ; T |
| 57F4 BA | 04440 | DEFB | 0BAH |     | 5819 95 | 04810   | DEFB | 149   |     |
| 57F5 A0 | 04450 | DEFB | 160  |     |         |         |      |       |     |
| 57F6 CB | 04460 | DEFB | 0CBH | ; S | 581A 14 | 04820   | DEFB | 14H   |     |
| 57F7 80 | 04470 | DEFB | 128  |     | 581B AA | 04830   | DEFB | 170   |     |
| 57F8 D3 | 04480 | DEFB | 0D3H | ; T | 581C 1C | 04840   | DEFB | 1CH   | ; R |
| 57F9 95 | 04490 | DEFB | 149  |     | 581D 80 | 04850   | DEFB | 128   |     |
| 57FA D4 | 04500 | DEFB | 0D4H |     | 581E 23 | 04860   | DEFB | 23H   |     |
| 57FB AA | 04510 | DEFB | 170  |     | 581F 80 | 04870   | DEFB | 120   |     |
| 57FC DC | 04520 | DEFB | 0DCH | ; R |         |         |      |       |     |
| 57FD 80 | 04530 | DEFB | 128  |     | 5820 28 | 04880   | DEFB | 28H   | ; I |
| 57FE E2 | 04540 | DEFB | 0E2H |     | 5821 8F | 04890   | DEFB | 143   |     |
| 57FF BD | 04550 | DEFB | 189  |     | 5822 29 | 04900   | DEFB | 29H   |     |
| 5800 E3 | 04560 | DEFB | 0E3H |     | 5823 8F | 04910   | DEFB | 143   |     |
| 5801 80 | 04570 | DEFB | 128  |     | 5824 2A | 04920   | DEFB | 2AH   |     |
|         |       |      |      |     |         |         |      |       |     |
| 5802 EB | 04580 | DEFB | 0EBH | ; I | 5825 8F | 04930   | DEFB | 143   |     |
| 5803 95 | 04590 | DEFB | 149  |     | 5826 2B | 04940   | DEFB | 2BH   |     |
| 5804 EC | 04600 | DEFB | 0ECH |     | 5827 85 | 04950   | DEFB | 133   |     |
| 5805 AA | 04610 | DEFB | 170  |     | 5828 2C | 04960   | DEFB | 2CH   |     |
| 5806 F4 | 04620 | DEFB | 0F4H | ; P | 5829 8A | 04970   | DEFB | 138   |     |
| 5807 80 | 04630 | DEFB | 128  |     |         |         |      |       |     |
|         |       |      |      |     | 582A 2D | 04980   | DEFB | 2DH   |     |
| 5808 04 | 04640 | DEFB | 04H  | ; S | 582B 8F | 04990   | DEFB | 143   |     |
| 5809 83 | 04650 | DEFB | 131  |     | 582C 2E | 05000   | DEFB | 2EH   |     |
| 580A 05 | 04660 | DEFB | 05H  |     | 582D 8F | 05010   | DEFB | 143   |     |
| 580B 8F | 04670 | DEFB | 143  |     | 582E 2F | 05020   | DEFB | 2FH   |     |
| 580C 06 | 04680 | DEFB | 06H  |     |         |         |      |       |     |
|         |       |      |      |     | 582F 8F | 05030   | DEFB | 143   |     |
|         |       |      |      |     | 5830 34 | 05040   | DEFB | 34H   | ; P |
|         |       |      |      |     | 5831 80 | 05050   | DEFB | 128   |     |
|         |       |      |      |     |         | 05060 ; |      |       |     |
|         |       |      |      |     | 534A    | 05070   | END  | START |     |

End

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## Portable Scripsit

by John and Aileen Corman

You use Model III Scripsit regularly and you wish your documents were as portable as your Model 100. With the help of CScrip they can be (see Program Listing 1). CScrip translates Model III Scripsit tapes into ones the Model 100 can read, converts Scripsit's text boundary markers to equivalent Model 100 characters, and adds the extra line feeds that the Model 100 expects after each carriage return.

Later, you can use Forms (June 1984, p. 156) to load your document back into Model III Scripsit with all the formatting characters intact.

### Installing CScrip

Lines 10-700 are CScrip's loader section. The loader automatically adjusts CScrip's machine-language instructions in accordance with the amount of memory you have. Consequently, you can use the program on 16K, 32K, and 48K machines.

The loader also helps you find mistyped hexadecimal (hex) codes in the data statements and computes a checksum to ensure their accuracy.

To use the loader, first answer the memory size question correctly: 32100 for a 16K machine, 48484 for a 32K machine, and 64868 for a 48K machine.

Now run the program. If you answered the memory size prompt incorrectly, the program reminds you of the correct responses and asks you to try again.

The loader asks you to wait while it reads the hex codes in the data statements and loads them into memory. If the program finds an unacceptable hex character in a data statement, it shows you the bad character pair and tells you the line number and hex pair you need to correct before rerunning the loader. Each data line has 18 pairs of characters except the last one, which has 12.

Even if all the hex codes are acceptable, they might be incorrect. The loader informs you if the hex codes in the data statements don't add up to the predetermined checksum total. With this kind of error, the loader can't give you further information to help find the incorrect code. You have to recheck the data statements against the listing to find the error before rerunning the loader.

If it doesn't detect any errors, the loader tells you which entry address to use with the System command when you run CScrip. Now you're ready to convert Model III Scripsit tapes to Model 100 format.

### Using CScrip

To use CScrip, begin by entering the System command. At the asterisk prompt, enter /32101 for a 16K machine, /48485 for a 32K machine, and /64869 for a 48K machine. Be sure to type the slash before and press the enter key after the number.

Next, the CScrip title screen appears and asks you to specify the one- to six-character name of the Text file. This is the name

you give to the Model 100 Text tape. If you press the break key at this point, you return to the "Cass?" prompt.

CScrip prompts you to prepare to play a Model III Scripsit tape and to press the enter key when the recorder is ready. Then the program reads the Scripsit tape into memory. If it detects a checksum error, you return to the title screen.

After CScrip successfully reads your tape, it prompts you to prepare to record a Model 100 Text tape. Place a blank cassette in your recorder; CScrip prompts you to press the enter key when the recorder is ready.

After the program writes the tape, CScrip asks if you would like to make another copy. If you answer Y, it again asks you to press the enter key when the recorder is ready.

If you press N, CScrip asks if you want to read another Scripsit tape for conversion. If you press Y, you return to the title screen; otherwise the program ends and you return to the "Cass?" prompt.

### Saving CScrip

You can load CScrip at any time by running Listing 1, but if you use the program often, it saves time to load a machine language System tape directly into your Model III. If you have a Debug or Monitor program that lets you write System tapes, you need the information in Table 1.

If you ever add more memory to your computer, you'll need to use the loader program to tailor CScrip to the new high-memory addresses.

### Guidelines

To take full advantage of CScrip, you should take your Scripsit reference card and the following explanation of equivalents along with your Model 100 (see Table 2).

The Model III surrounds headers, footers, and other text blocks with on-screen brackets. To include these symbols in your text, use the left (I) and right (J) bracket keys on the Model 100 keyboard. Be sure to include the one- or two-character block description code and the greater-than (>) symbol

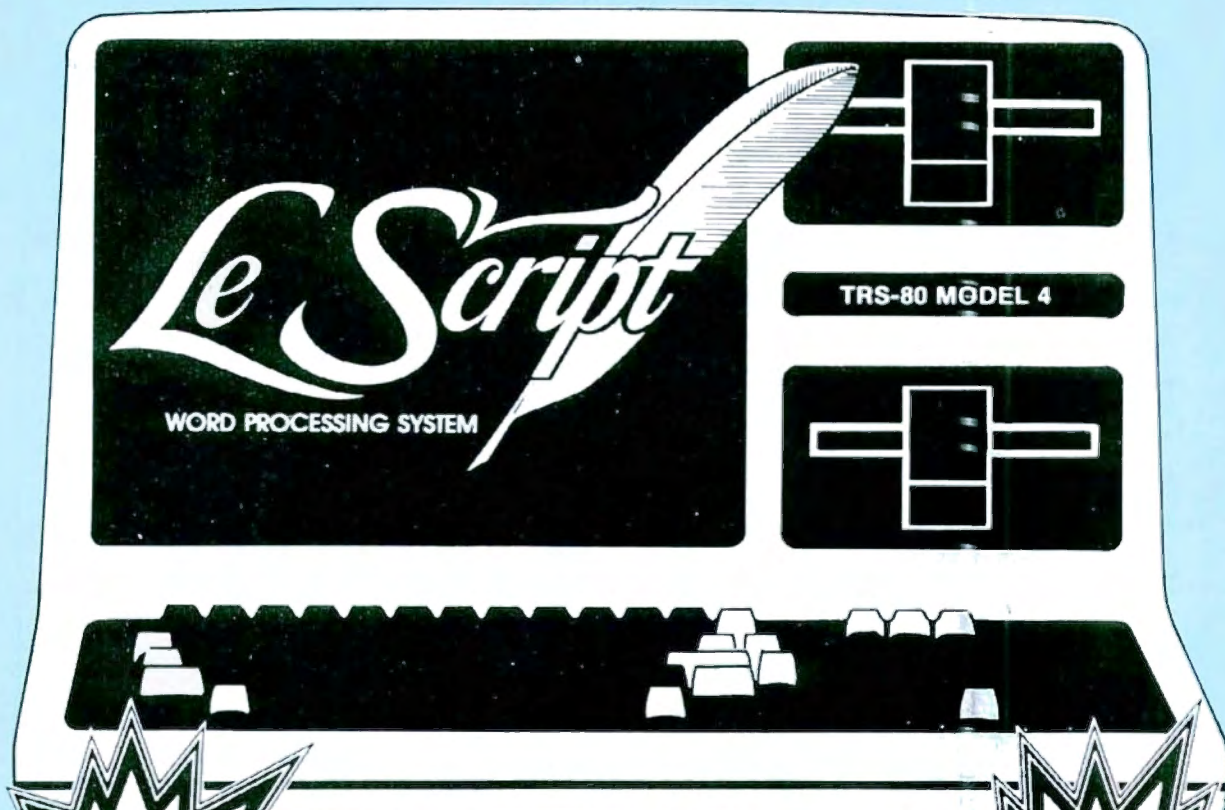
| Machine | Start Address |         | End Address |         | Entry Point |         |
|---------|---------------|---------|-------------|---------|-------------|---------|
|         | Hex           | Decimal | Hex         | Decimal | Hex         | Decimal |
| 16K     | 7D65          | 32101   | 7FFF        | 32767   | 7D65        | 32101   |
| 32K     | BD65          | 48485   | BFFF        | 49151   | BD65        | 48485   |
| 48K     | FD65          | 64869   | FFFF        | 65535   | FD65        | 64869   |

Table 1. System tape information.

### The Key Box

All this month's programs run in 8K RAM. A dot-matrix printer is optional for "Etch-A-Screen." "Portable Scripsit" requires a 16K RAM Model III, a cassette recorder, Cassette Basic, and Scripsit.

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after the left bracket to terminate the block description or begin a format line.

Create end-of-line symbols on the Model 100 by using the enter key as usual. The triangle symbol will appear on the Model 100 screen, but when you load the file into Scripsit, it will look like the normal block symbol (■).

You can use the paragraph symbol (¶) in your Model 100 text by pressing the code and zero keys together. The same symbol will appear in the text's Scripsit version.

Scripsit uses the backslash character (\) to indicate a forced end-of-page. You can enter this symbol in your Model 100 text by pressing the graph and hyphen keys together.

Copy markers appear as the caret symbol (^) in Scripsit. You can enter carets into your Model 100 text by pressing shift-6. ■

Contact John and Aileen Corman at Structured Software Services, 9233 N.E. 269th St., Battle Ground, WA 98604.

| Scripsit symbol | Model 100 keyboard | Meaning                |
|-----------------|--------------------|------------------------|
| [ Left bracket  | [ Left bracket     | Block start            |
| ] Right bracket | ] Right bracket    | Block end              |
| > Greater than  | > Greater than     | Block name end; format |
| ■ Square block  | Enter key          | Forced end-of-line     |
| ¶ Paragraph     | Code-zero          | Begin new paragraph    |
| \ Backslash     | Graph/-            | Forced end-of-page     |
| ^ Caret         | Shift-6            | Copy marker            |

Table 2. Symbol reference chart.

### Listing 1 continued

```

580 PA1 = BA * 256 + 101 'PA1 = START ADDRESS FOR POKING
590 IF PA1 > 32767 THEN PA = -1 * (65536 - PA1) ELSE PA = PA1
600 RETURN 'PA ADJUSTED IF PA! > 32767
620 PRINT@256,"Before running CSCRIIP loader, you must
answer Memory Size?"
630 PRINT"question according the the following table:" : PRINT
640 PRINT"Machine Memory Size?"
650 PRINT" 16K 32100"
660 PRINT" 32K 48484"
670 PRINT" 48K 64868"
680 PRINT:PRINT"Please press the orange reset button and answer th
e"
690 PRINT"Memory Size? question again before rerunning this progr
am."
700 GOTO700
800 DATA CD,C9,01,21,15,3C,22,20,40,21,FB,*1,CD,1B,02,21,50,3C
802 DATA 22,20,40,21,11,*2,CD,6F,*1,3E,03,32,14,42,CD,77,*1,DA
804 DATA 00,00,AF,32,11,42,21,30,*2,CD,1B,02,21,A3,*2,CD,1B,02
806 DATA CD,6F,*1,CD,65,*1,F3,21,50,44,36,00,CD,96,02,CD,35,02
808 DATA 47,0E,00,CD,5D,*1,FE,8D,20,85,36,0D,23,3E,0A,77,23,10
810 DATA F0,CD,35,02,B9,C2,4E,*1,2B,7E,23,B7,20,DD,CD,F0,01,21
812 DATA 50,44,7E,B7,28,2E,FE,97,20,86,3E,5B,77,23,18,F2,FE,9B
814 DATA 20,04,3E,5D,18,F4,FE,5E,20,04,3E,AF,10,EC,FE,8C,20,84
816 DATA 3E,5C,1E,84,FE,8B,20,04,3E,5E,18,DC,E6,7F,18,D8,CD,C9
818 DATA 01,21,A3,*2,CD,1B,02,21,CD,*2,CD,6F,*1,3E,48,32,11,42
820 DATA CD,65,*1,CD,9E,*1,CD,F8,01,21,6C,*2,CD,6F,*1,CD,49,00
822 DATA FE,59,28,EA,FE,79,28,E6,21,89,*2,CD,6F,*1,CD,49,00,F5
824 DATA CD,C9,01,F1,FE,59,CA,05,*0,FE,79,CA,85,*0,C3,00,00,CD
826 DATA F8,01,CD,C9,01,21,E9,*2,CD,6F,*1,C3,85,*0,C3,50,2,F5
828 DATA 81,4F,F1,C9,21,40,*2,CD,6F,*1,CD,49,00,C9,CD,1B,02,2B
830 DATA CD,1B,02,C9,21,31,*2,CD,1B,02,21,F9,*2,06,06,CD,40,00
832 DATA D8,48,06,00,09,3E,06,91,C8,47,3E,20,77,23,10,FC,C9,F5
834 DATA 81,4F,F1,CD,64,02,C9,21,00,00,CD,87,02,01,00,06,3E,9C
836 DATA CD,64,02,21,F9,*2,7E,CD,96,*1,23,10,F9,06,0A,3E,AA,CD
838 DATA 96,*1,10,FB,79,ED,44,CD,64,02,21,50,44,81,00,20,CD,60
840 DATA 00,E5,21,00,00,CD,87,02,E1,3E,8D,CD,64,02,7E,87,20,0E
842 DATA 3E,1A,CD,96,*1,10,FB,79,ED,44,CD,64,02,C9,CD,96,*1,23
844 DATA 10,E8,79,ED,44,CD,64,02,18,CD,53,43,52,49,50,53,49,54
846 DATA 20,74,6F,20,4D,6F,64,65,6C,20,31,30,39,0D,62,79,20,53
848 DATA 74,72,75,63,74,75,72,65,64,20,53,6F,66,74,77,61,72,65
850 DATA 20,53,65,72,76,69,63,65,73,8D,45,6E,74,65,72,20,54,45
852 DATA 58,54,20,66,69,6C,65,20,6E,61,6D,65,3A,20,03,50,72,65
854 DATA 73,73,20,45,4E,54,45,52,20,77,68,65,66,20,72,65,63,6F
856 DATA 72,64,65,72,20,69,73,20,72,65,61,64,79,2E,0D,57,72,69
858 DATA 74,65,20,61,6E,6F,74,68,65,77,20,63,6F,70,79,3F,20,28
860 DATA 59,20,6F,72,20,4E,29,20,52,65,61,64,20,61,20,6E,65,77
862 DATA 20,74,61,70,65,3F,20,78,59,20,6F,72,20,4E,29,0D,57,72
864 DATA 65,70,61,72,65,20,74,6F,20,83,70,6C,61,79,20,4D,6F,64
866 DATA 65,6C,20,49,49,49,20,53,43,52,49,50,53,49,54,20,74,61
868 DATA 70,65,2E,0D,72,65,63,6F,72,64,20,4D,6F,64,65,6C,20,31
870 DATA 30,30,20,54,45,58,54,20,74,61,70,65,2E,0D,43,68,65,63
872 DATA 68,73,75,6D,20,65,72,72,6F,72,2E,0D
    
```

End

### Program Listing 1. CScript.

```

10 CLS:DEFINT A-Z
20 PRINTTAB(19)"SCRIPSIT to Model 100 Loader"
30 PRINTTAB(17)"by Structured Software Services":PRINT
40 PRINT:PRINT"Loading CSCRIIP into memory; please wait..."
50 GOSUB 500 'CHECK MEMORY SIZE AND SET UP ADDRESSES
60 FOR I=1 TO 660
70 READ HX$: 'GET A PAIR OF HEX DIGITS
80 D$ = LEFT$(HX$,1) 'LOOK AT THE LEFT DIGIT
90 IF D$ = "*" THEN 210 '* MEANS ADDRESS ADJUSTMENT
100 GOSUB 500 'CONVERT HEX DIGIT TO DECIMAL
110 IF D = -1 THEN 400 '-1 IS FLAG FOR BAD HEX CHAR.
120 DC = D * 16 'DC GETS VALUE OF LEFT DIGIT
130 D$ = RIGHT$(HX$,1) 'LOOK AT THE RIGHT DIGIT
140 GOSUB 500 'CONVERT RIGHT DIGIT
150 IF D = -1 THEN 400
160 DC = DC + D 'DC = THE DECIMAL CONVERSION
170 CS1 = CS1 + DC 'ADD IT TO THE CHECKSUM
180 POKE PA,DC 'LOAD IT INTO MEMORY
190 IF PA < 32767 THEN PA = PA + 1 'ADVANCE POKE ADDRESS
200 GOTO 300
210 D$ = RIGHT$(HX$,1) 'READY FOR NEXT HEX PAIR
220 GOSUB 500 'D$ = RIGHT DIGIT OF *-PAIR
230 IF D = -1 THEN 400
240 CS1 = CS1 + D 'ADD TO CHECKSUM
250 DC = BA + D 'BASE ADDRESS + DISPLACEMENT
260 GOTO 180 'GO POKE ADJUSTED ADDRESS
300 NEXT
310 IF CS1 <> 60622 THEN 350 'VERIFY CHECKSUM TOTAL
320 PRINT:PRINT"CSCRIIP has been successfully loaded."
330 PRINT:PRINT"Entry address for SYSTEM command is:";PA1
340 PRINT:PRINT"You may now convert SCRIPSIT tapes to Model 100 fo
rmat." : PRINT : END
350 PRINT:PRINT"Checksum error."
360 PRINT:PRINT"Please correct contents of DATA lines 800 - 872 an
d rerun." : PRINT : END
400 LN = INT((I-1) / 10) 'RELATIVE LINE # OF ERROR
410 CH = I - (LN * 10) 'BAD CHARACTER PAIR #
420 LN = 800 + LN * 2 'ACTUAL DATA LINE #
430 PRINT:PRINT"Invalid hex character: ";HX$
440 PRINT:PRINT"Please correct pair #";CH;"in line";LN;"and rerun.
"
450 PRINT : END
500 D = ASC(D$)
510 IF D > 47 AND D < 58 THEN D = D - 48 : RETURN '0-9 OK
520 IF D > 64 AND D < 71 THEN D = D - 55 : RETURN 'A-F OK
530 D = -1 : RETURN 'BAD HEX CHARACTER
550 BA = PEEK(16562) 'GET BASE ADDRESS
560 IF BA = 253 OR BA = 189 OR BA = 125 THEN 570 ELSE 620
570 IF PEEK(16561) <> 98 THEN 620
    
```

Listing 1 continued

## Sort Order

by Ronald F. Balonis

Don't put up with unorganized data files any longer. Use my utility program, Sort.CO, to alphabetize them, beginning at any point you specify. This machine-language program requires only 988 bytes of memory and sorts your RAM files in a matter of seconds.

Sort.CO performs an in-memory sort that physically moves your file's records. However, there are file constraints: You can have no more than 254 records, and they must have equal lengths of fewer than 254 bytes.

### Preparing to Sort

Program Listing 2 is the Basic boot of Sort.BA, which, when run, creates Sort.CO. I formatted the data lines so you can read and debug them. Type in Listing 2 and save it before running it.

Line 50 reserves memory for Sort.CO. Lines 200-300 read and POKE the data statements into memory, summing each for a checksum. (Pay heed to the checksum; don't run the program if it's in error, as errors are hazardous to the Model 100's files.) If the checksum equals 95393, then the data statements are correct; line 500 saves the POKED data statements as Sort.CO. At the OK prompt, press F8 to see and use the program.

### Using Sort

The program is easy to use. At the main menu, place the cursor on Sort.CO. If the machine beeps, you haven't re-

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from XYZT Computer Dimensions, Inc.

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Visicalc menu

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| 2.          | 10. Utilities        |
| 3. Letters  | 11.                  |
| 4.          | 12. Communications   |
| 5. Business | 13.                  |
| 6.          | 14. NICE development |
| 7.          | 15.                  |
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Format utility

Customer retrieval

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Address => \_\_\_\_\_

City => \_\_\_\_\_

State => \_\_ zip => \_\_\_\_

Phone => \_\_\_\_\_

Ref => \_\_\_\_\_

=> \_\_\_\_\_

Full screen input/output, editing, formatting and validation, PF keys, messages, full cursor control. Can be used directly from BASIC.

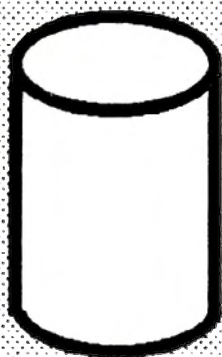
### Visicalc<sup>(tm)</sup> interface

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| Parking     | 08/20/83 | \$15.00  |
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The information kept in the database can be processed by Visicalc.

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### Database

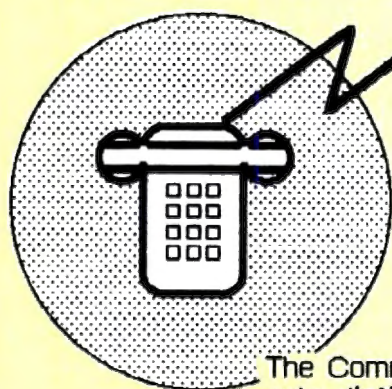


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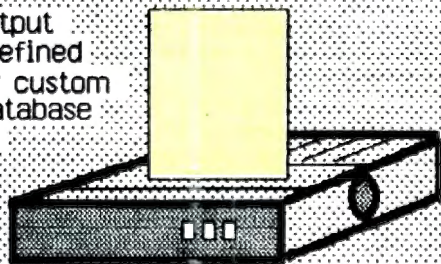
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served enough memory. In this case, go into Basic and type in CLEAR 100, MAXRAM-100.

Once you've reserved enough memory and have gone into Sort.CO, enter the name of the file you want to sort. If the records in the file don't meet the specifications, the computer tells you what file error to look for. If it meets Sort's specifications, the program displays the file's statistics (number of records and record size). Then it prompts for sort positions and an ascending or descending sort. At all prompts, you can press the enter key to return to the initial screen and then to the menu. Sorting a file with 242 39-byte records takes less than five seconds.

Sort.CO's sort algorithm is a simple linear-selection type—it exchanges records at the end of each pass. The Model 100's text file structure consists of records terminated by a carriage return/line feed with an end-of-file (EOF) marker following the last record. Its operating system uses dynamic memory management so files move about in memory.

To sort a data file in RAM, you must find the file's memory location, measure the length of the records in the file, count the number of records, and compute their locations. Then, you have to compare the records' sort keys and physically swap the records.

The data-input and error-trapping routines form the major part of the program. The program uses single-byte math computations for length, number of records, compare, and swap; this is why the program has file constraints. Each record can consist of 255 bytes: 253 bytes of information plus a carriage return and a line feed. ■

Write to Ronald F. Balonis at 118 Rice St., Trucksville, PA 18708.

Program Listing 2. Sort.BA. Use this program to create Sort.CO.

```

0 'SORT.BA ** MODEL 100 SORT BOOT ** **
10 'BY RONALD F. BALONIS
20 'RESERVE MEMORY FOR MACHINE LANGUAGE
30 '
50 CLEAR 100, MAXRAM-1000
100 CLS
150 PRINT@8, "*** MODEL 100 SORT BOOT **
200 FOR I=61960 TO 62948
250 READ Z:POKE I,Z:CKSUM=CKSUM+Z
300 NEXT I
350 IF CKSUM=95393 THEN 500
400 PRINT@88, "***** ERROR IN DATA!*****
450 STOP
490 '---SAVE IT AS A MACHINE FILE
500 SAVEM "SORT.CO",61960,62948,61968
1000 '---DATA VIA RS232 AND DODATA/CMD
10000 'START=61960 END=62948 EXEC=61986
10005 DATA 0, 0, 0, 0, 0, 0, 0
10010 DATA 0, 0, 0, 0, 0, 0, 0
10015 DATA 0, 0, 0, 0, 0, 0, 0
10020 DATA 0, 0, 0, 0, 0, 6, 26
10025 DATA 33, 8,242, 54, 0, 35, 5
10030 DATA 194, 39,242,205, 49, 66, 33
10035 DATA 118,244,205, 11,244, 33,154
10040 DATA 244,205, 11,244, 33,182,244
10045 DATA 205, 11,244,205, 68, 70, 33
10050 DATA 133,246,126,183,202,151, 87

```

Listing 2 continued

Listing 2 continued

```

10055 DATA 62, 9,235,205,171, 90,202
10060 DATA 102,242,126,205,227, 90,254
10065 DATA 192,202,108,242, 33,145,245
10070 DATA 195,247,243, 33,117,245,195
10075 DATA 247,243, 34, 22,242, 43, 6
10080 DATA 0, 35, 4, 62,255,184,202
10085 DATA 162,242,126,254, 26,202,168
10090 DATA 242,254, 13,194,114,242, 35
10095 DATA 4, 58, 12,242, 60,254,255
10100 DATA 202,173,242, 50, 12,242, 58
10105 DATA 14,242,183,194,158,242,120
10110 DATA 50, 14,242,184,202,112,242
10115 DATA 33,173,245,195,247,243, 58
10120 DATA 12,242,214, 4, 33,201,245
10125 DATA 218,247,243, 58, 14,242,254
10130 DATA 3,218,162,242, 61, 61, 50
10135 DATA 32,242, 33,210,244,205, 11
10140 DATA 244, 33, 3, 2,205,124, 66
10145 DATA 33,133,246,205,177, 39, 42
10150 DATA 12,242,205, 25,244, 33, 3
10155 DATA 16,205,124, 66, 33, 8,242
10160 DATA 205,177, 39, 33, 3, 31,205
10165 DATA 124, 66, 42, 32,242,205, 25
10170 DATA 244, 33, 8,242,205,177, 39
10175 DATA 33, 25,245,205, 11,244, 33
10180 DATA 5, 23,205,124, 66,205, 80
10185 DATA 244,123, 61, 50, 18,242,123
10190 DATA 183,202, 34,242, 58, 32,242
10195 DATA 187,218,246,242, 33, 61,245
10200 DATA 205, 11,244, 33, 5, 35,205
10205 DATA 124, 66,205, 80,244,123, 61
10210 DATA 50, 20,242,123,183,202, 34
10215 DATA 242, 58, 32,242,187,218, 22
10220 DATA 243, 58, 18,242,187,210, 22
10225 DATA 243, 33, 75,245,205, 11,244
10230 DATA 33, 6, 35,205,124, 66,205
10235 DATA 68, 70, 33,133,246,126,183
10240 DATA 202, 34,242,254, 65,202, 99
10245 DATA 243,254, 68,194, 61,243, 62
10250 DATA 235,195,101,243, 62, 0, 50
10255 DATA 198,243, 58, 20,242, 33, 18
10260 DATA 242,150, 60, 50, 16,242, 58
10265 DATA 12,242, 61, 50, 30,242, 50
10270 DATA 31,242, 42, 22,242, 34, 26
10275 DATA 242, 34, 28,242, 34, 24,242
10280 DATA 195,164,243, 42, 14,242,229
10285 DATA 193, 42, 28,242, 9, 34, 28
10290 DATA 242, 34, 24,242, 34, 26,242
10295 DATA 58, 31,242, 50, 30,242, 42
10300 DATA 14,242,229,193, 42, 26,242
10305 DATA 9, 34, 26,242, 42, 18,242
10310 DATA 229,193, 42, 24,242, 9,235
10315 DATA 42, 26,242, 9, 58, 16,242
10320 DATA 79, 58, 14,242, 71, 0,205
10325 DATA 109, 90,250,211,243, 42, 26
10330 DATA 242, 34, 24,242, 33, 30,242
10335 DATA 53,194,164,243, 42, 24,242
10340 DATA 235, 42, 28,242,126,245, 26
10345 DATA 119,241, 18, 35, 19, 5,194
10350 DATA 225,243, 33, 31,242, 53,202
10355 DATA 151, 87,195,140,243,205, 11
10360 DATA 244, 33,253,244,205, 11,244
10365 DATA 205, 66,114,254, 32,202, 34
10370 DATA 242,195, 0,244, 94, 35, 86
10375 DATA 229,235,205,124, 66,225, 35
10380 DATA 205,177, 39,201, 17, 10,242

```

Listing 2 continued



# CLONE I



# CLONE III

Dear Customer:

If you care about TIME, you need Clone. Why did you buy your computer? If you are like us, you need your computer to save you time. You follow proper programming procedures and backup everything twice. THIS TAKES TIME! If you use more than one disk operating system, IT TAKES TIME. At the end of our programming day we have at least 8 disks to backup twice. With the disk backup utilities that came with our disk operating systems, formatting and verifying that many disks could take 64 minutes, not to mention the amount of time that it took to initialize and answer the opening inquiries for the various disk operating systems we use. Now we use the Clone duplication system and the entire process takes less than 23 minutes. Clone is so reliable at verifying that we never worry about having a bad duplication. We are sure you know that a disk which has not been properly verified might cause problems you would not detect for months. Clone is so advanced that passwords, densities or different disk operating systems don't affect its efficient operation. Clone is so flexible that we are also able to duplicate Atari 400, Atari 800, TRS-80 Color Computer as well as TRS-80 Model I, III, or IV disks. Clone is so sophisticated that if it encounters a damaged disk and is unable to read it, you can ask it to keep trying, take it's best guess, or give up. Most backup utilities just give up. Clone's error messages will explain exactly what the trouble is. Finally, Clone IS FAST! It takes just 1 minute 25 seconds to format, duplicate, and verify a disk that used to take us 4 minutes to complete.

We are sure that everyone who owns a TRS-80 Model I, III, or IV would benefit from owning the Clone duplication system. Clone will become an indispensable part of your programing library. Unlike copying utilities, Clone will have a lasting usefulness which is not dependent on any other program's availability. That is why we at Gibberman Enterprises are proud to offer you Clone I for TRS-80 Model I or Clone III for TRS-80 Model III or IV.

Sincerely,

James Schoengarth  
Marketing Director  
Gibberman Enterprises

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|-------|------|------|------|------|------|------|------|-----|
| 10385 | DATA | 1,   | 3,   | 10,  | 197, | 175, | 14,  | 17  |
| 10390 | DATA | 195, | 43,  | 244, | 144, | 242, | 48,  | 244 |
| 10395 | DATA | 128, | 41,  | 23,  | 195, | 51,  | 244, | 41  |
| 10400 | DATA | 23,  | 35,  | 13,  | 194, | 38,  | 244, | 31  |
| 10405 | DATA | 193, | 198, | 48,  | 18,  | 27,  | 13,  | 194 |
| 10410 | DATA | 31,  | 244, | 33,  | 8,   | 242, | 62,  | 48  |
| 10415 | DATA | 190, | 192, | 54,  | 32,  | 35,  | 190, | 192 |
| 10420 | DATA | 54,  | 32,  | 201, | 205, | 68,  | 70,  | 33  |
| 10425 | DATA | 133, | 246, | 17,  | 0,   | 0,   | 126, | 183 |
| 10430 | DATA | 200, | 254, | 58,  | 208, | 254, | 48,  | 216 |
| 10435 | DATA | 214, | 48,  | 131, | 95,  | 35,  | 62,  | 0   |
| 10440 | DATA | 190, | 200, | 235, | 41,  | 229, | 41,  | 41  |
| 10445 | DATA | 193, | 9,   | 235, | 195, | 89,  | 244, | 1   |
| 10450 | DATA | 8,   | 61,  | 61,  | 61,  | 61,  | 32,  | 32  |
| 10455 | DATA | 77,  | 79,  | 68,  | 69,  | 76,  | 32,  | 49  |
| 10460 | DATA | 48,  | 48,  | 32,  | 83,  | 79,  | 82,  | 84  |
| 10465 | DATA | 32,  | 32,  | 61,  | 61,  | 61,  | 61,  | 32  |
| 10470 | DATA | 82,  | 70,  | 66,  | 47,  | 56,  | 52,  | 0   |
| 10475 | DATA | 8,   | 8,   | 61,  | 61,  | 32,  | 80,  | 82  |
| 10480 | DATA | 69,  | 83,  | 83,  | 32,  | 69,  | 78,  | 84  |
| 10485 | DATA | 69,  | 82,  | 32,  | 84,  | 79,  | 32,  | 69  |
| 10490 | DATA | 88,  | 73,  | 84,  | 32,  | 61,  | 61,  | 0   |
| 10495 | DATA | 3,   | 1,   | 32,  | 32,  | 70,  | 73,  | 76  |
| 10500 | DATA | 69,  | 78,  | 65,  | 77,  | 69,  | 32,  | 60  |
| 10505 | DATA | 88,  | 88,  | 88,  | 88,  | 88,  | 88,  | 46  |
| 10510 | DATA | 88,  | 88,  | 62,  | 32,  | 63,  | 32,  | 0   |
| 10515 | DATA | 3,   | 1,   | 60,  | 32,  | 32,  | 32,  | 32  |
| 10520 | DATA | 32,  | 32,  | 32,  | 32,  | 32,  | 62,  | 32  |
| 10525 | DATA | 61,  | 32,  | 32,  | 32,  | 32,  | 32,  | 32  |
| 10530 | DATA | 82,  | 69,  | 67,  | 79,  | 82,  | 68,  | 83  |
| 10535 | DATA | 32,  | 79,  | 70,  | 32,  | 32,  | 32,  | 32  |
| 10540 | DATA | 32,  | 32,  | 66,  | 89,  | 84,  | 69,  | 83  |
| 10545 | DATA | 0,   | 8,   | 8,   | 61,  | 61,  | 61,  | 61  |
| 10550 | DATA | 32,  | 80,  | 82,  | 69,  | 83,  | 83,  | 32  |
| 10555 | DATA | 83,  | 80,  | 65,  | 67,  | 69,  | 32,  | 66  |
| 10560 | DATA | 65,  | 82,  | 32,  | 61,  | 61,  | 61,  | 61  |
| 10565 | DATA | 0,   | 5,   | 1,   | 83,  | 79,  | 82,  | 84  |
| 10570 | DATA | 32,  | 80,  | 79,  | 83,  | 73,  | 84,  | 73  |
| 10575 | DATA | 79,  | 78,  | 32,  | 32,  | 83,  | 84,  | 65  |
| 10580 | DATA | 82,  | 84,  | 61,  | 32,  | 32,  | 32,  | 32  |
| 10585 | DATA | 32,  | 32,  | 32,  | 32,  | 32,  | 32,  | 32  |
| 10590 | DATA | 32,  | 0,   | 5,   | 30,  | 69,  | 78,  | 68  |
| 10595 | DATA | 61,  | 32,  | 32,  | 32,  | 32,  | 32,  | 32  |
| 10600 | DATA | 32,  | 0,   | 6,   | 1,   | 83,  | 79,  | 82  |
| 10605 | DATA | 84,  | 32,  | 60,  | 65,  | 62,  | 83,  | 67  |
| 10610 | DATA | 69,  | 78,  | 68,  | 73,  | 78,  | 71,  | 32  |
| 10615 | DATA | 79,  | 82,  | 32,  | 60,  | 68,  | 62,  | 69  |
| 10620 | DATA | 83,  | 67,  | 69,  | 78,  | 68,  | 73,  | 78  |
| 10625 | DATA | 71,  | 32,  | 32,  | 32,  | 32,  | 32,  | 32  |
| 10630 | DATA | 32,  | 0,   | 3,   | 1,   | 32,  | 32,  | 42  |
| 10635 | DATA | 42,  | 42,  | 32,  | 67,  | 65,  | 78,  | 78  |
| 10640 | DATA | 79,  | 84,  | 32,  | 70,  | 73,  | 78,  | 68  |
| 10645 | DATA | 32,  | 42,  | 42,  | 42,  | 32,  | 32,  | 32  |
| 10650 | DATA | 32,  | 0,   | 3,   | 1,   | 42,  | 42,  | 42  |
| 10655 | DATA | 32,  | 70,  | 73,  | 76,  | 69,  | 32,  | 78  |
| 10660 | DATA | 79,  | 84,  | 32,  | 84,  | 69,  | 88,  | 84  |
| 10665 | DATA | 32,  | 42,  | 42,  | 42,  | 32,  | 32,  | 32  |
| 10670 | DATA | 32,  | 0,   | 3,   | 1,   | 42,  | 32,  | 82  |
| 10675 | DATA | 69,  | 67,  | 79,  | 82,  | 68,  | 32,  | 76  |
| 10680 | DATA | 69,  | 78,  | 71,  | 84,  | 72,  | 32,  | 69  |
| 10685 | DATA | 82,  | 82,  | 79,  | 82,  | 32,  | 42,  | 32  |
| 10690 | DATA | 32,  | 0,   | 3,   | 1,   | 42,  | 42,  | 32  |
| 10695 | DATA | 35,  | 32,  | 79,  | 70,  | 32,  | 82,  | 69  |
| 10700 | DATA | 67,  | 79,  | 82,  | 68,  | 83,  | 32,  | 69  |
| 10705 | DATA | 82,  | 82,  | 79,  | 82,  | 32,  | 42,  | 42  |
| 10710 | DATA | 32,  | 0:   | :    | :    | :    | :    | :   |

## Etch-A-Screen

by Richard J. Perry

When I was a kid, just about everybody I know had an Etch-A-Sketch—you know, the flat, red box with a gray screen and two knobs that looked like a toy television set. By turning the knobs you could draw lines every which way across the screen. Now that I've aged, I've gotten more sophisticated. I found a way to make an electronic etcher using the Model 100 and my Basic program, Etcher.

Etcher lets you create complex graphics on your Model 100's screen (see Program Listing 3). You can access all the Model 100's graphics capabilities by positioning the blinking pixel cursor and entering Etcher's single-key commands. Etcher lets you draw circles, enter text, and produce reverse-video images. You can even store the pictures you create in a binary (.CO) file. Etcher also lets you merge images from different files.

Two additional Basic utility programs, Dump and Hexech, dump screen images to a graphics printer and convert binary image files to ASCII text files (.DO files) for uploading and downloading files via Telecom, the Model 100's telecommunications program (see Program Listings 4 and 5, respectively).

## Running Etcher

You execute each Etcher command with a single key-stroke. In conjunction with the line or pixel commands, the shift key determines whether the drawing is in normal or reverse video by setting or resetting the pixels.

Pressing the shift key along with a command key resets a screen pixel (turns it off). Pressing a command key without pressing the shift key sets a pixel (turns it on). This lets you move the pixel-sized cursor across the screen or draw a line.

Table 3 contains a list of program commands and their functions for quick reference.

## Pixel Commands

Pixel commands set and reset individual pixels and move the cursor around the screen. Hit the less-than sign to move the cursor left, the greater-than sign to move right, the A key to move up, and the Z key to move down.

## Line Commands

Etcher's line commands create lines, boxes, and circles. Etcher uses two pixel positions as reference points when executing a line command.

Use the Mark command (M) to mark the cursor position. Then move the cursor to the desired second pixel position and press the appropriate line command.

The C command connects lines that you mark. The B command draws a box. The marked pixel indicates one corner of the box, and the current cursor position indicates the opposite corner.

The H command draws a filled box, and the O command draws an oval. The marked pixel indicates the center of the circle, and the current cursor position determines the radius.

## File Commands

When you run Etcher, it first prompts you for a file name. If the file name you type in exists as a binary file, Etcher loads

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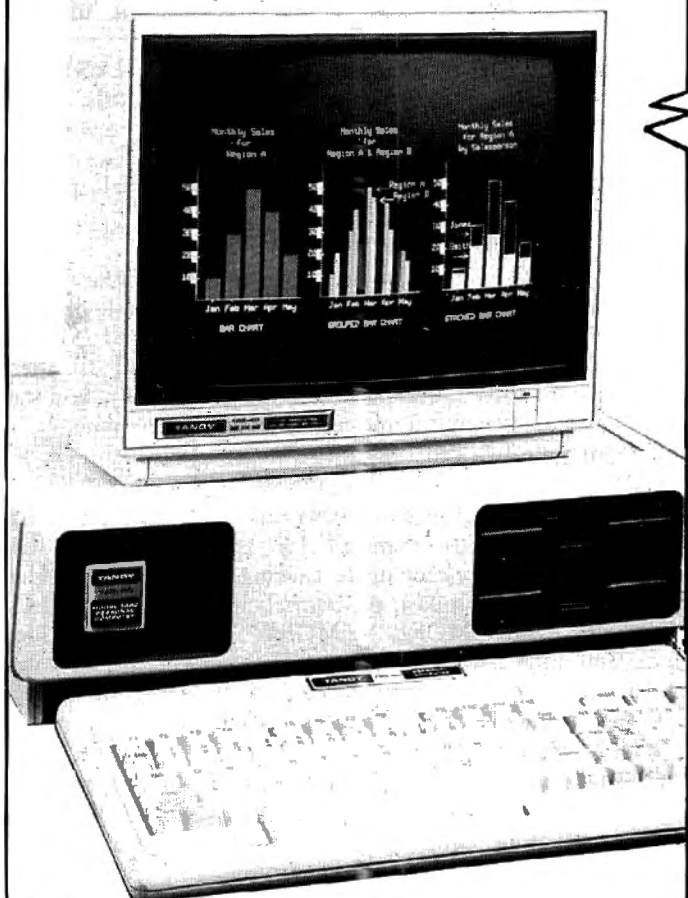
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and displays it on the screen. Use the file name when saving the file with the S command.

The F command files the image under a new name. When the block cursor appears, enter the desired file name and press the enter key. To preserve the screen graphics, the name does not appear on the screen.

The L command loads an image from a binary file and merges it with the current screen. Press the L key and enter the file name as you would at the file prompt.

G is the Dump command. It sends the screen image to the printer by executing the Dump utility (see Listing 4). This utility produces a double-height, double-width image on the DMP-100 printer.

### Other Commands

T is the Text Entry command. It puts a block cursor on the screen at the current pixel position. Type in the desired text and press the enter key. To move the cursor and control reverse video in this mode, I used the escape and control codes shown in Table 3.

The Invert command (I) inverts the screen. This sets and resets pixels to create a reverse-video image.

E is the Erase command. It clears the screen and returns control to the beginning of the program.

Q, the Quit command, ends the program and returns control to the menu. It does not save the screen image.

### Program Description

Etcher's main program is a loop in lines 70-100 that controls the cursor's blinking and dispatches the appropriate subroutine to execute the commands you enter.

The C\$ variable in line 60 contains a list of command abbreviations. You can modify it to change command symbols or to add new commands. If you press the shift key when entering a command, the program sets the variable P to zero. Otherwise, Etcher sets it to -1.

The On Error GOTO 410 statement in line 60 facilitates error trapping so you don't lose the screen image if anything goes wrong during program execution. If an error occurs, line 410 makes your Model 100 beep and sends the program to line 70.

The Clear 256,60829 statement at the beginning of Etcher reserves space in high memory to contain a set of machine-language utility subroutines and the binary screen image. I assembled the machine-language routines and placed them into data statements at the end of the program. These routines allow quick and efficient screen image transfers to and from the buffer in high memory.

Etcher POKEs the machine code into RAM from 60830 to 61016. The calling syntax for these routines from Basic is CALL 60830,A. "A" specifies the routine the program should execute and its value ranges from zero to 2.

The routine at zero copies the screen image to the memory buffer. The routine at 1 copies the buffer to the screen, and the routine at 2 inverts the screen image.

I placed the screen buffer in RAM from 61030 to 62949 using 1 bit per pixel for a total of 1,920 bytes. Etcher saves the screen RAM image as a binary file. From there you can save it to cassette.

### The Hexech Utility

My Basic Hexech utility in Program Listing 5 lets you convert binary image files to ASCII hexadecimal (hex) representa-

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| <p><b>Verbatim.</b></p> <p>5 1/4" sin-side dbl-den. <b>2.30</b></p> <p>5 1/4" dbl-side dbl-den. <b>3.05</b></p> <p>5 1/4" sin-side quad <b>3.20</b></p> <p>5 1/4" dbl-side quad <b>4.20</b></p> <p>8" sin-side sin-den. <b>2.60</b></p> <p>8" sin-side dbl-den. <b>2.90</b></p> <p>8" dbl-side dbl-den. <b>3.35</b></p> <p><b>Head Cleaning Kits... 5.20</b></p> <p><b>Refills. 9.55</b></p> | <p><b>Dysan CORPORATION</b></p> <p>5 1/4" sin-side dbl-den. <b>2.70</b></p> <p>5 1/4" dbl-side dbl-den. <b>3.95</b></p> <p>5 1/4" sin-side quad <b>3.95</b></p> <p>5 1/4" dbl-side quad <b>4.95</b></p> <p>8" sin-side sin-den. <b>3.05</b></p> <p>8" sin-side dbl-den. <b>3.75</b></p> <p>8" dbl-side dbl-den. <b>4.00</b></p> <p><b>We Stock "Bulk-Packed" Diskettes</b></p> | <p><b>3M Scotch</b></p> <p>5 1/4" sin-side dbl-den. <b>2.10</b></p> <p>5 1/4" dbl-side dbl-den. <b>2.80</b></p> <p>8" sin-side sin-den. <b>2.30</b></p> <p>8" sin-side dbl-den. <b>2.80</b></p> <p>8" dbl-side dbl-den. <b>3.50</b></p> <p style="text-align: center;">Disk Minder<br/>-Smoked Plastic<br/>-Holds 75 Disks</p> <p style="text-align: center;"><b>17.95 ea</b></p> <p style="text-align: center;">Dealer Inquiries Welcomed</p> |
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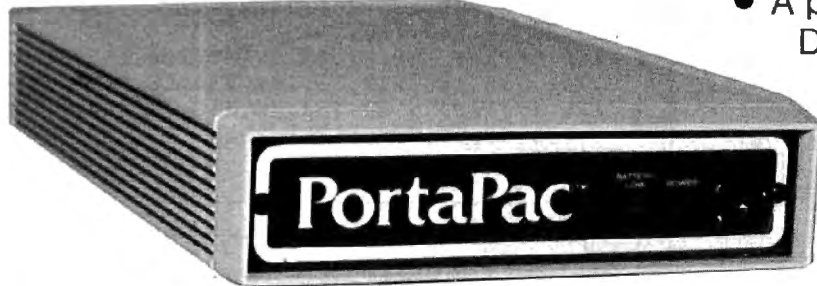
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tion that you can up- and download via Telecom. The binary files require 1,926 bytes for storage; the ASCII equivalent requires 3,873 bytes. Since Etcher doesn't access this utility, you must load and run it from the main menu.

**The Dump Utility**

Etcher's G command prints the screen display by executing the Dump utility in Listing 4. If you have a Radio Shack DMP-100 printer, you can use Dump.BA to create a machine-code Dumpbinary file that you can call from Etcher.

Dumpbinary loads into RAM from 61900 to 62260. You can call it from Basic by typing CALL 61900. If you don't have the Dumpbinary file in RAM, Etcher ignores the G command.

If you have a printer other than the DMP-100 and you have the necessary software to dump screen graphics, modify line 360 in Etcher to call your routine. ■

*Richard J. Perry teaches electrical engineering at Villanova University. He is the co-founder of Secure Systems Inc. (P.O. Box 30, Blue Bell, PA 19422), which provides encryption programs for the Model 100 and other computers. Write to him at Villanova University, Department of Electrical Engineering, Villanova, PA 19085.*

*Program Listing 3. Etcher.*

```

10 REM ETCHER by Richard J. Perry
20 CLEAR256,60829:SCREEN0,0:DEFINTA-
Z:READX,Y:FORK=XTOY:READZ:POKEK,Z:NEXT:O
NERRORGOTO420
30 LINEINPUT"File:";F$:IFF$=""THEN400
ELSEZ=-4516:POKEZ,LEN(F$):FORK=1TOLEN(F$
):POKEZ+K,ASC(MID$(F$,K,1))
:NEXT:LOADMF$:CLS:CALL60830,1
40 DEFINTA-Z:GOTO60
50 PRINT@280,"Box ? ";:I=INSTR(
"YyNn",INPUT$(1)):IFI=0THEN50ELSECLS:IFI
<3THENLINE(0,0)-(239,63),1,B
60 ONERRORGOTO410:X=120:Y=32:M=0:P=0:
Q=0:C=0:C$=",<.>aAzZmMcCbBhHoOiItTsSff
lLgGeEqQ"
70 C=C+1:IFC>20THENC=0:IFQTHENPRESET(X,Y
):Q=0ELSEPSET(X,Y):Q=-1
80 A$=INKEY$:IFA$=""THEN70ELSEI=INSTR(
C$,A$):IFI=0THEN70ELSEQ=0:IFPTHENPSET(
X,Y)ELSEPRESET(X,Y)
90 IFI<23THENP=-1(IMOD2)
100 I=(I+1)\2:ONIGOSUB110,130,150,170
,190,200,220,240,260,290,300,320,320,370
,360,390,400:GOTO70
110 X=X-1:IFX<0THENX=239
120 RETURN
130 X=X+1:IFX>239THENX=0
140 RETURN
150 Y=Y-1:IFY<0THENY=63
160 RETURN
170 Y=Y+1:IFY>63THENY=0
180 RETURN
190 M=-1:X1=X:Y1=Y:RETURN
200 IFMTHENLINE(X1,Y1)-(X,Y),-P
210 RETURN
220 IFMTHENLINE(X1,Y1)-(X,Y),-P,B
230 RETURN
240 IFMTHENLINE(X1,Y1)-(X,Y),-P,BF
250 RETURN
260 IFNOTMTHENRETURNELSEI=SQR((X-X1)^2+
(Y-Y1)^2):Y2=Y1:X2=X1+R!+.5:IFX2>239
THENX2=239
    
```

*Listing 3 continues*

*Listing 3 continued*

```

270 FORZ!=0TO8*ATN(1)STEP.25:X3=X1+R!*
COS(Z!)+.5:Y3=Y1+R!*SIN(Z!)+.5:IFX3<
240ANDX3>=0ANDY3<64ANDY3>=0THENLINE(
X2,Y2)-(X3,Y3),-P:X2=X3:Y2=Y3
280 NEXT:RETURN
290 CALL60830,2:RETURN
300 E$=CHR$(27):PRINT@40*(Y\8)+
X\6,E$"V"E$"q";
310 A$=INPUT$(1):IFASC(A$)
=13THENPRINTES"W"E"q"E"Q";:X=6*POS(0)
:Y=8*CSRLIN:RETURNELSEPRINTA$;:GOTO310
320 CALL60830,0:F$="":IFI=13THEN350
330 Z=-4516:FORK=1TOPEEK(Z):F$=F$+CHR$(
PEEK(Z+K)):NEXT
340 SAVEMF$,61030,62949
350 A$=INPUT$(1):I=ASC(A$):IFI=13THENIF
F$=""THEN330ELSE340ELSEF$=F$+A$:GOTO350
360 LOADM"DUMP":CALL61900:GOTO40:REM
This line can be replaced by a simple
RETURN if you do not have a DMP-100
printer
370 F$=""
380 A$=INPUT$(1):I=ASC(A$):IFI<>
13THENF$=F$+A$:GOTO380ELSELOADMF$:
CALL60830,1:GOTO40
390 CLS:GOTO20
400 CLEAR256,MAXRAM:MENU
410 BEEP:RESUME70
420 IFERR=52THENRESUME50ELSEBEEP
:RESUME30
430 DATA-4706,-4520,254,3,208,111,38,0
,41,17,174,237,25,94,35,86,213,201,180,2
37,9,238,60,238,205,73,66,33,102,238,30,
1,22,1,205,211,237,20,62,41,186,194,190,
237,28,62,9,187,194,188
440 DATA237,205,78,66,201,213,235,205
,124,66,235,62,1,50,243,255,62,10,6,170,
5,194,226,237,61,194,224,237,62,47,50,25
5,237,58,242,255,183,194,249,237,50,255,
237,17,236,255,6,6,26,0
450 DATA119,35,19,5,194,254,237,209
,201,33,102,238,14,0,22,0,121,7,7,95,6
,8,126,229,15,210,38,238,245,197,213,205
,76,116,209,193,241,28,5,194,25,238,225,
35,20,62,240,186,194
460 DATA16,238,12,62,8,185,194,14,238
,201,205,180,237,33,102,238,30,8,22,240,
126,47,119,35,21,194,70,238,29,194,68,23
8,205,49,66,205,9,238,201
    
```

*End*

*Table 3. Command and function reference table for Etcher.*

| Command       | Function                                  |
|---------------|-------------------------------------------|
| A             | Move cursor up                            |
| Left arrow    | Move cursor left                          |
| Right arrow   | Move cursor right                         |
| Shift         | Use with other commands for reverse-video |
| Z             | Move cursor down                          |
| Line Commands |                                           |
| B             | Draw a box                                |
| C             | Connect pixels                            |
| H             | Draw a filled box                         |
| M             | Mark pixel position                       |
| O             | Draw an oval                              |

*Table continued*

## C•NOTES

Table continued

| Command                         | Function                         |
|---------------------------------|----------------------------------|
| <b>File Commands</b>            |                                  |
| F                               | Save image to new name           |
| G                               | Print screen                     |
| L                               | Load file over current screen    |
| S                               | Save screen to current file name |
| <b>Other Commands</b>           |                                  |
| E                               | Erase screen                     |
| I                               | Invert screen                    |
| Q                               | Quit                             |
| T                               | Text entry mode                  |
| <b>Escape and Control Codes</b> |                                  |
| ESC/A                           | Cursor up                        |
| ESC/B                           | Cursor down                      |
| ESC/C                           | Cursor right                     |
| ESC/D                           | Cursor left                      |
| ESC/P                           | Reverse video on                 |
| ESC/Q                           | Reverse video off                |
| CTRL/J                          | Cursor down                      |
| CTRL/K                          | Cursor home                      |
| CTRL/L                          | Clear screen                     |

Program Listing 4. Dump utility for printing out the screen display.

```

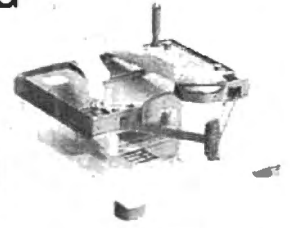
1 REM DUMP.BA by Richard J. Perry
2 CLEAR256, 61899 :DEFINTA-
Z:READX,Y:FORK=XTOY:READZ:POKEK,Z:NEXT:S
AVEM"DUMP",X,Y,X
10 DATA-3636,-3276,33,73,242,229,42
,57,246,34,117,247,33,133,246,6,240,175,
119,35,5,194,220,241,62,18,205,63,109,21
6,205,73,66,30,1,33,123,242,54,1,35,35,5
4,6,35,54,7,33,164,242
11 DATA54,8,205,96,242,33,123,242,54
,254,35,35,54,1,35,54,15,205,96,242,33,1
23,242,126,183,31,119,35,35,35,126,254,1
5,194,37,242,54,0,195,50,242,183,194,46,
242,54,7,195,50,242
12 DATA43,126,60,119,33,164,242,126
,61,119,28,62,9,187,194,13,242,29,33,164
,242,54,1,205,96,242,201,62,30,205,63,10
9,218,73,242,62,13,205,63,109,42,117,247
,34,57,246,205,78,66,201
13 DATA62,2,50,119,247,22,1,33,133
,246,205,251,242,14,6,213,229,33,122,247
,126,35,34,120,247,225,230,0,6,0,0,5,194
,126,242,182,95,58,119,247,61,123,202,15
0,242,7,7,7,205,226
14 DATA242,195,172,242,205,226,242
,122,15,87,229,42,120,247,43,126,225,6,0
,183,31,5,194,165,242,119,122,246,128,20
5,63,109,212,63,109,210,187,242,209,225,
201,35,229,42,120,247,13,194,116,242
15 DATA225,209,20,62,41,186,194,106
,242,62,13,205,63,109,210,215,242,225,20
1,58,119,247,61,50,119,247,194,101,242,2
01,7,22,0,6,4,95,122,7,7,87,123,7,95,210
,246,242,122,246,3,87
16 DATA5,194,232,242,201,229,213,235
,205,124,66,62,1,50,243,255,62,10,6,170,
5,194,10,243,61,194,8,243,62,47,50,42,24
3,58,242,255,183,194,33,243,50,42,243,17
,236,255,33,122,247,6
17 DATA6,26,0,119,35,19,5,194,41,243
,209,225,201
    
```

End

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## C•NOTES

Program Listing 5. Hexech binary hex file conversion utility.

```
10 REM HEXECH by Richard J. Perry
20 CLEAR256,61009:DEFINTA-Z
30 CLS:PRINT@122,"Convert <1> to hex, <
2> from hex":PRINT@280,"Select:";
40 N=VAL(INPUT$(1)):IFN<1ORN>
2THENBEEP:GOTO40ELSECLS:FILES:LINEINPUT"
Input:";F$:ONNGOTO110,140
50 A$="";K=X-16*(X\16):IFK>9THENK=K+7
60 A$=CHR$(K+48):K=X\16:IFK>9THENK=K+7
70 A$=CHR$(K+48)+A$:RETURN
80 K=ASC(LEFT$(A$,1))-48:IFK>9THENK=K-7
90 X=K*16:K=ASC(RIGHT$(A$,1))-48:IFK>
9THENK=K-7
100 X=X+K:RETURN
110 LOADMF$:DEFINTA-Z:LINEINPUT"Output:"
```

```
;F$:OPENF$FOROUTPUTAS1
120 Z=-4507:FORI=1TO16:FORJ=1TO120:Z=Z+
1:X=PEEK(Z):GOSUB50:PRINT#1,A$;:NEXT
:PRINT#1,"":NEXT
130 CLOSE:CLEAR256,MAXRAM:BEEP:END
140 OPENF$FORINPUTAS1:
LINEINPUT"Output:";F$:Z=-4526:POKEZ,LEN(
F$):FORK=1TOLEN(F$):POKEZ+K,ASC(MID$(
F$,K,1)):NEXT
150 Z=-4507:FORI=1TO16:FORJ=1TO120:Z=Z+
1:A$=INPUT$(2,1):GOSUB80:POKEZ,X:NEXT:
A$=INPUT$(2,1):NEXT
160 CLOSE:BEEP:F$="":Z=-4526:FORK=1
TOPEEK(Z):F$=F$+CHR$(PEEK(Z+K))
:NEXT:SAVEMF$,61030,62949
```

End

## RAM FILES

### Alternative to Uploading

The article "Uploading Text to WordStar" (August 1983, p. 210) discusses the disadvantage of using Telecom to upload files: It inserts carriage returns where none existed before.

The author's program solves the problem by transmitting the text as typed, without extra carriage returns. This slows transmission, however, so that a computer set at 19,200 baud actually transmits at 1,200 baud.

One way to solve this problem is to use Telecom for transmission and then eliminate the extra carriage returns on the receiving end. In WordStar, use the search and replace function (^QA) to search for ^P^M (a carriage return character).

Replace it with ^N, a carriage return/line feed sequence. Do a global search and replace without query (options G and N). Speed up the search and replace operation by typing ^X.

If your original text uses a double carriage return to denote a paragraph, eliminate the extra carriage returns and save the ones you type. To do this, turn your double carriage returns into double carriage return/line feed sequences by searching for ^P^M^P^M and replacing it with ^N^N.

Remove all carriage returns by searching for ^P^M. Then replace all line feed characters with carriage return/line feed sequences by searching for ^P^J and replace it with N. Use the Reformat Paragraph command (^B) to insert soft carriage returns according to the margins.

Another method is to use an undocumented feature of the Text Save command (F3). Use Text to open the file you want to save, then press the F3 key. After the Save to: prompt, type COM:parameters, where "parameters" is the parameter list for the RS-232 port.

You can use Telecom's Stat command to see what RS-232 parameters you've been using. I use 9711E to transmit at

19,200 baud by typing COM:9711E. This lets you send the file without inserting carriage return characters and without having to use a separate program.

Warren H. Buske  
Det. Wobeck Box 5683  
502d ASA Bn.  
APO, NY 09742

### The Bottom Line

Radio Shack's Personal Finance programs for the Model 100 lack many useful features.

My patches in Program Listing 1 calculate budget totals for the ACCTM.BA program so you can see how budget changes affect your total.

Pressing the F6 key displays the budget total. Pressing any other key returns control to the ACCTM menu.

Brad Alan Wright-Hulett  
500 S. 4th St., Apt. C9  
Morton, IL 61550

Program Listing 1. Patches for ACCTM.BA.

```
11 ONERROR GOTO0:INPUT#1,N:IFN=0THEN12ELSEBA=0
:FORX=1TON:FORY=1TO3:INPUT#1,A$(X,Y):
NEXTY:BA=BA+VAL(A$(X,3)):NEXTX
14 GOSUB50:KEYON:
ONKEYGOSUB5000,6000,7000,70,75,8000,16,80
30 GOSUB 31:PRINT@280,
"Add Edit Rem Wtpe Wram Tot PF ";
:RETURN
```

Listing 1 continued



## RAM FILES

Listing 1 continued

```

5200 FORF5=2TO3:B=F5:A=Q:GOSUB36:A=N:GOSUB40
:GOSUB55:B=T$:GOSUB56:A$(N,B)=T$:NEXT F5
:BA=BA+VAL(A$(N,3)):B=1:J=0:IFN=1THENP=1:S=1
:BEEP:GOTO5505
6005 A$(A,B)=T$:GOSUB55:GOSUB20:GOSUB18
:IFB>1THENIFB=3THENBA=BA-VAL(Q1$)
:BA=BA+VAL(A$(A,3)):RETURNELSERETURN
7100 BA=BA-VAL(A$(A,3)):FORX=ATON:FORY=1TO3
:A$(X,Y)=A$(X+1,Y):NEXTY,X:IFA=NTHENA=A-1
:IFA=0THENA=1:P=1:S=1
8000 PRINT@280,CHR$(27);"K";"TOTAL BUDGET ";
:PRINTUSING"$$###,###.##":BA:
8010 K$=INKEY$:IFK$=""THEN8010ELSEGOSUB30
:RETURN
    
```

End

## Improved Gas Mileage

You can modify Gas.BA from my article, "Gas/Oil Mileage" (July 1983, p. 170), to keep a running record of your gas costs by typing in the line changes in Program Listing 2.

*Beve Woodbury*  
 Technical Editor  
 80 Micro

Program Listing 2. Modifications for Gas.BA.

```

90 DIMDD(L+1),Y(L+1,4):INPUT#1,Y(0,2)
130 FOR K=0TO4
195 PRINTB;"3. TOTAL GAS COST"
200 PRINTB;"4. PRINT OIL USAGE":PRINT
240 ONZGOTO250,500,592,600
425 Y(N,4)=P*Q
470 FORK=0TO4
592 FORK=1TON
593 TG=TG+Y(K,4)
594 NEXT
596 PRINT:PRINT"TOTAL GAS COST":PRINT
USING"$$###.##":TG
598 GOTO 710
    
```

End

## Around in Circles

You can reduce the time needed to plot the circle in Emmett Carmody's pie chart program ("Graphic Results," April 1984, p. 188) by making these minor changes:

```

30 FOR A=0 TO 1.57 STEP .1
45 R1=R*COS(A):R2=R*SIN(A)
50 PSET(197+R1,32+R2):PSET(197-R1,32-R2)
55 PSET(197+R2,32-R1):PSET(197-R2,32+R1)
    
```

The revised program plots opposite points on each quarter of the circle each time through the loop, and plotting time drops from 16 to 4 seconds.

*Michael ShROUT*  
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|      |       |        |       |       |       |
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| 2516 | 2732  | 27128A | 2815  | 8742* | 8749* |
| 2532 | 2732A | 27256  | 2816  |       | 8751* |
| 2564 | 2764  | 68704  | 2817  |       | 8755* |

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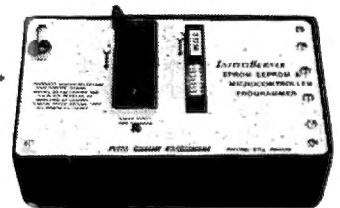
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Listing continued from p. 78

|      |          |       |             |                                       |
|------|----------|-------|-------------|---------------------------------------|
| 73E5 | 18CB     | 05310 | JR          | SOCKET.                               |
| 73E7 | 010131   | 05320 | P40 LD      | BC,3101H                              |
| 73EA | 218001   | 05330 | LD          | HL,180H                               |
| 73ED | 18C3     | 05340 | JR          | SOCKET                                |
| 73EF | CDDF71   | 05350 | COMM CALL   | SCTH                                  |
| 73F2 | CDC901   | 05360 | CALL        | CLS                                   |
| 73F5 | 218A75   | 05370 | ERR LD      | HL,CMD                                |
| 73F8 | CD4475   | 05380 | CALL        | WRITE                                 |
| 73FB | 3A1038   | 05390 | LOP9 LD     | A,(3810H)                             |
| 73FE | B7       | 05400 | OR          | A                                     |
| 73FF | 20FA     | 05410 | JR          | NZ,LOP9                               |
| 7401 | CD0075   | 05420 | GETCMD CALL | INPUT ; LOADS IN 2 BYTE COMMAND       |
| 7404 | 78       | 05430 | LD          | A,B ; B=FIRST CHR ,C=2ND CHR          |
| 7405 | FE50     | 05440 | CP          | 'P'                                   |
| 7407 | 286A     | 05450 | JR          | Z,PBOARD ; PRINT P.C.B TO PRINTER     |
| 7409 | FE43     | 05460 | CP          | 'C'                                   |
| 740B | 2845     | 05470 | JR          | Z,CLP ; CLEAR ALL PICTURES            |
| 740D | FE53     | 05480 | CP          | 'S'                                   |
| 740F | 284C     | 05490 | JR          | Z,SPEED ; CHANGE DRAWING SPEED        |
| 7411 | FE45     | 05500 | CP          | 'E'                                   |
| 7413 | CA2D40   | 05510 | JP          | Z,402DH ; DOS RETURN                  |
| 7416 | FE44     | 05520 | CP          | 'D' ; DARK PRINT                      |
| 7418 | 2814     | 05530 | JR          | Z,DARK                                |
| 741A | FE4C     | 05540 | CP          | 'L' ; LIGHT PRINT                     |
| 741C | 2822     | 05550 | JR          | Z,LIGHT                               |
| 741E | 3E0D     | 05560 | ERR1 LD     | A,13                                  |
| 7420 | CD3300   | 05570 | CALL        | 33H                                   |
| 7423 | 219975   | 05580 | LD          | HL,ERROR                              |
| 7426 | CD4475   | 05590 | CALL        | WRITE                                 |
| 7429 | 218A75   | 05600 | LD          | HL,CMD                                |
| 742C | 18C7     | 05610 | JR          | ERR                                   |
| 742E | 0618     | 05620 | DARK LD     | B,27                                  |
| 7430 | CDBE72   | 05630 | CALL        | PRINT                                 |
| 7433 | 061F     | 05640 | LD          | B,31 ; BOLD PRINT                     |
| 7435 | CDBE72   | 05650 | CALL        | PRINT                                 |
| 7438 | CDBE71   | 05660 | CALL        | MTSC                                  |
| 743B | ED5BFE7F | 05670 | LD          | DE,(Y)                                |
| 743F | C9       | 05680 | RET         |                                       |
| 7440 | 0618     | 05690 | LIGHT LD    | B,27                                  |
| 7442 | CDBE72   | 05700 | CALL        | PRINT                                 |
| 7445 | 0620     | 05710 | LD          | B,32 ; END BOLD                       |
| 7447 | CDBE72   | 05720 | CALL        | PRINT                                 |
| 744A | CDE671   | 05730 | CALL        | MTSC                                  |
| 744D | ED5BFE7F | 05740 | LD          | DE,(Y)                                |
| 7451 | C9       | 05750 | RET         |                                       |
| 7452 | CDD472   | 05760 | CLP CALL    | CLR                                   |
| 7455 | CDE671   | 05770 | CALL        | MTSC                                  |
| 7458 | ED5BFE7F | 05780 | LD          | DE,(Y)                                |
| 745C | C9       | 05790 | RET         |                                       |
| 745D | 79       | 05800 | SPEED LD    | A,C                                   |
| 745E | D630     | 05810 | SUB         | 30H                                   |
| 7460 | 28BC     | 05820 | JR          | Z,ERR1                                |
| 7462 | 32F97F   | 05830 | LD          | (SPD),A                               |
| 7465 | CDE671   | 05840 | CALL        | MTSC                                  |
| 7468 | ED5BFE7F | 05850 | LD          | DE,(Y)                                |
| 746C | 3A1038   | 05860 | LOP15 LD    | A,(3810H)                             |
| 746F | B7       | 05870 | OR          | A                                     |
| 7470 | 20FA     | 05880 | JR          | NZ,LOP15                              |
| 7472 | C9       | 05890 | RET         |                                       |
| 7473 | 79       | 05900 | PBOARD LD   | A,C                                   |
| 7474 | FE41     | 05910 | CP          | 'A' ; ALL SIDES                       |
| 7476 | 280A     | 05920 | JR          | Z,ALL                                 |
| 7478 | FE31     | 05930 | CP          | '1' ; 1ST SIDE                        |
| 747A | 281C     | 05940 | JR          | Z,ONE                                 |
| 747C | FE32     | 05950 | CP          | '2' ; 2ND SIDE                        |
| 747E | 282E     | 05960 | JR          | Z,TWO                                 |
| 7480 | 189C     | 05970 | JR          | ERR1                                  |
| 7482 | 210080   | 05980 | ALL LD      | HL,0000H ; START ADDRESS              |
| 7485 | 224172   | 05990 | LD          | (PST),HL ; STORE IT                   |
| 7488 | 3EC0     | 06000 | LD          | A,0C0H ; END ADDRESS                  |
| 748A | 327E72   | 06010 | LD          | (PND),A ; STORE IT                    |
| 748D | CD2F72   | 06020 | CALL        | SCRIPT ; PRINT TO PRINTER             |
| 7490 | CDE671   | 06030 | CALL        | MTSC                                  |
| 7493 | ED5BFE7F | 06040 | LD          | DE,(Y)                                |
| 7497 | C9       | 06050 | RET         |                                       |
| 7498 | 210080   | 06060 | ONE LD      | HL,0000H                              |
| 749B | 224172   | 06070 | LD          | (PST),HL                              |
| 749E | 3EA0     | 06080 | LD          | A,0A0H                                |
| 74A0 | 327E72   | 06090 | LD          | (PND),A                               |
| 74A3 | CD2F72   | 06100 | CALL        | SCRIPT                                |
| 74A6 | CDE671   | 06110 | CALL        | MTSC                                  |
| 74A9 | ED5BFE7F | 06120 | LD          | DE,(Y)                                |
| 74AD | C9       | 06130 | RET         |                                       |
| 74AE | 2100A0   | 06140 | TWO LD      | HL,0A000H                             |
| 74B1 | 224172   | 06150 | LD          | (PST),HL                              |
| 74B4 | 3EC0     | 06160 | LD          | A,0C0H                                |
| 74B6 | 327E72   | 06170 | LD          | (PND),A                               |
| 74B9 | CD2F72   | 06180 | CALL        | SCRIPT                                |
| 74BC | CDE671   | 06190 | CALL        | MTSC                                  |
| 74BF | ED5BFE7F | 06200 | LD          | DE,(Y)                                |
| 74C3 | C9       | 06210 | RET         |                                       |
| 74C4 | C5       | 06220 | PUT PUSH    | BC                                    |
| 74C5 | 7E       | 06230 | PUT1 LD     | A,(HL)                                |
| 74C6 | 12       | 06240 | LD          | (DE),A                                |
| 74C7 | 23       | 06250 | INC         | HL                                    |
| 74C8 | 13       | 06260 | INC         | DE                                    |
| 74C9 | 7B       | 06270 | LD          | A,E                                   |
| 74CA | E6C0     | 06280 | AND         | 0C0H                                  |
| 74CC | BB       | 06290 | CP          | E                                     |
| 74CD | CCD474   | 06300 | CALL        | Z,EDGE ; SOCKET IS OFF EDGE OF SCREEN |
| 74D0 | 10F3     | 06310 | DJNZ        | PUT1                                  |
| 74D2 | C1       | 06320 | POP         | BC                                    |
| 74D3 | C9       | 06330 | RET         |                                       |
| 74D4 | 1B       | 06340 | EDGE DEC    | DE                                    |
| 74D5 | E5       | 06350 | PUSH        | HL                                    |
| 74D6 | C5       | 06360 | PUSH        | BC                                    |
| 74D7 | D5       | 06370 | PUSH        | DE                                    |

Listing continued

Listing continued

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74D8 3E02      06300      LD      A,Z
74DA CD7771    06390      CALL   MOV      ; MOVE SCREEN RIGHT
74DD 3AFF7F    06400      LD      A,(X)
74E0 D602      06410      SUB    2H
74E2 32PP7F    06420      LD      (X),A
74E5 D1         06430      POP    DE
74E6 C1         06440      POP    BC
74E7 E1         06450      POP    HL
74E8 C9         06460      RET
74E9 C5         06470      GETAD  PUSH   BC
74EA 3AFE7F    06480      LD      A,(Y)
74ED 0600      06490      LD      B,0
74EF FE03      06500      NOT    CP      3H
74F1 3806      06510      JR     C,GOTB
74F3 3D         06520      DEC    A
74F4 3D         06530      DEC    A
74F5 3D         06540      DEC    A
74F6 04         06550      INC    B
74F7 18F6      06560      JR     NOT
74F9 05         06570      GOTB  DEC    B
74FA 05         06580      DEC    B
74FB 21003C    06590      LD      HL,3C00H
74FE 3AFF7F    06600      LD      A,(X)
7501 1F         06610      RRA
7502 05         06620      ADD    A,L
7503 6F         06630      LD      L,A
7504 114000    06640      LD      DE,40H
7507 19         06650      ADDR  ADD    HL,DE
7508 10FD      06660      DJNZ  ADDR
750A EB         06670      EX     DE,HL
750B C1         06680      POP    BC
750C C9         06690      RET
750D CD1675    06700      ; INPUT TWO CHR INTO B,C AND RETURN
7510 47         06710      INPUT CALL   SCN
7511 CD1675    06720      LD      B,A
7514 4F         06730      CALL   SCN
7515 C9         06740      LD      C,A
7516 CD2B00    06750      RET
7519 B7         06760      SCN   CALL   2BH ; LOOK AT KEYBOARD
751A 28FA      06770      OR     A
751C FE58      06780      JR     Z,SCN
751E 2804      06790      CP     'X'
7520 CD3300    06800      JR     Z,EXIT
7523 C9         06810      CALL  33H ; PRINT IT
7524 E1         06820      RET
7525 E1         06830      EXIT  POP    HL
7526 CDE671    06840      POP    HL
7529 ED5BFE7F  06850      CALL  MTSC
752D C9         06860      LD      DE,(Y)
752E C9         06870      RET
752E 214D75    06880      ; INTRODUCTION TO THE PROGRAM
7531 CD4475    06890      INTRO LD     HL,TITLE
7534 0603      06900      CALL  WRITE
7536 C5         06910      LD     B,3H
7537 01FFFF    06920      PAUSE PUSH  BC
753A CD6000    06930      LD     BC,0FFFFH
753D C1         06940      CALL  60H
753E 10F6      06950      POP   BC
7540 CDC901    06960      DJNZ  PAUSE
7543 C9         06970      'CALL CLS
7544 7E         06980      RET
7545 B7         06990      WRITE LD     A,(HL)
7546 C8         07000      OR     A
7547 CD3300    07010      RET
754A 23         07020      CALL  33H
754B 18F7      07030      INC   HL
754D 50         07040      JR     WRITE
754E 2E         07050      TITLE DEFB 'P.C. Board Drafters Aid. V1.1 1983'
754F 43
7550 2E
7551 20
7552 42
7553 6F
7554 61
7555 72
7556 64
7557 20
7558 44
7559 72
755A 61
755B 66
755C 74
755D 65
755E 72
755F 73
7560 20
7561 41
7562 69
7563 64
7564 2E
7565 20
7566 56
7567 31
7568 2E
7569 31
756A 20
756B 20
756C 31
756D 39
756E 30
756F 33
7570 0A      07060      DEFB  10
7571 20      07070      DEFB  '
7572 20
7573 20
7574 20

```

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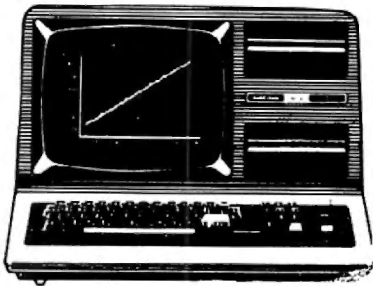
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|-------|--------------|-------|-------|-------|------------------------------------------------------|
| 7575  | 20           |       |       |       |                                                      |
| 7576  | 20           |       |       |       |                                                      |
| 7577  | 20           |       |       |       |                                                      |
| 7578  | 20           |       |       |       |                                                      |
| 7579  | 20           |       |       |       |                                                      |
| 757A  | 20           |       |       |       |                                                      |
| 757B  | 20           |       |       |       |                                                      |
| 757C  | 20           |       |       |       |                                                      |
| 757D  | 42           |       |       |       |                                                      |
| 757E  | 79           |       |       |       |                                                      |
| 757F  | 20           |       |       |       |                                                      |
| 7580  | 4A           |       |       |       |                                                      |
| 7581  | 69           |       |       |       |                                                      |
| 7582  | 6D           |       |       |       |                                                      |
| 7583  | 20           |       |       |       |                                                      |
| 7584  | 43           |       |       |       |                                                      |
| 7585  | 6C           |       |       |       |                                                      |
| 7586  | 61           |       |       |       |                                                      |
| 7587  | 72           |       |       |       |                                                      |
| 7588  | 6D           |       |       |       |                                                      |
| 7589  | 00           | 07080 | DEFB  | 0     |                                                      |
| 758A  | 45           | 07090 | CMD   | DEFW  | 'ENTER COMMAND'                                      |
| 758B  | 4E           |       |       |       |                                                      |
| 758C  | 54           |       |       |       |                                                      |
| 758D  | 45           |       |       |       |                                                      |
| 758E  | 52           |       |       |       |                                                      |
| 758F  | 20           |       |       |       |                                                      |
| 7590  | 43           |       |       |       |                                                      |
| 7591  | 4F           |       |       |       |                                                      |
| 7592  | 4D           |       |       |       |                                                      |
| 7593  | 4D           |       |       |       |                                                      |
| 7594  | 41           |       |       |       |                                                      |
| 7595  | 4E           |       |       |       |                                                      |
| 7596  | 44           |       |       |       |                                                      |
| 7597  | 3E           |       |       |       |                                                      |
| 7598  | 00           | 07100 | DEFB  | 0     |                                                      |
| 7599  | 49           | 07110 | ERROR | DEFW  | 'INPUT ERROR. ILLLEGAL COMMAND OR NUMBER (X=E) XIT)' |
| 759A  | 4E           |       |       |       |                                                      |
| 759B  | 50           |       |       |       |                                                      |
| 759C  | 55           |       |       |       |                                                      |
| 759D  | 54           |       |       |       |                                                      |
| 759E  | 20           |       |       |       |                                                      |
| 759F  | 45           |       |       |       |                                                      |
| 75A0  | 52           |       |       |       |                                                      |
| 75A1  | 52           |       |       |       |                                                      |
| 75A2  | 4F           |       |       |       |                                                      |
| 75A3  | 52           |       |       |       |                                                      |
| 75A4  | 2E           |       |       |       |                                                      |
| 75A5  | 20           |       |       |       |                                                      |
| 75A6  | 20           |       |       |       |                                                      |
| 75A7  | 49           |       |       |       |                                                      |
| 75A8  | 4C           |       |       |       |                                                      |
| 75A9  | 4C           |       |       |       |                                                      |
| 75AA  | 45           |       |       |       |                                                      |
| 75AB  | 47           |       |       |       |                                                      |
| 75AC  | 41           |       |       |       |                                                      |
| 75AD  | 4C           |       |       |       |                                                      |
| 75AE  | 20           |       |       |       |                                                      |
| 75AF  | 43           |       |       |       |                                                      |
| 75B0  | 4F           |       |       |       |                                                      |
| 75B1  | 4D           |       |       |       |                                                      |
| 75B2  | 4D           |       |       |       |                                                      |
| 75B3  | 41           |       |       |       |                                                      |
| 75B4  | 4E           |       |       |       |                                                      |
| 75B5  | 44           |       |       |       |                                                      |
| 75B6  | 20           |       |       |       |                                                      |
| 75B7  | 4F           |       |       |       |                                                      |
| 75B8  | 52           |       |       |       |                                                      |
| 75B9  | 20           |       |       |       |                                                      |
| 75BA  | 4E           |       |       |       |                                                      |
| 75BB  | 55           |       |       |       |                                                      |
| 75BC  | 4D           |       |       |       |                                                      |
| 75BD  | 42           |       |       |       |                                                      |
| 75BE  | 45           |       |       |       |                                                      |
| 75BF  | 52           |       |       |       |                                                      |
| 75C0  | 20           |       |       |       |                                                      |
| 75C1  | 28           |       |       |       |                                                      |
| 75C2  | 50           |       |       |       |                                                      |
| 75C3  | 3D           |       |       |       |                                                      |
| 75C4  | 45           |       |       |       |                                                      |
| 75C5  | 58           |       |       |       |                                                      |
| 75C6  | 49           |       |       |       |                                                      |
| 75C7  | 54           |       |       |       |                                                      |
| 75C8  | 29           |       |       |       |                                                      |
| 75C9  | 8A           | 07120 | DEFB  | 10    |                                                      |
| 75CA  | 00           | 07130 | DEFB  | 0     |                                                      |
| 75CB  | B795         | 07140 | PINS  | DEFW  | DOT                                                  |
| 75CD  | AABB         | 07150 | DEFW  | DOT1  |                                                      |
| 75CF  | 80           | 07160 | DEFB  | 80H   |                                                      |
| 75D0  | B795         | 07170 | DEFW  | DOT   |                                                      |
| 75D2  | AABB         | 07180 | DEFW  | DOT1  |                                                      |
| 75D4  | 80           | 07190 | DEFB  | 80H   |                                                      |
| 75D5  | B795         | 07200 | DEFW  | DOT   |                                                      |
| 75D7  | AABB         | 07210 | DEFW  | DOT1  |                                                      |
| 75D9  | 80           | 07220 | DEFB  | 80H   |                                                      |
| 75DA  | B795         | 07230 | DEFW  | DOT   |                                                      |
| 75DC  | AABB         | 07240 | DEFW  | DOT1  |                                                      |
| 75DE  | 80           | 07250 | DEFB  | 80H   |                                                      |
| 75DF  | B795         | 07260 | DEFW  | DOT   |                                                      |
| 75E1  | AABB         | 07270 | DEFW  | DOT1  |                                                      |
| 75E3  | 80           | 07280 | DEFB  | 80H   |                                                      |
| 75E4  | B795         | 07290 | DEFW  | DOT   |                                                      |
| 75E6  | AABB         | 07300 | DEFW  | DOT1  |                                                      |
| 75E8  | 80           | 07310 | DEFB  | 80H   |                                                      |
| 75E9  | B795         | 07320 | DEFW  | DOT   |                                                      |
| 75EB  | AABB         | 07330 | DEFW  | DOT1  |                                                      |
| 75ED  | 80           | 07340 | DEFB  | 80H   |                                                      |
| 75EE  | B795         | 07350 | DEFW  | DOT   |                                                      |
| 75F0  | AABB         | 07360 | DEFW  | DOT1  |                                                      |
| 75F2  | 80           | 07370 | DEFB  | 80H   |                                                      |
| 75F3  | B795         | 07380 | DEFW  | DOT   |                                                      |
| 75F5  | AABB         | 07390 | DEFW  | DOT1  |                                                      |
| 75F7  | 80           | 07400 | DEFB  | 80H   |                                                      |
| 75F8  | B795         | 07410 | DEFW  | DOT   |                                                      |
| 75FA  | AABB         | 07420 | DEFW  | DOT1  |                                                      |
| 75FC  | B795         | 07430 | CON1  | DEFW  | 95BFH                                                |
| 75FE  | AABB         | 07440 | DEFW  | 80H   | 00FAAH                                               |
| 7600  | 80           | 07450 | DEFW  | 80H   |                                                      |
| 7601  | B795         | 07460 | CON2  | DEFW  | 95BFH                                                |
| 7603  | 8080         | 07470 | DEFW  | 8080H |                                                      |
| 7000  |              | 07480 | END   | START |                                                      |
| 00000 | Total Errors |       |       |       |                                                      |

End

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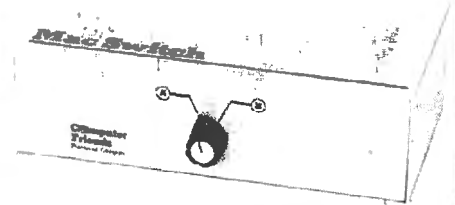
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A relatively simple external circuit and some software can eliminate such problems. This month's project, a real-time clock board (using National Semiconductor's MM58174 real-time clock chip), has battery back-up so the clock always keeps the correct time and date, whether or not primary power is supplied to the board. You only have to set time and date once, and they'll be available whenever you turn on the system. You can build the board (see the Photo) for the Model I, III, or 4, with any amount of memory. Model I users don't need an expansion interface, either.

## A Real-Time Clock Chip

The MM58174 I use in this project is a relatively inexpensive device that allows precise time-keeping with minimal power requirements (see Fig. 1 for a block diagram). The CMOS technology behind the 58174 results in its low power requirements—typically 1 milliampere (mA) when active—and permits it to have a low-power standby mode, requiring only 10 microamps ( $\mu$ A). This small current draw lets you back up the date and time by a single 3-volt (V) lithium battery (with 1,200

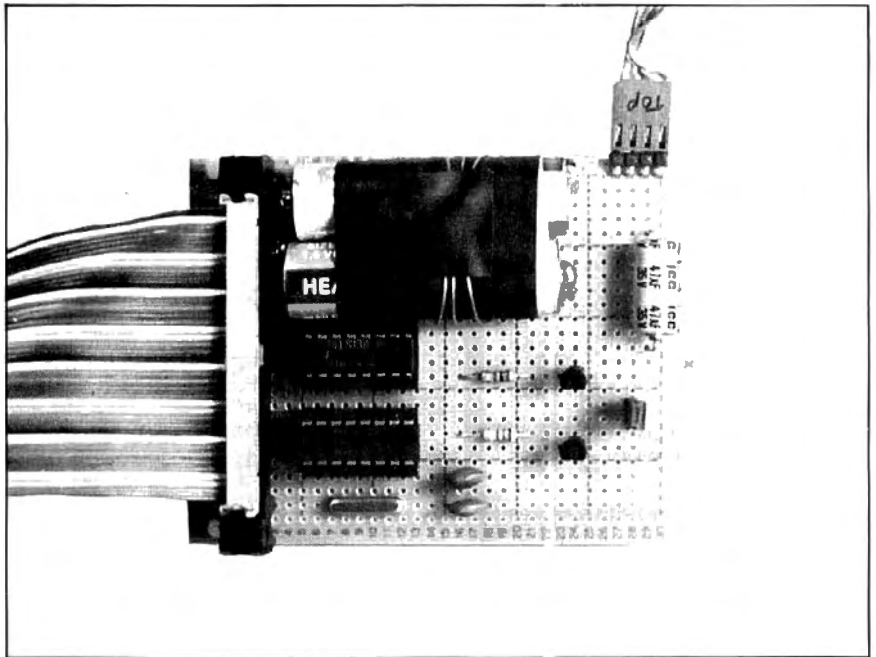


Photo. Real-time clock board.

mA-hour) for over 13 years. Even a 50 mAh lithium battery (watch-battery size) can back up the 58174 for nearly seven months.

The 58174 exists in a 16-pin DIP (dual in-line package), making it relatively small and economical. It has internal registers for all time values from hours to tenths of seconds and date registers including day of the week, month, and day of the month. While the date registers do not support the year, there is a leap-year register that receives a value telling the chip when February gets 29 days.

The 58174 was designed for simple interfacing to microprocessor buses, so you need very little circuitry to build this month's project. Because of the chip's timing specifications, however, Model 4 users must run in Model III mode (slower processor speed) unless they add special circuitry to support the faster timing.

Set only hours and minutes when

you set the 58174; the seconds are automatically cleared to zero; seconds and tenths of seconds can, however, be read from the device. The 58174 can also generate interrupts on an interval of 0.5 seconds, 5.0 seconds, or 60 seconds (+/- 16.6 ms). Although I didn't use the interrupt feature in this project, the board schematic shows the interrupt connection if you want to use it (see Fig. 2).

National Semiconductor has noted the deficiencies of the 58174 and has corrected them in their new MM58274. The 58274 is a pin-compatible (identical functional pinout)

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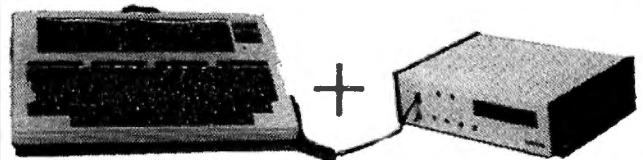
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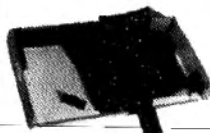
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# PROJECT 80

replacement for the 58174. It provides a year register, lets you set seconds, and provides much greater flexibility in interrupt interval selection. Since the 58274 is pin-compatible with the 58174, it can directly replace the 58174 in this month's project when it becomes readily available. The 58274 does have a somewhat different register arrangement, however, so software for the two devices is not compatible.

## Constructing the Board

The real-time clock board schematic shows an optional jumper coming off the battery that removes it from the circuit. If the battery is in its holder when you don't want it backing up the real-time clock chip, you can remove the jumper to keep the battery from draining. If you intend always to use the battery for back-up while in its holder, don't put the jumper on the board.

The capacitor on pin 15 of the 58174 is a critical timing capacitor that permits you to set the 58174 precisely. The schematic shows a 10 pF capacitor in this position, but National recommends a 6-36 pF variable capacitor for precise frequency tuning. If you use a variable capacitor you can set the crystal frequency precisely to the desired 32.768 kHz in a number of ways; refer to "The MM58174 Applications Note," by Steve Munich of National Semiconductor.

You use the 74LS138 shown in the schematic for address decoding. Although you can use other port addressing, the decoding for the board as shown uses port addresses 20 hex-2F hex (32-47 decimal). The software shown later assumes you used this address decoding.

The back-up battery must be approximately 3V, but that's the only requirement. I used two AA-size batteries in series to create the 3V. For longer life, you can also use a 3V lithium battery.

Aside from the two integrated circuits (ICs) mentioned (the 58174 and the 74LS138) and the batteries described above, you need only seven other components for the board: a 32.768 kHz crystal, two resistors, two capacitors, and two PNP transistors (see Table 1 for parts list and ordering information). Finally, you need a +5V power supply (at 15 mA) to operate the board.

## Theory of Operation

You use the two PNP transistors as switches. When the +5V power supply is on, Q1 is forward-biased, allowing the 58174 to draw its current from the +5V source. When you turn off the power supply and the voltage from the 100 μF capacitor falls below the battery voltage, Q1 becomes reverse-biased, switching Q2 on. The current for the 58174 then comes from the back-up battery. At this point VDD of the 58174 will be approximately 2.7V and the real-time clock will be in standby mode (VDD is less than 4V). When in standby mode, Q2 also keeps

the 58174's chip select pin (pin 1) high, as required by its power-down timing.

## Operating the Board

To access the board, either to read it or set it, be sure that the main power supply (+5V) is on. Otherwise, the board is in standby mode and the processor can't access it. Also, without the +5V, the 74LS138 doesn't function, so the 58174 could never be selected.

Table 2 shows the 58174 registers as addressed on the real-time clock board. I have included the test register (port 20 hex) primarily for a produc-

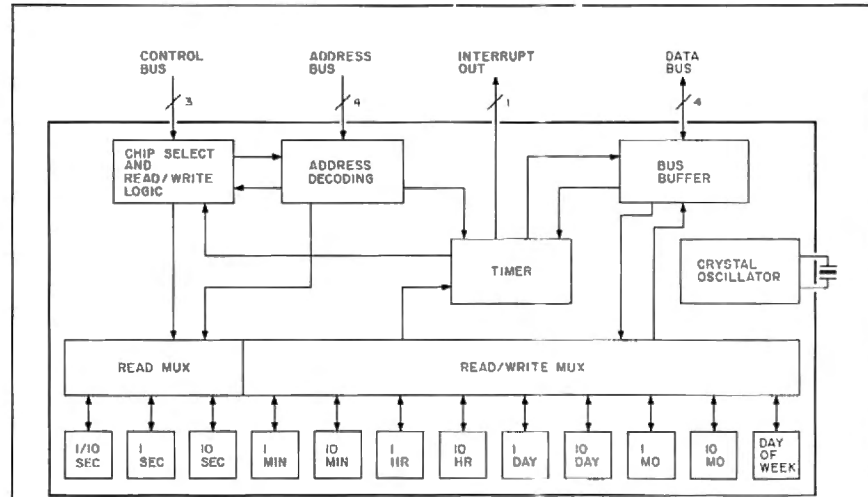


Figure 1. The 58174 real-time clock block diagram.

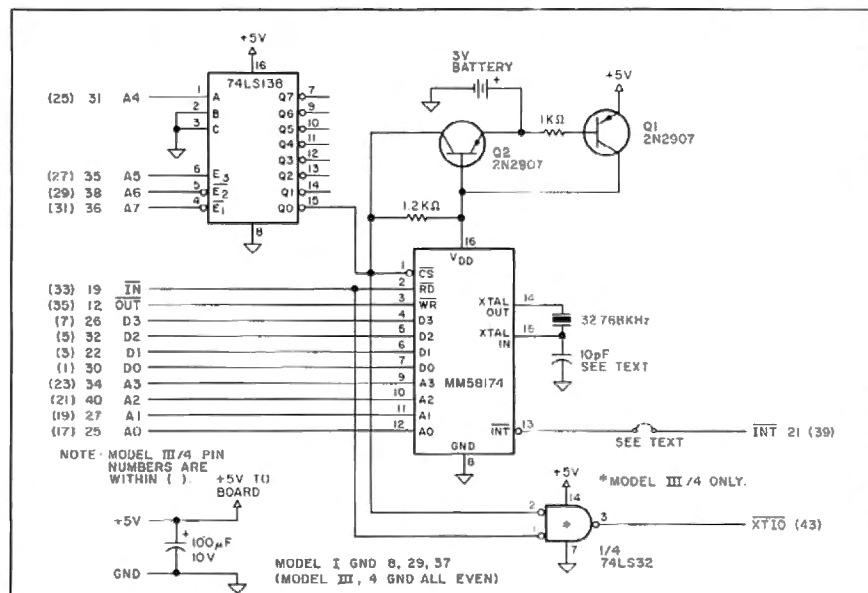


Figure 2. Real-time clock board schematic.



# PROJECT 80

| Port Number | Register Function | Access Mode |
|-------------|-------------------|-------------|
| 20 hex      | Test register     | Write only  |
| 21 hex      | Tenths of seconds | Read only   |
| 22 hex      | Units of seconds  | Read only   |
| 23 hex      | Tens of seconds   | Read only   |
| 24 hex      | Units of minutes  | Read/write  |
| 25 hex      | Tens of minutes   | Read/write  |
| 26 hex      | Units of hours    | Read/write  |
| 27 hex      | Tens of hours     | Read/write  |
| 28 hex      | Units of days     | Read/write  |
| 29 hex      | Tens of days      | Read/write  |
| 2A hex      | Day of week       | Read/write  |
| 2B hex      | Units of months   | Read/write  |
| 2C hex      | Tens of months    | Read/write  |
| 2D hex      | Leap year         | Write only  |
| 2E hex      | Stop/start        | Write only  |
| 2F hex      | Interrupt/status  | Read/write  |

Table 2. Registers of the 58174 real-time clock chip.

tion test of the device. For proper operation of the real-time clock, bit 3 of the register should be set to zero during chip initialization, placing the chip in non-test mode.

The start/stop register, port 2E hex, starts and stops the internal timing operations of the real-time clock. When the processor writes a zero to bit zero of this register, the clock stops. A 1 written to the same bit starts the clock. This is a necessary register, since you should stop the time when setting the real-time clock with time and date information. As soon as the processor writes all values to the chip, you can start the clock again.

The interrupt and status register (port 2F hex) sets up interrupt-generation information. By writing various values to this register, the processor

can enable and disable the interrupt function, as well as select the interrupt time interval.

Most of the remaining registers are reasonably straightforward. Since there is only a 4-bit data bus on the 58174 to communicate with the TRS-80's Z80, all time and date values are communicated (written and read) as single decimal digits. Thus, the high-order digit (in units of tens) and low-order digit (units of ones) are stored in separate registers for the seconds, minutes, hours, days, and months. The tenths-of-seconds and day-of-week values have their own registers.

One register that can be confusing is the years register. As mentioned earlier, the 58174 doesn't hold a year value. The years register is merely a 4-bit shift register that keeps track of leap year. Exactly 1 bit should be set in this register at any time. The position of the bit indicates the relative position of the current year to leap year. If bit 3 is set, the current year is leap year (February has 29 days); if bit 2 is set, the current year is one year before leap year, and so on. This lets the 58174 know when to base its calculations on 28 days in February and when to base its calculations on 29 days.

Also note that the 58174 does not provide error-checking features. If you give the date as January 32, the real-time clock believes you and stores that date in its internal registers.

Because the 58174 keeps track of time constantly—to a tenth of a second—you have to provide the time read functions in Assembly-language software. From a software standpoint, the entire time read must take place within a tenth of a second. You also must ensure that the time didn't change between the beginning and the end of the register reads.

The 58174 does have an internal data-changed flip-flop to indicate a tenth-of-a-second change. Whenever the tenths-of-seconds counter changes, this flip-flop sets all 58174 data lines high; it is cleared by the next low-to-high transition of the read strobe. There are several reasons, however, why a program may never see the "F" on the data lines. First, if other peripheral reads (to other devices) take place during the time a program reads the registers (because of an interrupt, for example), the flip-flop would be

| Quantity | Description                                  | Distributor | Part Number | Price (each) |
|----------|----------------------------------------------|-------------|-------------|--------------|
| 1        | Real-time clock IC                           | JE          | MM58174AN   | \$7.95       |
| 1        | 3-to-8 decoder IC                            | JDR         | 74LS138     | .55          |
| 1        | Quad 2-input OR gate (LS TTL) IC*            | JDR         | 74LS32      | .29          |
| 2        | 2N2907 low-power switching transistor (PNP)  | RS          | 276-2023    | .79          |
| 1        | 1k resistor (¼ watt)                         | RS          | 271-1321    | .08          |
| 1        | 1.2k resistor (¼ watt)                       | DK          | 1.2KQ       | .05          |
| 1        | 32.768 KHz crystal                           | JDR         |             | 1.95         |
| 2        | 1.5V battery                                 |             |             | —            |
| 1        | 10 pF/500V disk capacitor                    | DK          | P4000       | .08          |
| 1        | 100 µF/10V electrolytic capacitor (PC mount) | JDR         |             | .18          |
| 1        | .1" matrix grid prototype board              | RS          | 276-158     | 1.95         |
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| 1        | 40 pos. ribbon cable edge connector†         | DK          | R503-ND     | 3.80         |
| 1        | 40 pos. ribbon cable socket connector†       | DK          | R306-ND     | 3.73         |
| 1 foot   | 40 cond. ribbon cable†                       | DK          | R007-ND     | —            |
| 1        | 50 pos. cable header (w/w)*                  | DK          | R247-ND     | 6.93         |
| 1        | 50 pos. ribbon cable edge connector*         | RS          | 276-1566    | 4.95         |
| 1        | 50 pos. ribbon cable socket connector*       | DK          | R307-ND     | 4.65         |
| 1 foot   | 50 cond. ribbon cable*                       | DK          | R008-ND     | —            |

\*Model III/4

†Model I

Note: You can substitute Radio Shack's 1.2k ½ watt resistor for the ¼ watt resistor specified, and a 3V lithium battery for the 1.5V battery. Use a variable capacitor for greater accuracy (see text).

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Table 1. Parts list and ordering information.

reset before the program could read it. Also, the data-changed flip-flop can be set while the read strobe is low; again, the program would never see the "F."

Because of the unreliability of the high-bus method of detecting a time change, National recommends that a read of the 58174 begin and end with a read of the tenths-of-seconds register. The two values are then compared; if they differ, the read was unsuccessful and the values are read again. When the two values agree, a successful read is assured.

My short Assembly-language program (see Listing 1) contains two real-time clock routines, one to read the clock chip and one to set it. The program begins at 0FFC0 hex, which is at the top of memory for a 48K system. Other systems should set the starting address where appropriate. Don't forget to reserve the top of memory by setting HIMEM when using Assembly-language routines you can call from Basic.

I designed the two routines in List-

*Program Listing 1. Two real-time clock routines.*

```

00100 ;*****
00110 ;      58174 Real-Time Clock                      *
00120 ;      Read Time and Set Time Routines        *
00130 ;      *
00140 ;      The two routines included here allow the *
00150 ;      National Semiconductor 58174 real-time clock *
00160 ;      to be set and reset via USR calls from Basic. *
00170 ;      A specific area of memory is set aside as a *
00180 ;      data area, where values read from the 58174 *
00190 ;      are stored, and where values to be written to *
00200 ;      the 58174 are found.                      *
00210 ;      *
00220 ;      No parameters need to be passed to either *
00230 ;      routine, and no result information is      *
00240 ;      returned. Also, no error checking takes place *
00250 ;      here. All information to be written to the *
00260 ;      real-time clock chip is assumed to be     *
00270 ;      correct.                                    *
00280 ;      *
00290 ;      Written by Roger C. Alford                 *
00300 ;*****
00310 ;
00320 ;*** Define Equates:
00330 TEST EQU 20H ;58174 TEST REGISTER
00340 TENTHSC EQU 21H ;58174 TENTHS OF SECONDS
00350 UNITSSEC EQU 77H ;58174 UNITS OF SECONDS
00360 TENSSEC EQU 23H ;58174 TENS OF SECONDS
00370 UNITMIN EQU 24H ;58174 UNITS OF MINUTES
00380 TENMIN EQU 25H ;58174 TENS OF MINUTES
00390 UNITHR EQU 26H ;58174 UNITS OF HOURS
00400 TENSHR EQU 27H ;58174 TENS OF HOURS
00410 UNITDY EQU 28H ;58174 UNITS OF DAYS
00420 TENDY EQU 29H ;58174 TENS OF DAYS
00430 DYOFWK EQU 2AH ;58174 DAY OF WEEK
00440 UNITMO EQU 2DH ;58174 UNITS OF MONTHS
00450 TENMO EQU 2CH ;58174 TENS OF MONTHS
00460 LPEYR EQU 2DH ;58174 LEAP YEAR CODE REGISTER
00470 STPSTR EQU 2EH ;58174 STOP/START REGISTER
00480 INTSTS EQU 2FH ;58174 INTERRUPT/STATUS REGISTER
00490 ;
00500 ;
00510 ;
00520 ;
FFC0 ; ORG 0FFC0H
    
```

*Listing 1 continued*

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# PROJECT 80

Listing 1 continued

```

00530 ;*****
00540 ; RDTIME is the routine to read the time and date *
00550 ; values from the 58174 and place them into the proper *
00560 ; locations in the time table (TIMTBL) below. All *
00570 ; values are read from tenths of a second to tens of *
00580 ; months. The calling Basic program can then read these *
00590 ; values using its PEEK function, then combine the *
00600 ; values as desired to create time and date strings. *
00610 ;*****
00620 ;
00630 RDTIME LD HL,TIMTBL ;POINT TO TIME TABLE
00640 LD C,TMTHSC-1 ;PNT TO 1ST READ REG - 1
00650 LD B,TENSNO-TMTHSC+1
00660 ;
00670 RDL00P INC C ;PUT # OF READ REG'S IN B
;POINT TO NEXT READ REG.
FFC0 21ECFF
FFC3 0E20
FFC5 060C
00680 ;
00690 INI ;PUT REG VALUE IN TABLE
00700 JR NZ,RULOOP ;LOOP UNTIL ALL READ
FFCC DB21
FFCE 47
00710 LD A,(TMTHSC) ;GET TENTHS OF SEC AGAIN
FFCF 3AECFF
00720 LD A,(TIMTBL) ;SAVE TEMP IN B REGISTER
FFD2 B6
00730 CP B ;GET ORIG TENTHS OF SEC
FFD3 20EB
00740 JR NZ,RDTIME ;ARE THEY STILL THE SAME?
FFD5 C9
00750 RET ;IF NOT, READ VALUES OVER
;ELSE, DONE - RETURN
00760 ;
00770 ;
00780 ;*****
00790 ; SRTIME is the routine to set the time and date in the *
00800 ; 58174 real-time clock chip. The time table (TIMTBL) *
00810 ; below is where the values to be written are expected *
00820 ; to be. Since nothing smaller than minutes can be *
00830 ; written to the 58174, the first three table locations *
00840 ; are ignored by this routine. The calling Basic *
00850 ; program must first POKE the proper time and date *
00860 ; values into the appropriate TIMTBL locations, then *
00870 ; call this routine. The values are then written to the *
00880 ; 58174, then control is returned to the Basic program. *
00890 ;*****
00900 ;
00910 SETIME XOR A ;CLEAR THE ACCUMULATOR
FFD6 AF
00920 OUT (TEST),A ;MAKE SURE NOT IN TEST MD
FFD7 D320
00930 OUT (STPSTR),A ;STOP 58174 OPERATION
FFD9 D32E
00940 LD HL,TIMTBL+3 ;PT TO 1ST USED TBL LOC.
FFDB 21EFFF

```

Listing 1 continued

ing 1 so that you can call them from Basic; Listing 2 is a Basic program that uses these routines. They reserve a 13-byte table for a buffer area for the time and date values. The locations correspond with the registers of the 58174, with the first location representing the tenths-of-seconds register. The RDTIME routine of Listing 1 reads the time and date values from the 58174 and stores them in the table (TIMTBL). The calling Basic program can then access these values (using PEEK).

Likewise, the Basic program can store set-up values in the appropriate locations (using POKE), and call the SETIME routine to set the time and date in the real-time clock. Since the 58174 doesn't check for incorrect time and date input, the Basic program in Listing 2 takes on this responsibility. If you want to set the time, the program prompts you for the time and date information, including the year. When you enter the information, the program checks its validity. If it detects an error—February 30, for ex-

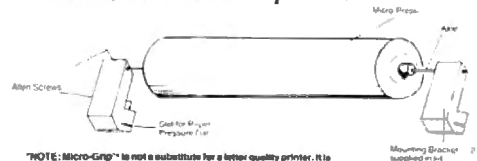


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ample—the set-up procedure starts over; otherwise, the program returns you to the main menu. The program uses the year you enter to determine the proper value for the years register (leap-year calculation).

If you select the read-time option when running the Basic program in Listing 2, the program calls the RDTIME routine, then converts the information into time and date strings and displays them on the screen, spelling out the actual month and day of the week.

Those of you whose systems have a 25 ms interrupt (Model I's with an expansion interface, for example) can use it to keep track of time and date after you've set them. Since the real-time clock board circumvents the date and time prompts each time you turn on the computer, my other Assembly-language program (see Listing 3) takes advantage of the 25 ms interrupt.

The program starts at 0FF60 hex for a 48K system, so make the appropriate adjustments for other configurations. I'm not sure about precise memory addresses for Model III and 4 for this program (I assume they're the same), so I can't guarantee this program will operate as is on those systems. To set up the interrupt interception, you must first call the main code section (RTIMER) from Basic, although the type of Basic determines how you'll implement this precisely. With Disk Basic, you can run the RTIMER code using two instructions:

```
DEFUSR=&HFF60
N=USR(0)
```

Once you make the interrupt interception, the program calls the TIMSRV routine whenever an interrupt occurs. If the 25 ms timer causes the interrupt, the interrupt servicing is forwarded to the normal interrupt service routine. Otherwise, the program reads the time and date from the real-time clock chip and stores the information in the reserved memory locations. The routine then returns from the interrupt. Since the 58174 does not support the year function, you have to POKE the year into location 4044 hex (16452 decimal) from Basic. ■

*Write to Roger C. Alford at Wash-tenaw Digital Systems, P.O. Box 2014, Ann Arbor, MI 48106. Please include a self-addressed, stamped envelope for a reply.*

*Listing 1 continued*

```
PFDE 0E23      00950      LD      C,UNITMN-1      ;PT TO 1ST WRITE REG - 1
PFEB 060A      00960      LD      B,LPYEAR-UNITMN+1
                                00970      ;PUT # OF WRITE REG IN B
FFE2 0C        00980      STLOOP  INC      C      ;PT TO NEXT WRITE REG.
FFE3 EDA3      00990      OUTI    ;TRANSFER VALUE TO REG
PFES 20FB      01000      JR      NZ,STLOOP      ;LOOP UNTIL DONE
FFE7 3E01      01010      LD      A,01H          ;GET 58174 START VALUE
PFEB 032E      01020      OUT     (STPSTR),A     ;START 58174 OPERATION
FFEB C9        01030      RET     ;DONE - RETURN
                                01040      ;
                                01050      ;
                                01060      ;Define Tables:
0000          01070      TIMTBL  DEFS   13      ;TABLE OF TIME READ/WRITE VALUES
                                01080      ;
PFCE          01090      END     RDTIME
00000 Total errors
```

End

*Program Listing 2. Real-time and set-time Basic code (for use with Program Listing 1).*

```
10 DIM A$(7),B$(12),A(12)
20 FOR I=1 TO 7
30 READ A$(I)
40 NEXT I
50 FOR I=1 TO 12
60 READ B$(I)
70 NEXT I
80 DEFUSR0=&HFFC0: READ TIME ROUTINE
90 DEFUSR1=&HFFD6: SET TIME ROUTINE
100 CLS
110 INPUT"READ TIME (R) OR SET TIME (S)":A$
120 IF A$="R" THEN GOSUB 1000 ELSE IF A$="S" THEN GOSUB 2000
130 GOTO 110
1000 '----- READ TIME ROUTINE -----
1005 N=USR0(0): READ CURRENT TIME
1010 FOR I=1 TO 12
1020 A(I)=PEEK(&HFFEB+I) AND 15: READ IN TIME VALUES
1030 NEXT I
1040 PRINT A$(A(10));", ";
1050 PRINT B$(A(12)*10+A(11));A(9)*10+A(8);" ";
1060 A$=STR$(A(7)*10+A(6))+": "
1062 B$=STR$(A(5)*10+A(4)):A$=A$+RIGHT$("0"+RIGHT$(B$,LEN(B$)-1),2)+": "
1064 B$=STR$(A(3)*10+A(2)):A$=A$+RIGHT$("0"+RIGHT$(B$,LEN(B$)-1),2)+": "
1066 A$=A$+RIGHT$(STR$(A(1)),1)
1070 PRINT A$
1080 PRINT
1090 RETURN
2000 '----- SET TIME ROUTINE -----
2005 CLS:GOSUB 1000
2010 INPUT "ENTER MONTH (1-12) ":MO%
2020 INPUT "ENTER DAY OF MONTH ":DT%
2030 INPUT "ENTER DAY OF WEEK ":DY%
2040 INPUT "ENTER YEAR 19":YR%
2050 INPUT "ENTER HOUR ":HR%
2060 INPUT "ENTER MINUTE ":MN%
2070 IF MN%>59 OR MN%<0 THEN 2000
2080 IF HR%>23 OR HR%<0 THEN 2000
2090 IF DY%<1 OR DY%>7 THEN 2000
2100 A=(YR%/4-INT(YR%/4))*4
2110 IF MO%<1 THEN 2000
2120 IF MO%=4 OR MO%=6 OR MO%=9 OR MO%=11 THEN IF DT%>30 THEN 2000
2130 IF MO%=2 AND A=0 THEN IF DT%>29 THEN 2000
2140 IF MO%=2 AND A<>0 THEN IF DT%>28 THEN 2000
2150 IF DT%>31 THEN 2000
2160 A(2)=INT(MN%/10)
2170 A(1)=INT((MN%/10-A(2))*10+.1)
2180 A(4)=INT(HR%/10)
2190 A(3)=INT((HR%/10-A(4))*10+.1)
2200 A(6)=INT(DT%/10)
2210 A(5)=INT((DT%/10-A(6))*10+.1)
2220 A(7)=DY%
2230 A(9)=INT(MO%/10)
2240 A(8)=INT((MO%/10-A(9))*10+.1)
2250 IF A=0 THEN A(10)=8 ELSE IF A=3 THEN A(10)=4 ELSE A(10)=A
2260 FOR I=1 TO 10
2270 POKE &HFFEE+I,A(I)
2280 NEXT I
2290 N=USR1(0)
2300 CLS:RETURN
```

```
5000 DATA "SUNDAY","MONDAY","TUESDAY","WEDNESDAY","THURSDAY"
5010 DATA "FRIDAY","SATURDAY"
5020 DATA "JANUARY","FEBRUARY","MARCH","APRIL","MAY","JUNE"
5030 DATA "JULY","AUGUST","SEPTEMBER","OCTOBER","NOVEMBER"
5040 DATA "DECEMBER"
```

End

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Program Listing 3. Code for 25 ms interrupt interception.

```

00100 ;*****
00110 ;      58174 Real-Time Clock
00120 ;      25ms Interrupt Interception Code
00130 ;
00140 ; This program allows the 58174 to be used as
00150 ; the real-time clock for the TRS-80 system.
00160 ; By first calling the setup code - RTSERV - TIME
00170 ; is set, the 25ms TRS-80 expansion interface
00180 ; interrupt will be controlled by the TRSRV
00190 ; routine below. The service routine reads the
00200 ; time and date, except year, from the 58174
00210 ; and stores the values in the pre-determined
00220 ; TRS-80 storage locations.
00230 ; Since the 58174 does not have a year
00240 ; register, the year value must be POKED into
00250 ; location 4044H (16452) by the user for the
00260 ; current date to appear.
00270 ;
00280 ;      Written by Roger C. Alford
00290 ;*****
00300 ;
00310 ;** Define Equates:
00320 TEST EQU 20H ;58174 TEST REGISTER
00330 TENTHSC EQU 21H ;58174 TENTHS OF SECONDS
00340 UNITSC EQU 22H ;58174 UNITS OF SECONDS
00350 TENSSEC EQU 23H ;58174 TENS OF SECONDS
00360 UNITMIN EQU 24H ;58174 UNITS OF MINUTES
00370 TENSMIN EQU 25H ;58174 TENS OF MINUTES
00380 UNITHR EQU 26H ;58174 UNITS OF HOURS
00390 TENSHR EQU 27H ;58174 TENS OF HOURS
00400 UNIDAY EQU 28H ;58174 UNITS OF DAYS
00410 TENDAY EQU 29H ;58174 TENS OF DAYS
00420 DYOFWK EQU 2AH ;58174 DAY OF WEEK
00430 WKMO EQU 2BH ;58174 UNITS OF MONTHS
00440 TENSMO EQU 2CH ;58174 TENS OF MONTHS
00450 LPEYEA EQU 2DH ;58174 LEAP YEAR CODE REGISTER
00460 STPSTA EQU 2EH ;58174 STOP/START REGISTER
00470 INTSTS EQU 2FH ;58174 INTERRUPT/STATUS REGISTER
00480 INTVEC EQU 4012H ;TRS-80 INTERRUPT VECT LOC.
00490 INT25M EQU 37E0H ;TRS-80 INTERRUPT STATUS BYTE
00500 FDCLOC EQU 37ECH ;TRS-80 FDC LOCATION
00510 SECLOC EQU 4041H ;TRS-80 SECONDS STORAGE LOC.
00520 MINLOC EQU 4042H ;TRS-80 MINUTES STORAGE LOC.
00530 HRLOC EQU 4043H ;TRS-80 HOURS STORAGE LOC.
00540 DATLOC EQU 4045H ;TRS-80 DATE STORAGE LOC.
00550 MONLOC EQU 4046H ;TRS-80 MONTH STORAGE LOC
00560 ;
FF60 ORG 0FF50H
00570 ;
00580 ;
00590 ;
00600 ;*****
00610 ; RTIMER sets up the interrupt vector locations *
00620 ; in the TRS-80 memory so that the TIMSRV *
00630 ; service routine will intercept all TRS-80 *
00640 ; interrupts. If the interrupt is from the 25ms *
00650 ; signal, the time and date storage locations *
00660 ; memory are updated, otherwise the interrupt *
00670 ; servicing is passed to the normal TRS-80 *
00680 ; service routine.
00690 ;*****
00700 ;
00710 RTIMER DI ;DISABLE INTERRUPTS
00720 LD A,0C3H ;GET JUMP OPCODE
00730 LD (INTVEC),A ;SAVE IN INT. VECT LOC
00740 LD HL,(INTVEC+1) ;GET CURRENT SERVICE ADDR
00750 LD (VECTR),HL ;SAVE IN TEMPORARY LOC.
00760 LD HL,TIMSRV ;GET ADDR OF SERVICE ROUT
00770 LD (INTVEC+1),HL ;STORE IN VECTOR LOC.
00780 EI ;RE-ENABLE INTERRUPTS
00790 RET ;DONE - RETURN
00800 ;
00810 ;
00820 ;*****
00830 ; TIMSRV service all maskable TRS-80
00840 ; interrupts. It first checks to see if the
00850 ; interrupt was caused by a 25ms timeout. If it
00860 ; was, it continues to read the 58174 real-time
00870 ; clock and updates the memory time and date
00880 ; storage locations. Otherwise, control is
00890 ; given to the TRS-80 routine that would
00900 ; normally service the interrupt.
00910 ;*****

```

```

00920 ;
00930 TIMSRV PUSH AF ;SAVE AF REGISTER
00940 PUSH BC ;SAVE BC REGISTER PAIR
00950 PUSH HL ;SAVE HL REGISTER PAIR
00960 LI A,(INT25M) ;GET INT. INDICATOR BYTE
00970 BIT A ;CHECK FOR 25MS INT.
00980 JR NZ,INTCR ;IF YES, SERVICE IT
00990 LD HL,INTDUN ;GET RESTORE REG LOC.
01000 PUSH HL ;SAVE GN STACK
01010 LD HL,(VECTR) ;GET OTHER SERVICE VECTOR
01020 JP HL ;SERVICE THE INTERRUPT
01030 CALL RDTIME ;READ THE CURRENT TIME-
01040 LD A,(FDCLOC) ;CLEAR FDC
01050 LD HL,INTBL+1 ;POINT TO START OF SECONDS
01060 LD (SECLOC),A ;GET SECONDS COUNT
01070 LD (MINLOC),A ;STORE SECONDS IN MEMORY
01080 LD (TENSLOC),A ;GET MINUTES VALUE
01090 LD (HRLOC),A ;STORE MINUTES IN MEMORY
01100 CALL GETTIM ;GET HOURS VALUE
01110 LD (DATLOC),A ;STORE HOURS IN MEMORY
01120 CALL GETTIM ;GET DATE VALUE
01130 LD (MONLOC),A ;STORE DATE IN MEMORY
01140 INC HL ;POINT TO MONTH VALUES
01150 CALL GETTIM ;GET MONTH VALUE
01160 LD (MONLOC),A ;STORE MONTH IN MEMORY
01170 LD A,(INT25M) ;CLEAR INTERRUPT
01180 IN7DUN POP HL ;RESTORE HL REGISTER PR
01190 POP BC ;RESTORE BC REGISTER PR
01200 POP AF ;RESTORE AF REGISTER SET
01210 EI ;RE-ENABLE INTERRUPTS
01220 RET ;DONE - RETURN FROM INT
01230 ;
01240 GETTIM LD A,(HL) ;GET LOW-ORDER TIME VALU
01250 AND 0FH ;MASK OF HIGH NYBBLE
01260 LD C,A ;STORE IN C REGISTER
01270 INC HL ;POINT TO NEXT LOC.
01280 LD A,(HL) ;GET HIGH-ORDER TIME VALU
01290 AND 0FH ;MASK OFF HIGH NYBBLE
01300 LD B,A ;STORE IN B REGISTER
01310 INC HL ;POINT TO NEXT LOC.
01320 CALL PROCTN ;GET PROPER TEN VALUE
01330 ADD A,C ;ADD ONES COUNT
01340 RET ;DONE - RETURN
01350 ;
01360 PROCTN OR A ;ZERO VALUE?
01370 RET Z ;IF YES, RETURN
01380 XOR A ;ELSE, CLEAR ACCUMULATOR
01390 ADDI A,10 ;ADD 10 (DEC.) TO ACC.
01400 DJNZ ADDI0 ;LOOP FOR ALL 10'S REQD.
01410 RET ;DONE - RETURN
01420 ;
01430 ;
01440 ;*****
01450 ; RDTIME is the routine to read the time and date
01460 ; values from the 58174 and place them into the proper
01470 ; locations in the time table (TINTBL) below. All
01480 ; values are read from tenths of a second to tens of
01490 ; months. The calling program can then read these
01500 ; values using its PEEK function, then combine the
01510 ; values as desired to create time and date strings.
01520 ;*****
01530 ;
01540 FDCD 21E3FF 01540 RDTIME LD HL,TINTBL ;POINT TO TIME TABLE
01550 FDCD 0E20 01550 LD C,INTHSC-1 ;PNT TO 1ST READ REG - 1
01560 FDCD 060C 01560 LD H,TENSHO-TENTHSC-1
01570 ;
01580 FDCD 0C 01580 RDLOOP INC C ;PUT # OF READ REG'S IN B
01590 FDCD EDA2 01590 INI ;POINT TO NEXT READ REG.
01600 FDCD 20FB 01600 JR NZ,RDLOOP ;PUT REG VALUE IN TABLE
01610 FDCD DB21 01610 IN A,(TNTHSC) ;LOOP UNTIL ALL READ
01620 FDCD 47 01620 LD B,A ;GET TENTHS OF SEC AGAIN
01630 FDCD 3AE3FF 01630 LD A,(TINTBL) ;SAVE TEMP IN B REGISTER
01640 FDCD B8 01640 LD A,(TINTBL) ;GET ORIG TENTHS OF SEC
01650 FDCD 20EB 01650 CP B ;ARE THEY STILL THE SAME?
01660 FDCD C9 01660 JR NZ,RDTIME ;IF NOT, READ VALUES OVER
01670 ; ;ELSE, DONE - RETURN
01680 ;
01690 ;*****
01700 ; Define Tables:
01710 TINTBL DEFS 11 ;TABLE OF TIME READ/WRITE VALUES
01720 ;
01730 ; Define Storage:
01740 VECTR DEFS 2 ;STORAGE OF NORMAL INT SERV VECT
01750 ;
01760 ;
01770 ;
01780 ;
01790 ;
01800 ;
01810 ;
01820 ;
01830 ;
01840 ;
01850 ;
01860 ;
01870 ;
01880 ;
01890 ;
01900 ;
01910 ;
01920 ;
01930 ;
01940 ;
01950 ;
01960 ;
01970 ;
01980 ;
01990 ;
02000 Total errors

```

PROJECT 80

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# Programming the Communications Module— The Heart of the BBS

**Y**ou went to great lengths last month to configure the universal asynchronous receiver/transmitter (UART) from Assembly language and Basic. We must confess. You could've done the same thing more simply with LDOS or TRSDOS commands. But command or no command, you should understand how to communicate directly with the UART. It's particularly important with TRSDOS, because its SETCOM command is a cranky piece of software.

Now you're ready to program the BBS's communications module. You'll also examine device control blocks and learn how the CPU transfers data to and from the UART.

Since you might use these commands in other applications, we'll include them. The SETCOM command for our BBS is:

```
SETCOM(WORD = 7,BAUD = 300,STOP = 1,
PARITY = 2,WAIT)
```

Typing SETCOM without any parameters displays the UART's present state. You might have noticed that SETCOM provides a parameter we haven't discussed: Wait or No Wait. If you specify Wait, calls to the ROM serial routine won't return until the UART receives a character—a splendid infinite loop.

LDOS doesn't have a SETCOM command and it avoids the Wait parameter. Since LDOS is a device-dependent operating system, you configure the UART with the same command you use for any device. The LDOS command for our BBS is:

```
*CL to RS232T/DVR (B=300,W=7,S=1,
P=ON,EVEN)
```

The Model III also has three ROM calls that manipulate the UART: \$RSINT, \$RSRCV, and \$RSTX. You



won't be using them, but if you're interested, the manual explains these calls in detail.

## UART Talk

You'll remember from last month that the UART communicates its status to the CPU through the Z80 ports. The CPU transfers data to and from the UART using the same Z80 ports you used to configure the UART. After doing some handshaking with the CPU, the UART communicates data through port EB hexadecimal (hex).

In the first installment of the BBS Express (May 1984, p. 42), we explained how the UART accepts a byte of information from the CPU, strips the bits off one by one, and sends them to the modem for transmission over the phone lines. On the other end, the UART receives the bits, reassembles them into a byte, and presents the byte to the CPU. All this stripping and reassembling takes time—the UART can't work as fast as the CPU.

To account for this, the UART uses status port EA hex to tell the CPU, "I'm busy." (The function of a port

depends on the direction data travels through it. Sending a byte to port EA hex sets the communications parameters and reading a byte indicates UART status to the CPU.)

Table 1 should help you navigate the bit map of port EA hex. Notice that only bits 3–7 communicate information. Bits 3, 4, and 5 detect errors that the BBS can't use, and bits 6 and 7 constitute the UART's busy signal. A UART is busy if it has no character ready for the CPU to pick up or if the UART hasn't yet sent the last character.

Bit 6 indicates to the CPU that the UART hasn't sent the last character, and bit 7 indicates that data is available. In other words, the CPU must wait until bit 6 is a one to transmit data to the UART, and it must wait until bit 7 is a one to receive data.

Data travels to and from the UART

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# BBS EXPRESS

through port EB hex. If bit 6 in port EA hex is a one, the UART gets its data from port EB hex. If bit 7 in port EA hex is a one, the UART sends its data to port EB hex.

Now that you have some background, you can put it to work, starting with the keyboard.

## Routine ROM

TRS-80s use a ROM routine to check the keyboard for pressed keys. Since your BBS needs to pick up characters from both the keyboard and the communications line, you want the CPU to scan the UART every time it scans the keyboard. With a direct link from the UART to the ROM's keyboard-scanning routine, the routine will pass characters from the UART to the CPU, and if the UART is busy, the CPU will scan the keyboard.

Once you link the ROM routine to the UART, a Basic routine such as INKEYS or Input can pick up characters from the UART as easily as from the keyboard. All you need do is figure a way to get the key scanning routine in ROM to also check the UART.

This could be an unsolvable problem, because the code that scans the keyboard is burned into ROM—you can't change it. Fortunately, you can get around this by changing the device control blocks.

A device control block is a switchboard that tells the ROM routine where to look for the keyboard-scanning code. Since the keyboard-scanning code ends with a return instruction, consider it a machine-language subroutine.

We'll make that clearer. Before the operating system scans the keyboard, it executes some code in ROM that you can't change. That code does some business, then checks the device control block for the address of the code to scan the keyboard.

You need to get into the device control block and make its address point to your routine. To get back to where you started in ROM, you need only end your routine with a return instruction.

The device control block for the keyboard is located at 4015 hex in RAM, and you can change it. Relative byte zero in a device control block contains a code for the type of device it controls (see Table 2). Relative bytes +1 and +2 contain the address of the

routine that handles that device.

The video's device control block, located at 401D hex, is laid out the same way as the keyboard's. Now you need to hitch the video to the communications line, so that material headed for printing on the BBS's screen also goes to the modem.

## Video Echo

Your callers expect an echo to their video screens. Full-duplex communications require that the host (your BBS) echo received characters back to callers as a primitive error-check. Program Listings 1 and 2 are an attempt to solve this problem, and the first real code on this expedition into telecommunications programming. Listing 1 is the TRSDOS version and Listing 2 is the LDOS version.

The action starts in line 700, at label

| Bit | Function                            |
|-----|-------------------------------------|
| 0   | Unused                              |
| 1   | Unused                              |
| 2   | Unused                              |
| 3   | Parity error (1 = true)             |
| 4   | Framing error (1 = true)            |
| 5   | Overrun error (1 = true)            |
| 6   | Transmitter buffer empty (1 = true) |
| 7   | Data received (1 = true)            |

Table 1. Bit map of port EA hex.

| Relative Byte | Contents           |
|---------------|--------------------|
| +0            | DCB type           |
| +1            | LSB driver address |
| +2            | MSB driver address |

Table 2. Relative bytes in a device control block.

Program Listing 1. Linking video, keyboard, and RS-232 in TRSDOS 1.3.

```

00100 ; TITLE <LISTING 1 - TRSDOS>
00110 ; VIDEO, KEYBOARD AND RS232 LINKING
00120 ; TRSDOS 1.3
00130 ;
00140 ;
00150 ;
401D 00160 VBLK EQU 401DH ;VIDEO DCB
4015 00170 KBLK EQU 4015H ;KB DCB
00EB 00180 UDATA EQU 0EBH ;UART DATA PORT
00EA 00190 USTAT EQU 0EAH ;UART STATUS REGISTER
00E8 00200 MSTAT EQU 0E8H ;MODEM STATUS PORT
0033 00210 PRINT EQU 33H ;ROM PRINT ROUTINE
002B 00220 KEYBRD EQU 2BH ;ROM KEYBOARD SCAN
0A9A 00230 BASIC EQU 0A9AH ;PASS TO BASIC
402D 00240 TODOS EQU 402DH ;JUMP TO DOS
00250 ;
00260 ;
00270 ;
00280 ; NEW VIDEO DRIVER PATCH
00290 ;
0000 F5 00300 VIDEO PUSH AF ;SAVE FLAGS
0001 C5 00310 PUSH BC ;SAVE CHARACTER
0002 DBEA 00320 VWAIT IN A,(USTAT) ;CHECK UART FOR CLEAR
0004 E640 00330 AND 0BH ;BIT 6 IS THE ONE
0006 28FA 00340 JR Z,VWAIT ;TRANSMITTER BUSY
0008 79 00350 LD A,C ;GET CHARACTER
0009 D3EB 00360 OUT (UDATA),A ;SEND IT
000B E6FF 00370 PF AND 255 ;LF/CR SWITCH
000D FE0D 00380 CP 0DH ;CAR. RET?
000F 2004 00390 JR NZ,VID010
0011 0E0A 00400 LD C,0AH ;INSERT L.F.
0013 18ED 00410 JR VWAIT ;SEND L.F.
0015 C1 00420 VID010 POP BC ;RECOVER CHARACTER
0016 F1 00430 POP AF ;RECOVER FLAGS
0017 C30000 00440 VCONT JP 0000 ;PATCH POINT
00450 ;
00460 ; NEW KEYBOARD DRIVER PATCH
00470 ;
001A C5 00480 KEYBD PUSH BC ;SAVE FLAGS
001B F5 00490 PUSH AF
001C DBEA 00500 IN A,(USTAT) ;CHECK UART
001E E600 00510 AND 0BH ;CHECK BIT 7 = DATA REC'D
0020 280B 00520 JR Z,KOUT ;NONE READY
0022 DBEB 00530 IN A,(UDATA) ;GET DATA
0024 FE01 00540 CP 1 ;CHECK FOR BREAK
0026 2805 00550 JR Z,KOUT ;AND IGNORE
0028 4F 00560 LD C,A
0029 F1 00570 POP AF ;RECOVER FLAGS
002A 79 00580 LD A,C ;CHAR. TO A
002B C1 00590 POP BC
002C C9 00600 RET
002D F1 00610 KOUT POP AF
002E C1 00620 POP BC
002F C30000 00630 KCONT JP 0000 ;PATCH POINT
00640 ;
00650 ; INSTALLATION OF NEW VIDEO AND KEYBOARD
00660 ; LINKS TO RS-232
00670 ;
00680 ; FIRST, PATCH VIDEO DCB TO NEW ROUTINE

```

Listing 1. continued

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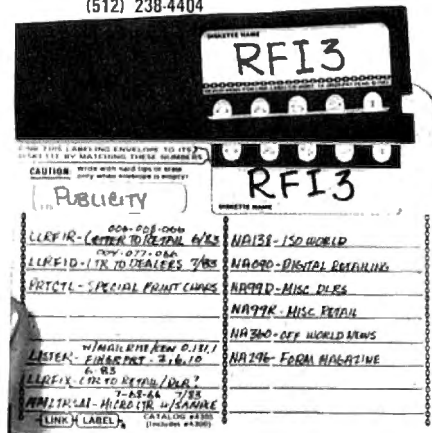
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INSTAL. The DI instruction contained there disables the interrupts to prevent the CPU from scanning the keyboard while you're changing things.

Since you want both your linking routine and the computer's ROM routine to either end with a return instruction or jump to the location the device control block intended before you

started meddling, your routine must save the original address for each device control block. Line 710 picks up the original address from the video device control block, then line 730 stores the address of your video handler in the device control block. Line 740 loads the original address into VCONT+1 and finishes the video patch.

Lines 810-840 do the same for the keyboard. The remainder of the code, lines 890-930, configures the UART. Line 890 executes a master reset, lines 900-910 write a 55 hex (300 baud) to the baud register, and lines 920 and 930 set 7-bit words, even parity, 1 stop bit by writing an A4 hex to port EA hex. Line 940 starts the clock again and jumps the routine back to DOS.

The video and keyboard subroutines are at labels VIDEO (line 300) and KEYBD (line 480). Let's examine the video first, since it's the simpler of the two. When the CPU sends a character to the screen, it gets routed through the video device control block, which sends it to your linking routine. The character is in the C register when the routine gets to the video subroutine, and lines 300-310 save the status of the flags and the character.

The routine waits at V WAIT (line 320) for the UART to get ready to receive another character. IN A,(USTAT) gets the status byte from the UART status register, EA hex. Bit 6 is the Transmitter Empty flag; your routine is looking for a 1 in this position (see Table 1). The video subroutine masks out everything but bit 6 by ANDing the status byte with 40 hex (01000000 binary). If the AND command results in a zero, the routine loops back to V WAIT.

When the UART signals that it's ready to accept a byte, your routine loads the character from the C register to the A register and writes it to port EB hex. The UART sends the character out through port EB hex.

Some of the BBS's callers will be using a terminal program that requires a carriage return and a line feed, and some won't. You must offer line-feed after carriage-return as an option for the BBS.

The Basic program we've written to accompany this month's machine-language programs has a way to turn this option on or off. Basic can POKE a zero into PF+1 to turn off line feed

*Listing 1 continued*

```

0032 F3 00700 INSTAL DI ;A LITTLE PRIVACY, PLEASE
0033 ED5B1E40 00710 LD DE,(VBLK+1) ;GET EXISTING ADDRESS
0037 210000 00720 LD HL,VIDEO ;NEW ADDRESS
003A 221E40 00730 LD (VBLK+1),HL ;PUT NEW ADDRESS IN DCB
003D ED531800 00740 LD (VCONT+1),DE ;PUT OLD ADDRESS IN VIDEO
0041 00 00750 NOP ;TRSDOS ONLY
0042 00 00760 NOP ;DELETE FOR LDOS
00770 ;
00780 ; THEN, PATCH KEYBOARD DCB
00790 ; TRSDOS 1.3 ONLY
00800 ;
0043 ED5B1640 00810 LD DF,(KBLK+1) ;GET OLD ADDRESS
0047 211A00 00820 LD HL,KEYBD ;NEW ADDRESS
004A 221E40 00830 LD (KBLK+1),HL ;INSTALL NEW ADDRESS
004D ED533000 00840 LD (KCONT+1),DE ;OLD ONE TO OUR ROUTINE
00850 ;
00860 ; FINALLY, CONFIGURE UART FOR 300/7/E/1
00870 ; TRSDOS 1.3 ONLY
00880 ;
0051 D3E8 00890 OUT (0E8H),A ;MASTER RESET
0053 3E55 00900 LD A,55H ;SET 300 BAUD SEND/RECV
0055 D3E9 00910 OUT (0E9H),A
0057 3EA4 00920 LD A,0A4H ;7/E/1
0059 D3EA 00930 OUT (0EAH),A ;SET IT
005B FB 00940 IN010 EI
005C C32D40 00950 JP TODOS
0032 00960 END INSTAL
00000 Total Errors
    
```

End

*Program Listing 2. Linking video, keyboard, and RS-232 in LDOS 5.1.3.*

```

00100 ; TITLE <LISTING 2 - LDOS>
00110 ; VIDEO, KEYBOARD AND RS232 LINKING
00120 ; LDOS 5.1.3
00130 ;
00140 ;
00150 ;
401D 00160 VBLK EQU 401DH ;VIDEO DCB
4015 00170 KBLK EQU 4015H ;KB DCB
00EB 00180 UDATA EQU 0EBH ;UART DATA PORT
00EA 00190 USTAT EQU 0EAH ;UART STATUS REGISTER
00E8 00200 HSTAT EQU 0E8H ;MODEM STATUS PORT
0033 00210 PRINT EQU 33H ;ROM PRINT ROUTINE
002B 00220 KEYBRD EQU 2BH ;ROM KEYBOARD SCAN
0A9A 00230 BASIC EQU 0A9AH ;PASS TO BASIC
402D 00240 TODOS EQU 402DH ;JUMP TO DOS
00250 ;
00260 ;
00270 ;
00280 ; NEW VIDEO DRIVER PATCH
00290 ;
0000 F5 00300 VIDEO PUSH AF ;SAVE FLAGS
0001 C5 00310 PUSH BC ;SAVE CHARACTER
0002 DBEA 00320 VWAIT IN A,(USTAT) ;CHECK UART FOR CLEAR
0004 E640 00330 AND 40H ;BIT 6 IS THE ONE
0006 28FA 00340 JR Z,VWAIT ;TRANSMITTER BUSY
0008 79 00350 LD A,C ;GET CHARACTER
0009 D3EB 00360 OUT (UDATA),A ;SEND IT
000B E6FF 00370 PF AND 255 ;LF/CR SWITCH
000D FE0D 00380 CP 0DH ;CAR. RET?
000F 2804 00390 JR NZ,VID010
0011 0E0A 00400 LD C,0AH ;INSERT L.F.
0013 18ED 00410 JR VWAIT ;SEND L.F.
0015 C1 00420 VID010 POP BC ;RECOVER CHARACTER
0016 F1 00430 POP AF ;RECOVER FLAGS
0017 C30000 00440 VCONT JP 0000 ;PATCH POINT
00450 ;
00640 ;
00650 ; INSTALLATION OF NEW VIDEO AND KEYBOARD
00660 ; LINKS TO RS-232
00670 ;
00680 ; FIRST, PATCH VIDEO DCB TO NEW ROUTINE
00690 ;
001A F3 00700 INSTAL DI ;A LITTLE PRIVACY, PLEASE
001B ED5B1E40 00710 LD DE,(VBLK+1) ;GET EXISTING ADDRESS
001F 210000 00720 LD HL,VIDEO ;NEW ADDRESS
0022 221E40 00730 LD (VBLK+1),HL ;PUT NEW ADDRESS IN DCB
0025 ED531800 00740 LD (VCONT+1),DE ;PUT OLD ADDRESS IN VIDEO
0029 FB 00940 IN010 EI
002A C32D40 00950 JP TODOS
001A 00960 END INSTAL
00000 Total Errors
    
```

End

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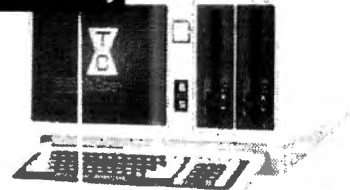
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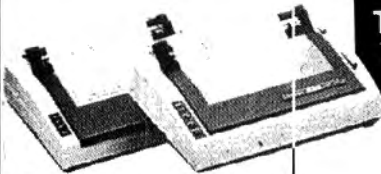
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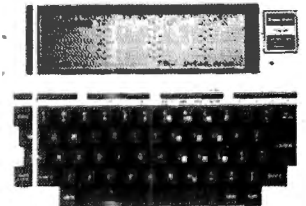


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# BBS EXPRESS

after carriage return, or a 255 to turn it on, depending on what the caller needs.

Consider how that works. ANDing the contents of the A register with 255 (11111111 in binary) doesn't affect it. If the character in the A register were a carriage return (0D hex) before the AND, it still will be. Then line 390 picks up the character, changes it to a line feed (0A hex), and jumps back to V Wait to send a line feed.

If Basic jams a zero into PF+1, the routine ANDs with zero (00000000 binary) to produce a result of zero. When line 390 detects a zero, it doesn't jump back to V Wait. Instead, lines 420 and 430 pick the character and the flags back from the stack, and line 440 jumps back to where the device control block intended for printing to the screen.

The keyboard patch is more complicated. When the computer arrives at your routine, the CPU hasn't scanned the keyboard yet. If the CPU gets a character from the UART and jumps to the routine originally contained in the device control block, the CPU

scans the keyboard and loses the character received from the UART. Your keyboard patch needs two exits: 1 for the UART when it's holding characters and another for when it isn't.

According to Fig. 1, bit 7 of the UART status byte indicates whether or not a character is ready for the UART to pick up from port EB hex. Lines 480 and 490 save the flags and the BC register, then line 500 reads in the status byte and checks bit 7 by ANDing with 80 hex (10000000 binary).

If bit 7 is a zero, the routine jumps to KOUT and POPs AF and BC off the stack and jumps to the keyboard scanner. If bit 7 is a one, the UART contains a character that the routine picks up from port EB hex and puts in the C register.

Line 570 POPs the flags and line 580 moves the recovered character into the A register. After setting the stack with a POP BC, the routine returns to the operating system—just as if the CPU had scanned the keyboard.

If TRSDOS users press the break key and send a CHR\$(1) character,

they'll hang up the program. To account for this, line 540 of Listing 1 (the TRSDOS version) checks for a 1 and ignores it. LDOS avoids this problem by screening out the break key.

LDOS and TRSDOS are dissimilar operating systems. As you saw last month, LDOS lets you link devices but TRSDOS doesn't. Under LDOS, you can simply link the keyboard and the video to the communications line by typing:

```
LINK *KI *CL
LINK *DO *CL
```

But this link won't accept a line feed after carriage return. You should link the video device to the communications line just as you did with TRSDOS, skipping the keyboard link. And using LDOS's Link command lets you take advantage of its type-ahead function.

The tracks are laid. Next month, you'll start building the BBS Express's engine. ■

Contact J. Stewart Schneider and Charles E. Bowen at P.O. Box 404, Catlettsburg, KY 41129.

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by Eric Bailey

Model 100

An 8K Basic program that lets you create a bar graph on the screen.

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Keeps seasonal statistics for a basketball team.

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Card trick.

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Math trick.

## **Coin Log (COIN/BAS)**

by Mike Carter

Model I/III

Handles coin collecting and investing records.

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Model I/III

Draws familiar constellations on the screen.

## **Cribbage (CRIB/BAS)**

by Robert Barker

Model I/III

Play cribbage with your computer.

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Model I/III

Real-time arcade game.

## **Dungeon of Death**

(DUNGEON/BAS)

by Mike Erickson

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Adventure game.

## **Flight Simulator (FLIGHT/BAS)**

by Tyler Kim

Model I/III

747 flight simulator.

## **Foreign Dictionary (FORDIC/BAS)**

by H. Steele Holley

Model I/III

Create your own foreign language dictionary.

## **Key Art (KEYART/BAS)**

by Raul Acevedo

Model I

Creates graphics on the screen and generates a program to draw the graphics.

## **Laser Destruct (LASER/BAS)**

by Mark Hall

Model I/III

Real-time graphics game.

## **Lunscope (LUNA/BAS)**

by Charles Gillen

Model I/III

Fortune-telling according to the oriental lunar calendar.

## **Mad Libs (MADLIB/BAS)**

by Frank Conley

Model I/III

Mad libs generator.

## **Magic Trick (MAGIC/BAS)**

by Gene Palmer

Model I/III

Cup and ball classic magic trick.

## **Manned Space Flight**

(SPACEMAN/BAS)

by Arnold van Beverhoudt

Model I/III

A manned space flight directory.

## **Matchmaker (MATCH/BAS)**

by Kim Skidmore

Model III

Electronic romance.

## **Music Printer (MUSIC/BAS)**

by Vincent Iverson

Model I/III

Creates sheet music on an Epson MX-80 with Grafrax.

## **New Home Analysis (HOME/BAS)**

by Cliff De Jong

Model I/III

Analyzes investment potential in buying a new home.

## **Solar System (SOLAR/BAS)**

by Arnold van Beverhoudt

Model I/III

Solar system data base.

## **Star Trek (STREK/BAS)**

by Arnold van Beverhoudt

Model I/III

Star Trek game.

## **Straight Line Graphics**

(GRAPHICS/BAS)

by Richard Melka

Model I/III

Collection of screen graphics routines.

## **Towers of Hanoi (TOWERS/BAS)**

by Jose Babilonia

Model I/III

Graphics demonstration/game.

# Putting Pascal Through Its Loops

Now that you can write and compile simple Pascal programs, you're ready to take on If statements, compound statements, and loops. I'll also introduce you to two of Alcor Pascal's graphics procedures that I'll use next month to create some interesting applications when we write our own procedures and functions.

Having learned Pascal's program structure, the assignment statement, and how to declare variables, you can write simple programs and compile them by entering the DOS command:

```
PASCAL ProgramName
```

For example, to compile the Circle program (see Program Listing 1), type PASCAL CIRCLE and press the enter key. Assuming that you typed in the program without mistakes, the compiler reports a no-error message.

To run the program, type in RUN CIRCLE and press the enter key. The program prompts you for input and output. For now, just press the enter key in response to these prompts to execute the program.

## Conditional Statements

In Basic, an If statement switches a program between two actions, based on a value. Pascal's If statement is similar. In Pascal, the value the If statement uses to make the choice must always be a Boolean variable. It can be a Boolean variable such as:

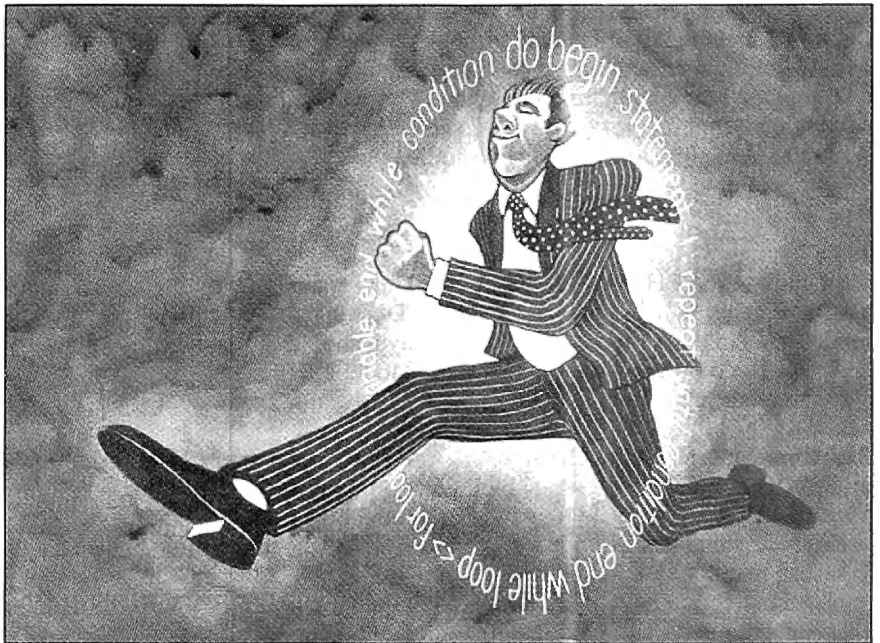
```
IF doneWorking THEN ...
```

or the result of a comparison of arithmetic values, such as:

```
IF (age < 55) THEN ...
```

The parentheses are optional here; they make the statement more readable.

Pascal's If statement also has an Else clause, and it works just like Basic's. Here's an example:



```
IF (weight < 200) THEN writeln ("Good!")
ELSE writeln("Have you considered a diet?");
```

Notice that the first WRITELN statement doesn't end in a semicolon. This is because the Else keyword really comes in the middle of the If statement. Since semicolons terminate statements, the If statement is over when it finds a semicolon and the Else clause produces an error. In general, as long as you don't put a semicolon on the statement preceding an Else clause you'll be OK.

Figure 1a shows the structure of an If statement. When you use an Else clause, don't precede it with a semicolon (i.e., don't end the If line with a semicolon), but you should use a semicolon—following the statement after the Then keyword—when you don't include an Else clause.

Pascal has a set of logical operators for more complicated tests. These are And, Or, and Not, and you use them much the same as you would in Basic. Suppose you want to add 10 points to a student's test score if he gets more

than 75 percent on his homework assignment and spells his name right. The command would look like this:

```
IF (homeWorkScore > 75) AND nameSpelled-
Correctly
THEN score := score + 10;
```

The And operator returns a value of True if *both* arguments are true. The example above adds 10 to the variable score if both the value of the variable homeWorkScore is greater than 75 and the Boolean variable nameSpelledCorrectly is true. If either or none of these conditions exist, the program doesn't execute the statement following the Then keyword.

The Or operator returns a value of True when *either* or *both* statements are true. Suppose, in the above example, that you want to add 10 points when either homeWorkScore is greater than 75 or when the student spells his name correctly. To do this, just replace And with Or in the statement.

The Not operator returns the opposite of its argument. For example, NOT TRUE returns a FALSE and





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NOT FALSE returns a TRUE. Suppose you want to print out a message to the student if he spells his name wrong. It would look like this:

```
IFNOT(nameSpelledCorrectly)
  THENwriteln('Have you misspelled your
  name?');
```

If the value of nameSpelledCorrectly is true, then the program skips the statement after the Then keyword. If it is false, then NOT FALSE returns a TRUE and the program prints the message to the student.

### Compound Statements

A statement in Pascal is very similar to a Basic statement. It contains commands, maybe some data, and performs some action. The two differ in that Basic contains only simple statements—each statement only does one thing. For example, the Basic statement OPEN "I",1,F\$ does only one thing—it opens a file for input.

In addition to simple statements, Pascal includes the compound statement. A compound statement is made up of more than one simple statement. In Pascal, you indicate the beginning of a compound statement with a Be-

## *A statement in Pascal is very similar to a Basic statement.*

gin keyword, and terminate it with an End keyword. You can use a compound statement anywhere you would use a simple statement (looping statements, conditional [If] statements, and so on). This feature alone makes Pascal a nice programming language.

Consider the compound If...Then...Else statement in Program Listing 2. The Begin/End keywords show which simple statements will execute if the variable overWeight is False (Not True). Again, notice the lack of a semicolon on the clause preceding the Else keyword.

You'll find the compound statement useful in conditional statements, loops, and many other places. In Basic, for example, you can put several statements after a Then keyword, but they must all be on the same line. This limits the number of statements you can have following a single If statement. In Pascal, there's no such restriction. The Begin and End key-

words tell Pascal where the compound statement starts and ends.

### Pascal Loops: For, Repeat, and While

In Basic you can use only one kind of loop—the For...Next loop. In Pascal, however, you have access to three different looping functions—For, Repeat, and While. Let me show you how these make programming easier in a variety of cases.

#### The For Loop

Pascal's For loop is similar to Basic's with one important restriction: its looping variable must be an integer variable. A Basic loop such as:

```
100 FOR I = 1 TO 10
110 SM = SM + A(I)
120 NEXT I
```

is written like this in Pascal:

```
FOR I := 1 TO 10 DO
  SM := SM + A[I];
```

Figures 1b and 1c show the proper syntax for Pascal's For statement. In Basic, the For loop marks the end of the loop with the Next keyword. This isn't necessary in Pascal because the For loop always executes only one

*Program Listing 1. Drawing a circle with Pascal.*

```
program circle;
const
  pi = 3.14159265;
VAR
  angle,scale,step : real;
  radius, centerX, centerY: integer;
procedure clearGraphics; external;
procedure setPoint(x,y: integer); external;
begin
  centerX := 63; centerY := 23; {center of screen}
  scale := 128/48; {adjusts for non-square blocks}
  repeat
    write('Enter the radius of the circle (1-20): ');
    readln(radius);
  until (radius>0) and (radius<= 20);
  clearGraphics;
  angle := 0;
  step := 1/(2*pi*radius);
  while angle <= 2*pi do
    begin
      setPoint(centerX + scale*radius*cos(angle),
        centerY + radius*sin(angle));
      angle := angle + step;
    end;
end
```

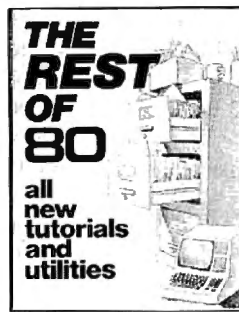
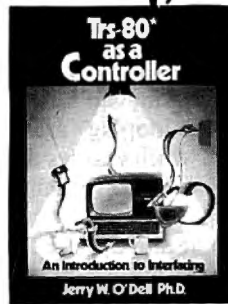
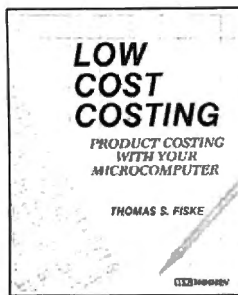
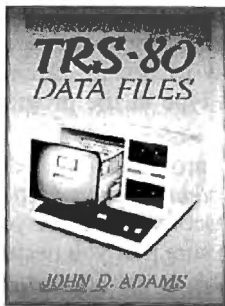
*Program Listing 2. A compound If...Then...Else statement.*

```
IF not overWeight THEN
  BEGIN
    writeln('Eat three meals a day. ');
    writeln('You may eat dessert if you wish. ');
    write('You may even drink beer');
    writeln(' and eat popcorn. ');
  END
ELSE
  BEGIN
    writeln('You must diet to lose weight. ');
    writeln('Eat nothing but broccoli for a month. ');
  END;
```

*Program Listing 3. Program that steps down.*

```
program countDown;
var
  i: integer;
begin
  for i := 10 downTo 1 do
    write(i:3);
end
```

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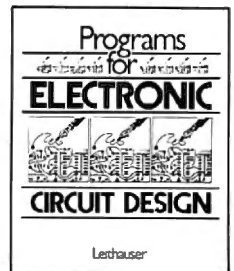
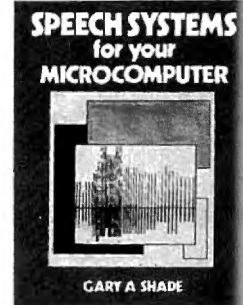
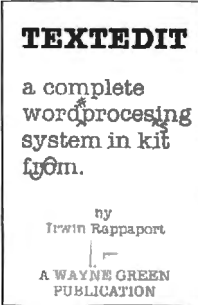
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statement. However, this one statement can be a simple or a compound statement. If it's a compound statement, then you indicate that with a Begin and End pair. For example:

```
FOR i := 1 to 10 DO
  BEGIN
    write('Enter a number:');
    readln(number);
    writeln('Its square root is',sqrt(number));
  END;
```

The step size in the For loop is always one. The looping variable must be declared as an integer type. You can reference this looping variable; you can't change its value within the loop by an assignment statement.

You might think this weak of Pascal, since Basic's For loop allows floating point looping variables and user-defined step sizes. But remember Basic only has one looping statement. Pascal, on the other hand, uses the For loop only for enumerated loops (those that loop for a specified number of times) and has other looping statements for non-enumerated loops (loops that execute while a condition is met or until a condition is met).

You can't execute true enumerated loops with Basic's For loop if you use floating point variables. This is due to round-off errors in the numbers repre-

sentation. If a loop is going from 0.00000 to 1.0000 with a step of 0.1000, the tenth step may give the looping variable the value .999999 rather than 1.00000. In this case, the loop executes one more time, although it shouldn't. This can't happen in Pascal, since the looping variable must be an integer, which ensures the loop executes for an exact number of iterations.

To step negatively, use the DOWNTO keyword instead of the To keyword. This means that the looping variable decrements rather than increments after each step or loop. Program Listing 3, when run, displays the numbers from 10 down to 1.

Another difference between Basic's and Pascal's For loop is that Basic always executes the body of the For loop once, even if the condition for the loop isn't met. Pascal, on the other hand, tests the condition before it does the loop. If the condition isn't met, the body of the loop isn't executed. For example, the following loop:

```
begin
  for i := 10 to 1 do
    write(i:3);
  end
```

doesn't execute since the test fails immediately—10 is already greater than 1.

Program Listing 4 draws a horizontal line between two points on the screen using a For loop. The program uses external procedures provided by Alcor for graphics. For now, don't worry about how to declare external procedures. Just type in the program as it appears.

The graphics procedures are discussed in the *System Implementation Manual* of the Alcor manual for you eager beavers. Be sure that you declare the looping variable in the For loop as an integer (as in Listing 4).

## The While Loop

The For statement is good when you can enumerate the number of times you want the statement repeated. Drawing a line is a good example of using the For statement. However, many times you want to execute a loop until some condition changes. You can force the For loop to handle some of these situations, but the code is clumsy at best. The While loop is a better way to handle such a condition.

Suppose you want to print the powers of two until they are greater than 517. It would be difficult to achieve with a For loop since you don't know how many times to loop. Program Listing 5 uses the While loop to print the powers of two.

- a) IF <Boolean expression> THEN <statement> ELSE <statement>;
- b) FOR <integer variable> := <value> to <value> DO <statement>;
- c) FOR <integer variable> := <value>downTo <value> DO <statement>;
- d) WHILE <Boolean value> DO <statement>;
- e) REPEAT <statement>;  
...  
<statement>;  
UNTIL <Boolean value>;

Note: The clipscs indicate that you can insert an indefinite amount of simple statements in the Repeat loop.

Figure 1. General syntax for Pascal statements.

Program Listing 4. Drawing a line using Pascal's For loop.

```
program Drawline;
var
  y,x1,x2,deltaX : integer;
  {declare Alcor Pascal external procedures}
procedure setPoint(x,y: integer); external;
procedure clearGraphics; external;
begin
  writeln('Draw Horizontal Line');
  writeln('Draws a horizontal line between two points. ');
  write('Enter the first x coordinate (0-127): ');
  readln(x1);
  write('Enter the second x coordinatc (0-127): ');
  readln(x2);
  write('Enter the y coordinate (0-47): ');
  readln(y);
  clearGraphics; {clear the screen}
  IF (x2<x1) THEN {step down, not up}
    FOR deltaX := x1 downto x2 do
      setPoint(deltaX,y) {notice no semicolon}
    ELSE {step up}
      FOR deltaX := x1 to x2 do
        setPoint(deltaX,y);
  END
```

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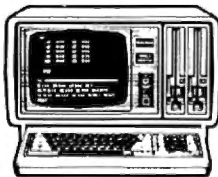
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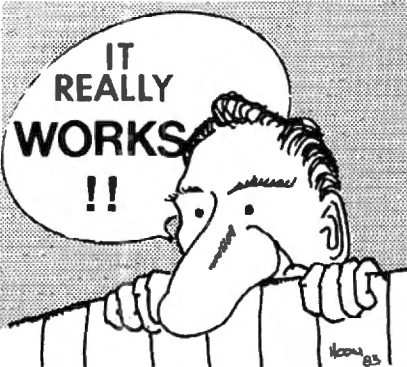
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Here's how the While loop works. First, Pascal makes the loop test before the loop begins. If the test fails, then the program continues with the first statement following the While statement. In the case of Listing 5, when the loop test fails, the program displays the message "Done."

If the loop tested is successful, then the body of the While loop executes. This can be a single or a compound statement (as in Listing 5). After the body of the loop executes, Pascal again makes the While test. This repeats until the test fails.

The While loop is handy when you're uncertain as to how many times you want to loop, particularly if you don't know whether to loop even once. Reading from files is a good example—you might want to loop while NOT EOF (end of file), but you may already be at the end of the file. Figure 1d shows the syntax for the While loop.

## The Repeat Loop

The Repeat loop is similar to the While loop in that you use it when you don't know how many loops to make. It differs from the While loop in a number of ways.

The Repeat keyword is always followed immediately by the loop body and then by the Until keyword. With the Until keyword comes the testing condition (since the test comes at the end of the loop, it always executes at least once). Furthermore, the loop repeats until the testing condition is true rather than false. With a little restructuring, you can make the Repeat and While loops serve the same purpose. Program Listing 6 does the same task

as Listing 5, but with the Repeat statement.

You'll notice that the Repeat statement doesn't use the Begin and End keywords for its compound statement. This is because the Until keyword tells the program where the loop body stops. The semicolon for the Repeat statement follows the conditional expression in the Until clause (see Listing 6). Each complete simple statement within the Repeat loop must also have its own semicolon, just as with other compound statements. See Figure 1e for the Repeat loop's general syntax.

You can implement the Repeat statement for useful applications such as the simple error correction demonstrated in Program Listing 7. This program segment prompts you for your name, then prints out the name and asks you if it's correct. If you enter anything besides a y or Y, the loop body executes again, letting you enter your name again. The only way out of the loop is to enter y or Y in response to the checking question.

The first program (Program Listing 1) draws a circle on the screen using the SetPoint procedure mentioned previously. It uses most of what you've learned so far. The fundamental formulas used by the program calculate the X and Y coordinates of the circle as  $X := \text{radius} * \text{COS}(\text{angle})$  and  $Y := \text{radius} * \text{SIN}(\text{angle})$ . This moves over so that the center of the screen (the point where  $X=63$  and  $Y=24$ ) is the center of the circle. The formulas for the points on the circle now become  $X := \text{centerX} + \text{radius} * \text{COS}(\text{angle})$  and  $Y := \text{centerY} + \text{radius} * \text{SIN}(\text{angle})$ , where centerX is 63 and centerY is 24.

This works all right, except for the fact that the TRS-80 display screen isn't square. The steps in the X direction (horizontal) are smaller than the steps in the Y direction (vertical). To adjust the X coordinates so that the circle comes out approximately circular, multiply the X coordinate by the ratio of the length of the directions (i.e., 126 horizontally and 48 vertical-

*Program Listing 5. Printing the powers of 2 using Pascal's While loop.*

```

program FindPowerOf2;
var
  bigNumber, exponent: integer;
begin
  bigNumber := 1;
  exponent := 0;
  while (bigNumber < 517) DO
    begin
      writeln('number = ', bigNumber:1, 'exponent = ', exponent:1);
      bigNumber := bigNumber * 2;
      exponent := exponent + 1;
    end; {end of WHILE loop}
  writeln('Done');
end; {end of program}

```

*Program Listing 6. Finding powers of 2 with the Repeat statement.*

```

program findPowerOf2;
var
  bigNumber, exponent: integer;
begin
  bigNumber := 1;
  exponent := 0;
  REPEAT
    writeln('number = ', bigNumber:1, 'exponent = ', exponent:1);
    bigNumber := bigNumber * 2;
    exponent := exponent + 1;
  UNTIL (bigNumber >= 517);
  writeln('Done');
end; {end of program}

```

*Program Listing 7. Error correction using the Repeat statement.*

```

VAR
  name: string;
  answer: char;
  ...
REPEAT
  write('Enter your first name: ');
  readln(name);
  WRITE('Is your first name ', name, ' (y/n)');
  readln(answer);
UNTIL (answer = 'y') OR (answer = 'Y');
...

```

# PASCALCULATIONS

ly). This makes the final formulas for a point on the circumference of a circle to be  $X := \text{centerX} + \text{scale} * \text{radius} * \text{COS}(\text{angle})$  and  $Y := \text{centerY} + \text{radius} * \text{SIN}(\text{angle})$ .

The program proceeds as follows: first, it prompts you for the radius of the circle—an integer value. If you enter a value larger than 20 or smaller than 1, it prompts you again. The Repeat loop repeats until you enter a value that falls into the range from 1-10. Then the program calculates the step size. It draws the circle by setting a point and incrementing the angle. It determines the coordinates of the point on the circle at that angle and sets that point, and so on until it draws the full circle (until the angle reaches  $2\pi$ ).

The step size is  $1/(2 * \text{radius})$ . This value leaves some gaps in the circle, but they're not too bad. You can use a smaller step if you like, but this decreases the speed of the draw. Conversely, a larger step value will draw the circle quicker but leave more gaps.

*In standard Pascal,  
you have to use  
Round or TRUNC  
functions to turn  
the real values into  
the nearest integer value.  
Alcor Pascal does  
this automatically.*

Listing 1 uses implicit number conversion. That is, it calculates the values of the coordinates as Reals, but the SetPoint procedure requires integers. In standard Pascal, you would have to use Round or TRUNC functions to explicitly turn the real values into the nearest (or next least) integer value. Alcor Pascal does this automatically. The reason that standard Pascal is so strongly typed (no conversions are done explicitly) is that the program assumes you're probably wrong most of

the time. Alcor Pascal assumes that you're probably right when you want to convert numbers between integer and real format.

Using the formula for a spiral (Radius := angle \* constant), try to write a Pascal program that draws spirals instead of circles. Try a value of  $1/3$  for the constant and see what happens. Be sure to avoid trying to set points off the screen (such as with x coordinates less than zero or greater than 127).

Next month I'll cover one of Pascal's greatest advantages over Basic—the ability for true modular programming. You'll learn how to define and use your own functions and procedures.

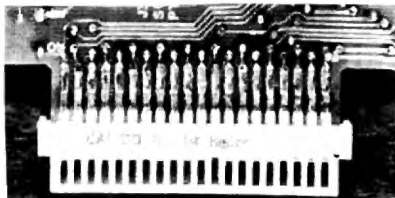
```
program signOff;
begin
  repeat
    writeln('Happy Pascaling');
  until nextMonth;
end. ■
```

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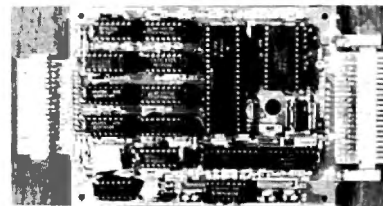


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I've received a steady stream of mail asking me how to do things on the Model 4 that are simple on the Model III. Interestingly, some writers have adopted a belligerent attitude toward Radio Shack because the Model 4's internal architecture differs from the Model III's.

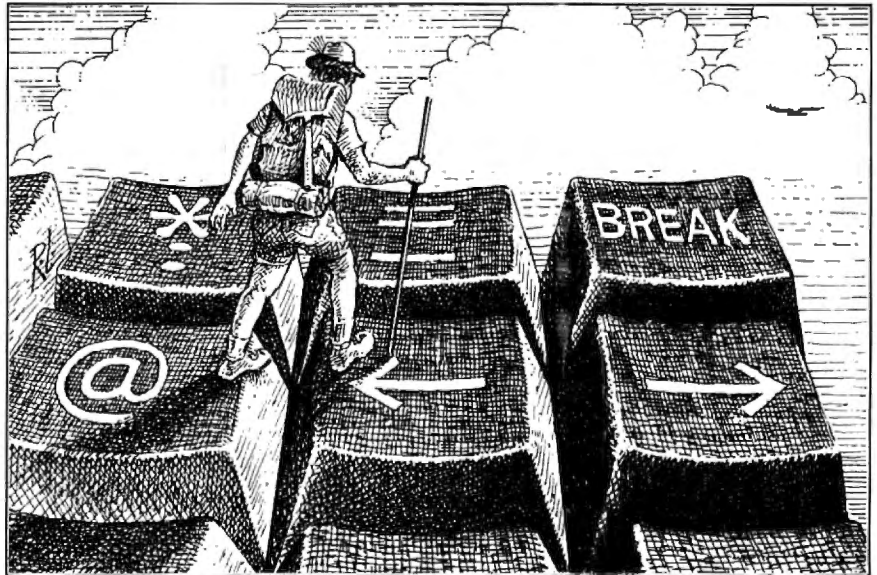
I think a Model 4/4P, running in Model 4 mode with either TRSDOS or DOSPLUS, is vastly superior to the Model III. The problem is changing your programming habits to match the 4's capabilities.

The Model I/III is ROM-based with fixed locations for the video memory, keyboard matrix, ROM routines, and the major data control blocks (DCBs). Many of us learned programming tricks and techniques based on the static locations inside the computer.

For example, you could change the cursor character on the Model III by merely POKing a new value into location 16419 (4023 hexadecimal [hex]). The cursor character was always at that location, regardless of what DOS you were using, because that was where the ROM routines looked for it.

You could also read characters directly from video memory, because the Model I/III's internal architecture dictated that the ROM would always address the video at locations 15360-16383 (3C00 hex to 3FFF hex). The machines were wired that way; you can't move the video addresses.

When you switch from the Model I/III to the Model 4/4P, you need to change your thinking and your programming habits. In the Model III mode (or with the Model III ROM image loaded into a 4P), the Model 4 is almost identical to a Model III, with only a few differences in the "C" ROM (for example, one change accommodates the new keyboard). Video memory, the DCBs, the keyboard matrix, and so on, are all in their familiar locations.



However, in the Model 4 mode, you may feel lost. No matter how carefully you search through memory, you won't find video memory or the keyboard matrix. And no matter what documentation you look at, you won't find the familiar list indicating locations for things like cursor address and characters. Because the Model 4 is entirely RAM-based, such items don't have fixed locations; you can't PEEK or POKE their locations as you can with the Model I/III.

## Supervisor Calls

Assembly-language programmers must learn to use the supervisor calls (SVCs) in the Model 4 mode to interact with the computer. An SVC asks the operating system to perform an operation for you. The SVCs have the same functions in all versions of TRSDOS 6.X, so your program will be compatible with all versions of that DOS. Also, most SVCs work identically with TRSDOS 6.X and DOSPLUS 4.X, the two operating systems currently available for the Model 4.

To invoke an SVC from a machine-

language program, you need to load the A register with the SVC number, perhaps set some other registers depending on which SVC you're using, and then execute an RST 28H. The *Model 4 Technical Manual* contains a complete list of TRSDOS 6.X SVCs, as does *A Programmer's Guide to LDOS/TRSDOS Version 6* by Roy Soltoff (Misosys, P.O. Box 4848, Alexandria, VA 22303).

## Video Control SVC

Since most people who write me about the Model 4 are concerned with video control, I'll focus on SVC 15 (0F hex), @VDCTL, which handles eight video functions (see the Figure). Only function 3, Reposition Cursor, changes the cursor position; many of the other functions print on the screen, but they don't move the cursor.

As you can see from the Figure, the value in the B register selects @VDCTL's eight functions when you invoke the SVC. Each function also uses the HL register to pass either absolute addresses or screen positions in a special row/column format. When

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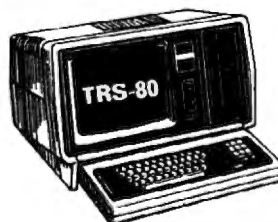
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## THE NEXT STEP

|                              |                                                                                                                                                                                                                                                                  |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Get Character from Screen    | <p>Entry: B = 1; get characters from HL position<br/>H = screen row (0-23)<br/>L = screen column (0-79)</p> <p>Exit: A = character at screen position<br/>Z flag = no error<br/>(If NZ, A contains error code)<br/>Changes AF, BC, DE</p>                        |
| Display Character on Screen  | <p>Entry: B = 2; put character at HL position<br/>C = display character<br/>HL = position (as above)</p> <p>Exit: Z flag = no error<br/>(does not change cursor position)<br/>Changes AF, BC, DE</p>                                                             |
| Reposition Cursor            | <p>Entry: B = 3; set cursor to HL position<br/>HL = screen position (as above)</p> <p>Exit: Z flag = no error<br/>Changes AF, BC, DE</p>                                                                                                                         |
| Find Cursor Position         | <p>Entry: B = 4; load cursor position into HL</p> <p>Exit: H = screen row of cursor (0-23)<br/>L = screen column of cursor (0-79)<br/>Changes AF, BC, DE</p>                                                                                                     |
| Move Buffer to Video         | <p>Entry: B = 5; move 2K block of RAM to video<br/>HL = address of buffer to move<br/>(entire buffer must be below 0F400 hex)</p> <p>Exit: HL = address of 1st byte past buffer<br/>Changes AF, BC, DE, HL</p>                                                   |
| Copy Video to Buffer         | <p>Entry: B = 6; move video to 2K memory buffer<br/>HL = address of buffer<br/>(entire buffer must be below 0F400 hex)</p> <p>Exit: Image of video contents in buffer<br/>(reverse-video characters will have bit 7 set)<br/>Changes AF, BC, DE, HL</p>          |
| Scroll Protect Video Display | <p>Entry: B = 7; protect top of video display<br/>C = number of lines to protect (0-7)</p> <p>Exit: Lines are protected<br/>(Note: pressing shift/clear will still clear entire screen, but scroll protection will remain in effect.)<br/>Changes AF, BC, DE</p> |
| Set Cursor Character         | <p>Entry: B = 8; change the cursor character<br/>C = ASCII code for new cursor</p> <p>Exit: A = previous cursor character<br/>Changes AF, BC, DE</p>                                                                                                             |

*Figure. @VDCTL SVC functions for TRSDOS 6.X. This supervisor call handles eight video control functions depending on the value in the B register. To execute it, load register A with 15 (0FH) and type in RST 28H.*

you use HL to specify a screen position, the H register contains the screen row (0-23) and the L register holds the column number (0-79). This row/column addressing should simplify machine-language programs that need to refer to specific video locations, just as Model 4 Basic's new PRINT@ command simplifies graphics and

screen management.

Program Listing 1 is the source code of a USR routine that calls most of the @VDCTL functions from a Basic program. The source code loads the A register with 0FH, @VDCTL's SVC number, but doesn't load any specific values into the other registers; it leaves that task to Basic. Program Listing 2

demonstrates how Basic manipulates five of the video functions.

Lines 130-140 of Listing 2 dimension the program variables to ensure that they all have a place in the variables table, and that CODE%( ) won't move while the program runs.

In previous columns, I've described how to use integer arrays to store machine-language USR routines. The technique is ideal for short, relocatable programs, but you must be sure that the array holding the routine doesn't move between the DEF USR statement and the X = USR ( ) command. The only thing that moves the array is using a new, simple (non-array) variable. If you define all variables at the beginning of a program, either with explicit values or with a DIM statement, Basic doesn't have to shift arrays around in memory to make room for new variables in the simple variables table.

The second section of the program (lines 160-230) loads the machine-language routine into the array CODE%( ). The eight values in the data table are the integer-array equivalent to Listing 1. Listing 1 sets the values of B, C, and HL equal to zero.

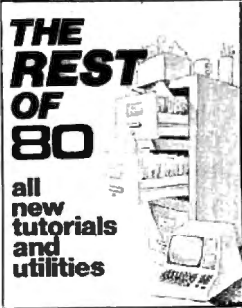
The last section of Listing 2 (prior to the demonstration) sets each element of VIDEO%( ) array to 0C2F0 hex. Functions 5 and 6 of @VDCTL, which move the screen to memory or vice versa, require a 2K buffer in RAM. Instead of using a buffer in high memory, the demonstration program uses 1,000 elements of an integer array as a screen buffer, avoiding the extra work needed to set up and maintain a buffer in a dedicated portion of high memory. You can find any byte in the array by adding the screen location (0-1919) to VARPTR(VIDEO%( 0)), the address of the first byte of the first element of the screen buffer.

### The Demonstrations

The first demonstration in Listing 2 (lines 310-400) shows how you can use @VDCTL to "POKE" characters to given screen locations. Lines 320 and 330 load the B register with the function number, 2, and the C register with the ASCII value of the character to be "POKEd" on the screen. Then the loop selects successive screen positions (every other row, every other column), joins the row and column values into a

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## THE NEXT STEP

Program Listing 1. Source code for @VDCTL demonstration.



```

00010 ;Source code for @VDCTL demonstration.
00020 ;
00030 ;
00040 ;NOPs added to align code with the
00050 elements of an integer array
00060 ;
00070 ;
00080 ;
0000 00080      ORG      0000H      ;Program is relocatable
0000 3E0F      LD        A,0FH      ;A = @VDCTL SVC number
0002 00      NOP
0003 0600      LD        B,00H      ;Basic will supply value
0005 00      NOP
0006 00      NOP
0007 0E00      LD        C,00H      ;Basic will supply value
0009 00      NOP
000A 00      NOP
000B 210000    LD        HL,0000H      ;Basic will supply value
000E EF      RST        28H      ;SVC CALL
000F C9      RET          ;Return to Basic
0000 00200    ;
0000 00210    ;
00000 Total errors      END
    
```

End

the second demonstration (if it didn't, you'd never see the pattern of diamonds and crosses), and then continues with the third demonstration. Lines 510-530 display a regular pattern of alphanumeric and graphics characters on the screen, and then the program copies the entire screen contents into the VIDEO%( ) array.

The program PEEKs the first line of the VIDEO%( ) array and displays it as ASCII code on the screen. This demonstration isn't as impressive as the others, but it shows how to use the SVC to read parts of screen memory.

The next section of Listing 2 (lines 640-740) demonstrates scroll protection. After you use the SVC to protect the top five lines from scrolling, 300 lines of single characters scroll up the screen. If all goes well, the original five top lines remain in place while the scrolling lines disappear. Then the program sets the scroll protect to a normal zero (protect no lines) and again calls the SVC to restore the transfer the array to the screen.

single integer value, and places that integer into CODE%(6) so the program loads it into the HL register. The computations needed to select screen positions in Basic are somewhat complex; they would be much simpler in a machine-language program dedicated to POKEing characters onto the screen.

When the first demonstration finishes scattering asterisks around the screen, the second demo immediately

copies the contents of the VIDEO%( ) array to the screen. The program now transfers the pattern of 0C2 hex and 0F0 hex bytes (that you previously loaded into the array) to the screen. The program loads CODE%(2) with the function number 5, and loads CODE%(6) with the address of the video buffer, VARPTR (VIDEO (0)).

The demonstration program pauses with a "Press any key" prompt after

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## THE NEXT STEP

### Program Listing 2. @VDCTL demonstration.

```

100 @VDCTL Demonstrations
110
120
130 DIM A,I%,J%,X% 'define before using to avoid moving arrays
140 DIM CODE$(7), VIDEO$(999)
150
160 FOR I% = 0 TO 7
170 READ CODE$(I%)
180 NEXT I%
190 DEF USR 0 = VARPTR(CODE$(0))
200
210 DATA 3902, 1536, 0, 3584, 0, 8448, 0, -13841
220
230 ' NOTE -- Load CODE$(2) with value for B
CODE$(4) with value for C
CODE$(6) with value for HL

240
250
260 FOR I% = 0 TO 999
270 VIDEO$(I%) = &HC2F0
280 NEXT I%
290
300
310 ' Demonstration of Video "POKR"
320 CODE$(2) = 2 'Function number
330 CODE$(4) = ASC(" ")
340 FOR I% = 0 TO 79 STEP 2
350 FOR J% = 0 TO 23 STEP 2
360 A = J% * 256 + I%: IF A > 32767 THEN A = A - 65536!
370 CODE$(6) = A
380 X% = USR 0(0)
390 NEXT J%
400 NEXT I%
410
420 ' Demonstration of moving memory buffer to Video
430 CODE$(2) = 5 'Function number
440 CODE$(6) = VARPTR(VIDEO$(0))
450 X% = USR 0(0)
460
470 PRINT @ 0, "Press any key";
480 IF INKEY$="" THEN GOTO 480
490
500 ' Demonstration of moving Video to buffer
510 CLS: FOR I% = 0 TO 639
520 PRINT CHR$(I% MOD 160)+32);
530 NEXT I%
540 CODE$(2) = 6
550 CODE$(6) = VARPTR(VIDEO$(0))
560 X% = USR 0(0)
570 CLS
580 PRINT "The ASCII codes for the previous first line are:"
590 J% = VARPTR(VIDEO$(0))
600 FOR I% = 0 TO 79
610 PRINT PEER(J% + I%);
620 NEXT I%
630
640 ' Demonstration of scroll protect
650 CODE$(2) = 7
660 CODE$(4) = 6
670 X% = USR 0(0)
680 FOR I% = 1 TO 300
690 PRINT CHR$(I% MOD 160)+32)
700 NEXT I%
710 CODE$(2) = 7
720 CODE$(4) = 0
730 X% = USR 0(0)
740 FOR I% = 1 TO 24 : PRINT : NEXT I%
750
760 ' Demonstration of cursor selection
770 CLS: INPUT "Enter ASCII code for new cursor": X%
780 CODE$(2) = 8
790 CODE$(4) = X%
800 X% = USR 0(0)
810 GOTO 770

```

End

screen to its original condition.

The last section of the program (lines 760-810) lets you select a new cursor character. I wrote it as an endless loop so you can see new cursor characters until you find one you want. Press the break key to escape the loop.

For clarity, I've taken two programming shortcuts in the demonstration program; you should never use these in a serious program. First, the USR routine doesn't check for a possible SVC error. Before returning to Basic, the USR program should check the Z flag and, if it's set to NZ, it should take some sort of corrective action (or at least report the error).

Second, the 2K video buffer, VIDEO\$( ), must start below 0EC01 hex. In a program this short, it always will; a longer program should check to be sure it does.

### Processing Speed

The difference in apparent processing speed between "POKEing" the video (B=2) and moving a block of RAM to the video led me to an experiment. I set up a program with two loops (Program Listing 3). The first uses @VDCTL to "POKE" characters to the video display. The second "POKEs" characters to the VIDEO\$( ) array, and then uses @VDCTL to



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## THE NEXT STEP

*Program Listing 3. @VDCTL timing demonstration.*

```

100 ' @VDCTL Timing Demonstration
110 '
120 '
130 DIM A,I%,J%,K%,L%,X% 'define before using to avoid moving arrays
140 DIM A1$,A2$,B1$,B2$
150 DIM CODE$(7), VIDEO$(999)
160 '
170 FOR I% = 0 TO 7
180 READ CODE$(I%)
190 NEXT I%
200 DEF USR 0 = VARPTR(CODE$(0))
210 '
220 DATA 3902, 1536, 0, 3564, 0, 8448, 0, -13841
230 '
240 ' NOTE -- Load CODE$(2) with value for B
CODE$(4) with value for C
CODE$(6) with value for HL

250 '
260 '
270 FOR I% = 0 TO 999: VIDEO$(I%) = 6H2020: NEXT I%
280 '
290 '
300 ' Test of Video "POKE"
310 CODE$(2) = 2 'Function number
320 A1$=TIMES$
330 FOR K% = 1 TO 10
340 CODE$(4) = 32 + K%
350 FOR I% = 0 TO 79 STEP 2
360 FOR J% = 0 TO 23 STEP 2
370 A = J% * 256 + I%: IF A > 32767 THEN A = A - 65536!
380 CODE$(6) = A
390 X% = USR 0(0)
400 NEXT J%
410 NEXT I%
420 NEXT K%
430 A2$ = TIMES$
440 INPUT "press ENTER to continue";B2$
450 '
460 ' Test of buffer-to-video move
470 CODE$(2) = 5 'Function number
480 CODE$(6) = VARPTR(VIDEO$(0))
490 I% = VARPTR(VIDEO$(0))
500 B1$= TIMES$
510 FOR K% = 1 TO 10
520 FOR I% = 0 TO 79 STEP 2
530 FOR J% = 0 TO 23 STEP 2
540 A = I% + J% * 80 + I%
550 POKE A, 32+K%
560 NEXT J%
570 NEXT I%
580 X% = USR 0(0)
590 NEXT K%
600 B2$ = TIMES$
610 CLS
620 PRINT "Using Video 'POKES' : ";A1$,A2$
630 PRINT "Moving buffer to video: ";B1$,B2$
640 END
    
```

*End*

When I ran the program (using TRSDOS 6.1 with Basic 1.0), the first loop required 60 seconds while the second loop took 41 seconds. Sending each character to the display took 50 percent longer than loading the array and using @VDCTL function 5.

Thinking the processing time of the two loops might have accounted for the difference, I modified the program

and ran it again. I wanted to find out how long each of the loops took without any video processing or USR calls, so I removed lines 380, 390, 550, and 580. For this trial, the first loop required 35 seconds compared to 27 seconds for the second loop.

In other words, the first loop had required 25 seconds to load CODE\$(6) with the correct value and

call @VDCTL 4,800 times. Loop 2 had required 14 seconds to perform 4,800 POKES and call @VDCTL 10 times. The second technique was almost twice as fast.

There's an important lesson here for both Basic and machine-language programmers. On the Model I/III, you normally access video RAM directly. While you can use the same techniques on a Model 4 by using @VDCTL, it appears to be much faster to work with a 2K memory buffer and transfer information to or from the video as seldom as possible for your application. The @VDCTL SVC takes much more time than a direct memory access, and using it more than necessary slows down your programs.

You could use many other SVCs in your Basic and Assembly-language programs. Two others, @DSP and @DSPLY, affect the video display. The first outputs a single character to the current video cursor position (similar to the 0033 hex ROM routine for the Model I/III); the second sends an entire message to the video screen.

Roy Soltoff's *Model 4 Technical Reference Manual* and the *Model 4 DOSPLUS Manual* explain all 94 SVCs. (However, DOSPLUS doesn't support some of the TRSDOS SVCs and has a few extras of its own.) If you plan to do serious Assembly-language programming on a Model 4, or use SVCs with USR calls from Basic, you'll need at least one of those books. ■

*Readers who subscribe to Compu-Serve can take part in discussions about topics covered in this column. Go PCS-117 to the Software and Authors' SIG and leave your questions addressed to me on section zero of the message board.*



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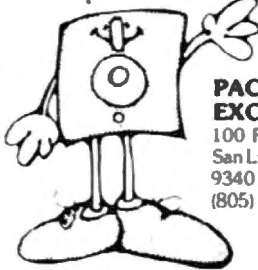
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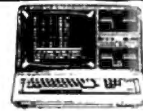
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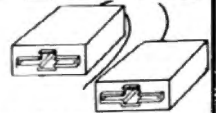
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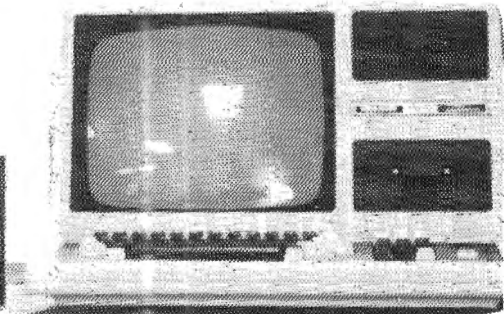
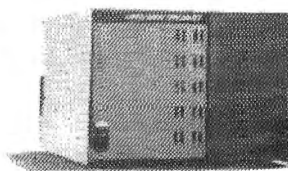
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Continued from p. 18

and reads them. If it doesn't find a 255, it reports the faulty location.

Everything works fine until I reach 32683. This location seems to hold an unchangeable 63. Once the program reaches 32696, it usually reboots to "MEM SIZE?". Testing higher locations from command mode revealed that 32683 to 32714 all hold unchanging values. POKEing these is like POKEing ROM. Locations 32715 to 32767 work correctly. I put in new RAMs and had the same results. I solved untimely reboots on my own machine, which has a revision D board, with Dennis Kitz's Z69 alteration (December 1981 Exclusive Oracle).

I tried that modification on this machine, but that didn't change the results. My only guess to the problem is that whatever controls the addressing of these locations is pointing somewhere other than RAM. What can I do to remedy this? (*Lawrence Gill, Berlin Hts., OH*)

**A** ■ One solution is to quit POKEing around in RAM. What you're doing wrong is trying to change the pointers and miscellaneous information about your program that Basic sets up when you type in RUN. I assume that your program is quite small, so what you need to do is use the "MEM SIZE?" question to cut Basic off from the RAM locations above 32682. I think you'll find that everything above this address checks out OK, and the area of "inflexible" data addresses starts 84 bytes below the address you gave in response to the "MEM SIZE?" prompt.

When you type in RUN, Basic examines the memory size available. Unless you specify otherwise, as defined by the "MEM SIZE?" prompt, Basic assumes that it can use everything between the top of RAM (32767 in a 16K computer) and the top of your program (varies according to the size of your program).

Now, as Basic progresses through your program, it stores each variable encountered, in order, starting at the top of RAM and moving down towards your program. For... Next loop variables are also located here. By POKEing around in this area you're confusing the daylights out of

Basic. It finally gives up and reboots.

For a more complete explanation of how Microsoft Basic manages your computer, get the IJG book *Microsoft Basic Decoded, and Other Mysteries* (address at column end).

**Q** ■ T.R.M.'s letter from London, England (November 1983, p. 318), illustrates a problem many people have in trying to obtain more directory space using NEW-DOS's PDRIVE feature.

The trouble is that a simple redefinition of the PDRIVE specification won't usually increase the available directory space if applied to a disk with files already on it. Neither does it work to start with a new system disk having increased disk drive gran allocation (DDGA) in the PDRIVE specification, and then making a straight copy from the old disk to the new one. The apparent DDGA is increased when you call up PDRIVE, but no extra space is allocated to the directory. The reason is that the extra room needed by the increased directory, which must be one continuous piece, is already occupied by another file, and the DOS refuses to let the directory overwrite an existing file.

The solution is to copy a new system disk having increased the directory specification and a new format, but using the Copy By File instruction. This allocates the needed directory space, and then copies the files from the old disk, relocating them as necessary to accommodate the larger directory space. (*William Briscoe, Bernillo, NM*)

**A** ■ Thank you very much for detailing the difficulties in increasing directory space allocation using NEWDOS80. I appreciate it since the NEWDOS80 manual is so difficult to understand.

**Q** ■ While I was glad to see a question from W.G. of Salt Lake City, UT, concerning genealogy software, I was surprised to see your answer.

Complimentary copies of our bi-monthly publication, *Genealogical Computing*, have been sent to 80 *Micro* since July 1981. Apparently, copies have never been routed to you.

There is software for the Model III, and other Radio Shack computers and

brands, but not what or where you said: Fiske was selling Apple software; Gensystems hasn't been sold by Smartware Systems for some time; Acorn Software is no longer at the SE Washington, DC, address and the software they sell is the same as your Computer Shack citation in Michigan.

The November 1983 issue of *Genealogical Computing* is a special issue on genealogy software (including the ones you named, plus others you missed): GENEAS/BASE, Genesis-80, LERCHEN Program, Genie, Your Family Tree (Acorn's program), and Ancestry I/III. (*Paul Andereck, Fairfax, VA*)

**A** ■ Sorry about that, but I try to be as accurate as possible when suggesting software sources. Unfortunately, there are thousands of programs and hundreds of computer newsletters and magazines out there, and no adequate index to them all. As a result, some of my information on these items is outdated or inadequate, and I haven't any way to cross-check them.

Thank you for telling me about your publication and the errors in my references.

For those of you interested in tracing your ancestry with a computer, you can write to *Genealogy Computing* for subscription information at: 5102 Pommeroy Drive, Fairfax, VA 22032.

**Q** ■ In response to R.K.'s problem with copying single-density to double-density above track 35 (December 1983, p. 286) under TRSDOS 2.7DD: His drives need to be configured for 40-track operation (TRSDOS 2.7DD is set for 35-track operation).

There are two ways to do this: temporary and permanent. The temporary method is to use the CONFIG command under TRSDOS, as explained in the manual on page 30. The permanent method is to patch TRSDOS 2.7DD, as explained on page 32 of the same manual. You can also specify the stepping rate. I was in the same situation when I converted to 2.7DD, and had no difficulties reading single-density 40-track disks. The only problem I had was copying from single to double density using one drive. Although the manual says this is possible, I couldn't do it. Since I had another

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## FEEDBACK LOOP

er drive on order, I decided to wait for it rather than puzzle it out.

My question relates to the double-density board itself. I understand that the Radio Shack board uses a different addressing scheme than the Percom, and other, boards. Would I have problems converting over to NEW-DOS80 or any other double-density operating system? TRSDOS 2.7DD is definitely an improvement over 2.3, but it still has its weak points. (*Kenneth Farley, Woodridge, VA*)

**A** ■ I've been told by the DOS manufacturers that they all support the Radio Shack double-density board, but not TRSDOS 2.7DD. It seems 2.7DD isn't consistent and causes problems for other DOSes. They suggest you transfer the 2.7DD programs and files to a 2.3 disk, then transfer them to your new DOS disk.

**Q** ■ I had a problem similar to that of R.L. of Bowie, MD, who experienced a hardware error problem with the Expansion Interface. The Microline 82A printer has a feature (priming the input buffer) that demonstrates the problem.

On power-up, the 82A pulls a data line called "prime" low for 100 ms or so. This is to clear the data latches in the sending computer. The Model I Expansion Interface clears the latches, but also shares that pull-up resistor, with some interrupt logic.

I found that the computer won't go into Basic, and other flaky things, when the printer is turned off but still connected to the computer. The powered-off printer loads down the shared pull-up line and operates the interrupt logic in the TTL undefined region.

My solution provides an additional 1,000 ohms pull-up to pin 1 of Z44. The shared pull-up resistor, R17, is 4,700 ohms. The additional ohms assure a valid TTL high to the interrupt circuitry when the printer is off but still connected. Another printer might draw slightly more current and require a better solution.

One such solution would involve the additional pull-up resistor and break the connection (cut the trace) from the prime input circuitry (J4 pin 26, U44 pin 1, and U45 pin 1) and everything else. This would allow the

prime circuit to work properly and independently from the rest of the expansion interface.

Since making my modification, I've had no further problems with the printer either on or off.

On another point, I'm trying to obtain a 2716-based character-generator kit for the TRS-80 Model I with descenders. I tried to buy the Model I character-generator kit from Exatron, but they're out of the business. I did receive a reply from A & J Micro, but they don't have this item.

The kit consists of a 2716 EPROM, and a small circuit board which is pin-compatible with the standard TRS-80 Model I character-generator ROM. This 2716 contained two sets of characters, one TRS-80, the other ASCII, both with descenders. You could also burn in your own custom set if you desired. (*Charles Gelsing, Albuquerque, NM*)

**A** ■ Thanks for the printer solution. The kit you want is available from Electronic Closet, 8187 Blakely, Ct. West, Bainbridge Is., WA 98110. It costs \$11. A more complete description of the circuit is in the December Feedback Loop.

**Q** ■ I'd like to add some input to your answer to Don Schenbarger (March 1984, p. 15). I agree with 90 percent of your answer. Your explanation of the problem and its solution—have the unit cleaned and aligned—is correct, but incomplete. The "Diskette?" prompt doesn't indicate an error or malfunction, but is the computer's expected response when no disk is installed during boot-up!

If Mr. Schenbarger had finished his ROM disassembly he would have discovered this. Most of us know that the Z80 begins processing at location 0000 hexadecimal (hex) after a power-up or reset. Here, the ROM contains instructions to disable the interrupts, clear the Z80 accumulator, and jump to a vector table in ROM C (specific location 3015 hex).

At this location, another vector jumps into the bootstrap routine. To the best of my knowledge, there are four different versions of ROM C, each with different locations for the bootstrap. Mine is Version C, so my vector table jumps to location 3401 hex.

The first part of the bootstrap routine sets up the system and some RAM pointers. It also checks the break key. If you press the break key, the bootstrap goes directly into Cassette Basic, ignoring the disk drives, even if disks are present.

If you don't press the break key, the bootstrap looks at the floppy disk controller to see if it's present. If it's not there, or not ready (this is an error), then the bootstrap jumps to Cassette Basic.

Having found a drive, the bootstrap checks for an index pulse indication. Here's the important part: If the bootstrap can't find an index pulse indication it assumes that the drive door is open. Bootstrap displays "Diskette?" and waits until you insert a disk and close the drive door.

Thus the "Diskette?" prompt is the normal response from the bootstrap routine. If all else works normally, nothing is wrong with Mr. Schenbarger's computer.

Since the ROMs for the Model III and Model 4 are almost identical (absolutely identical in this area) you can expect the Model 4 to behave the same way. Why then, do so many machines run for three or four seconds then quit? Why was Mr. Schenbarger able to make his drive stop with a flashlight?

You know that the index pulse is produced when the index hole in the disk passes the index LED. The light from the LED passes through the hole and activates the light detector opposite it. If light falls on the detector, it gives an index pulse.

The trouble is that the bootstrap doesn't time the index pulse; it only looks to see if it's active for more than a few microseconds (to prevent false triggering due to electrical noise). Once it finds the index pulse is active (light on the detector) it tries to read the boot sector on track zero of the disk.

The detector is activated by the index LED only if the drive door is closed. Unfortunately, the detector is sensitive and ambient light shining through the open drive door can activate it. If the door is closed with no disk in place, the LED will activate the detector. When Mr. Schenbarger looked inside with a flashlight, he activated the detector.

When the bootstrap finds an active

## FEEDBACK LOOP

index sensor, it assumes that a disk is in place and the drive door is closed, and it tries to read the disk. If there is no disk, it sends no data to the CPU, and the CPU patiently waits (forever) for the data to start coming in. However, the motor time-out circuit on the floppy disk controller shuts the drive off after three or four seconds.

Once the drive is off, simply insert the disk, press the reset key and start the bootstrap all over again, this time properly.

Now to Mr. Schenbarger's problem: sounds like his computer was working normally. The first year when his index sensor was sensitive it was activated by ambient light, and the system shut down after three seconds. In the second year he says his drive runs continuously. He didn't specifically say the "Diskette?" prompt appeared, but I suspect it did. The change is probably due to a dirt build-up over the detector, making it less sensitive. Cause of the film—smoking. (*Gerald Davidson, Fort Worth, TX*)

**A**■ I don't think I said the "Diskette?" prompt wasn't a normal response. I said that with the "Diskette?" prompt on the screen, TRSDOS waited for the drive to start shipping information, and the drive had already completed a brief verification of operation. (I should have said ROM instead of TRSDOS—a slip of the fingers.)

According to my R/S repair technician, when the "Diskette?" prompt appears, the drives should time-out in three or four seconds and stop running. Similarly, if the "Diskette?" prompt fails to appear (indicating that the computer thinks there's a disk in the drive and it's trying to load the disk's DOS bootstrap routine), the drives should also time-out in three or four seconds and stop running. Under no circumstances should the drives continue spinning without data transfer after more than a few seconds.

To demonstrate this, put a blank unformatted disk in drive zero and reboot your computer. In a few seconds, when the bootstrap discovers it isn't getting data transfer, the drives shut off.

Mr. Schenbarger's computer is *not* operating normally if it doesn't shut off the drives after a few seconds. □

### Information Update

Several months ago I mentioned that Soft Sector Marketing had a book with a commented disassembly of the Model III ROMs. This book has become scarce because SSM is no longer in business. However, RAMparts (145 Grove St., Peterborough, NH 03458, 603-924-9882) has the book, *Model III ROM Commented*, for \$12.95. Unfortunately, they have a limited quantity. If more show up, I'll post the information here.

In the February column I mentioned two Basic utilities from Prosoft—Faster and Trashman. Modular Software Associates (209 18th St., Huntington Beach, CA 92648) sells similar products: The Analyst (to speed up Basic programs) and The Collector (which replaces Basic's garbage collection routine with a better and faster one); each program retails for \$24.95.

Modular Software also sells a Disk Basic enhancement program, that I feel is well done. They include a special execute-only version for runtime packages that lets you develop and sell programs to people who have only standard Basic. Contact Modular Software for details. ■

*Terry Kepner is a freelance writer and programmer, and the vice-president of Interpro. He's been writing about microcomputers since 1979. Contact Terry c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.*

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Radio Shack, National Parts Division, 900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662. M/C and Visa accepted, each order has \$1.50 handling charge.

IJG Inc., 1953 W. 11th St., Upland, CA 91786, 714-946-5805. Publisher of *TRS-80 Disk and Other Mysteries* (\$22.50), *Micro-soft Basic Decoded and Other Mysteries* (\$29.95), *The Custom TRS-80 and Other Mysteries* (\$29.95), *Basic Faster and Better* (\$29.95), *Machine-language Disk I/O and Other Mysteries* (\$29.95), *TRSDOS 2.3 Decoded and Other Mysteries (Model I)* (\$29.95), *How to do it on the TRS-80* (\$29.95), and the Electric Pencil Word Processor (\$89.95).

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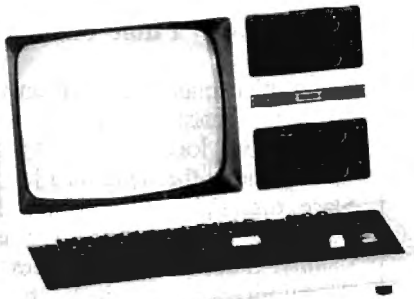
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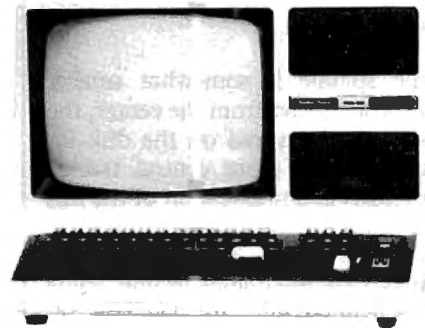


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Continued from p. 46

to the spindle is somewhat smaller than those further from the center, the density of bits stored on the disk increases on the more central tracks. This results in a mislocation of the bits which must be compensated for when your drive writes to your disk. PAT-1 defaults this pre-compensation value to 185 nanoseconds, but lets you adjust the track where the compensation will begin.

PAT-1 easily accommodates 96- and 100-TPI drives as well as double-density and two-headed drives. You can test 8-inch floppy disk drives as easily as 5¼-inchers; all you require is the appropriate Dysan diagnostic disk. You can also set faster step rates, as well as longer or shorter seek settle times. With the parameters set up according to the drive manufacturer's specifications, you're ready to put your drive through its paces.

Since most drives you test are part of a system, PAT-1 lets you specify the drive you want to examine. The immediate benefits of this are obvious to TRS-80 owners whose drives are internally configured for their positions as :0, :1, :2, or :3 (that's A:, B:, C:, or D: to CP/M and MS-DOS users). This addressing is independent of where you have plugged the drives on to PAT-1's ribbon cable. In other words, you can hang drive zero on either of PAT-1's plugs, then test it by configuring PAT-1 to find a zero drive at that plug.

| Command | Function           |
|---------|--------------------|
| 0       | Parameters         |
|         | a. Step rate       |
|         | b. Seek settle     |
|         | c. Retries         |
|         | d. TPI             |
|         | e. Density         |
|         | f. Pre-comp        |
| 1       | Drive              |
| 2       | Side               |
| 3       | Track              |
| 4       | Alternate seek     |
| 5       | Centering*         |
| 6       | Spindle speed      |
| 7       | Index width        |
| 8       | Index timing*      |
| 9       | Skew*              |
| 10      | Head load*         |
| 11      | Radial*            |
| 12      | Azimuth*           |
| 13      | Accordion†         |
| 14      | Step rate†         |
| 15      | Hysteresis*        |
| 16      | Locate head†       |
| 17      | Controller status  |
| 18      | Clear controller   |
| 19      | Verify format†     |
| 20      | Write sector†      |
| 21      | Rewrite sector†    |
| 22      | Format track       |
| 23      | Format disk        |
| 24      | Random seek, read† |
| 25      | Random seek, w/r†  |
| 26      | Write pattern      |
| 27      | Constant write     |
| 28      | Tap test           |
| 29      | Sequence selects   |
| 30      | Toggle side        |

\*Dysan diagnostic disk required

†Formatted disk required

Table 3. Summary of PAT-1 commands.

If you're unsure about the position for which a drive is configured, the sequence-selects test will search out the correct address for you—a real boon when you find a mystery drive sitting somewhere in the back of your repair shop.

### Using PAT-1 for Maintenance

PAT-1 can do more than test your drives; it can replace an oscilloscope when a drive needs alignment. My technician found it a little disconcerting at first to look at a numerical readout, instead of the undulations of his scope, but once he got the hang of it, he felt that the PAT-1 was more than adequate for the job. Indeed, the little black box tended to reduce some of

the hit-or-miss nature of head alignment.

Let me explain what I mean when I say hit-or-miss: when you align a drive, you loosen the adjustment screws, move the head into its proper place, then tighten it up again. But re-tightening the screws moves the head slightly. Since drive allowances are to the hundredth of an inch, that slight movement can be enough to ruin your adjustments. Thus, adjusting a drive requires that you guess just how much the head will move when the screws are tightened and that you compensate for it.

Although my technician balked at PAT-1's numerical readout, I found it easier to see than to get a fix on the oscilloscope's bouncing waveforms. PAT-1's readout let me know when the adjustment slipped, how far it had slipped, and how to compensate for it.

### Documentation and Support

When I approached Dysan about getting a review copy of their product, they obliged by sending not only the machine, but a company representative to demonstrate it. A wise-cracking friend said, "The manual must really be a mess, if they have to send a translator."

*Au contraire:* After working with the product and its documents for a month, I can attest that not only is the machine simple to use but the documentation is also easy to understand and informative. And when I did have questions about PAT-1's features, a toll-free phone call quickly put me in touch with a friendly voice that had the answers. ■

*Editor's note:* At press time, Dysan planned to discontinue PAT-1 and replace it with PAT-2+, retailing at the same price.

## WIBASIC: Powerful Compiler/Interpreter

by Ronald Cangro

You may wonder if the microcomputer industry needs another Basic compiler. At first, I, too, was skeptical. But WIBASIC is different: It is

## PAT-1



Dysan Corp.  
5201 Patrick Henry Drive  
Santa Clara, CA 95050  
\$999

Easy to use? ★★★★★☆  
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# REVIEWS

an uncomplicated program designed specifically to generate Z80 machine code, not to compile existing Level II Basic programs.

This uniqueness means that you'll find extensions and restrictions on some of the Level II and Disk Basic commands you're familiar with (see Table 4), but you'll learn these differences in a matter of hours.

Like ZBASIC, WIBASIC is really an interpreter and compiler in one package. Rather than writing your code, saving it to disk, loading the linker, linking the object modules, saving the code back to disk, and executing the program, WIBASIC lets you write and debug your program interactively, the same way you do with Disk Basic now.

When you're satisfied that your program runs correctly, you call the compiler by typing in COMPILE or COMPILE/M right from Basic. The commands available from the interpreter are the same ones that execute after you convert the code to machine language. So if your program runs interactively, it will run after compilation without syntax errors.

### System Installation

WIBASIC is compatible with all currently available operating systems.

## WIBASIC 1.1



WittSoft Inc.  
1302 41st St.  
Orlando, FL 32809  
Models I and III  
\$89.95

*Easy to use?* ★★★★★☆  
*Good docs?* ★★★★★☆  
*Bug free?* ★★★★★★  
*Does the job?* ★★★★★☆

NEWDOS80 2.0, TRSDOS 2.3, and LDOS run as is, but DOSPLUS 3.5, TRSDOS 1.3, and TRSDOS 2.7DD require patches necessary only to use Basic's command (CMD) feature.

### Special Features

WIBASIC offers an impressive list of features. It supports both tape and disk input and output (I/O) so you can make system tapes. The compiler's object code isn't subject to any royal-

ties. Compiled programs run on either a Model I or a Model III without modification.

You needn't convert your Basic programs to ASCII format. WIBASIC supports program chaining, module definition, and code relocation for the advanced programmer. You can compile to memory, check for errors, and recompile to disk quickly and easily without leaving WIBASIC.

The best features of WIBASIC are for those who require more control over the Z80 microprocessor. WIBASIC has two levels of operation: rudimentary and advanced. The second level is not as easy to use, but it allows you more control over a compiled program's location in memory. That includes the subroutine library, I/O buffer segment, variables storage, and program and data statements, taking

*Program Listing 2. Sample. You can refer to lines by name as well as by number.*

```
10 IF A > B THEN GOTO ROUTINE1
.
60 NAME ROUTINE1
70 PRINT 'A is greater than B'
```

the place of a more complicated linking loader.

WIBASIC supports decimal, hexadecimal, or octal numeric constants. It fully supports strings, although it handles them a little differently once compiled. Since the program author's intent was to make a powerful and easy-to-use compiler, he didn't take care to assure compatibility with Disk Basic. While WIBASIC is the easiest compiler I've ever used, I found I had to modify existing programs before I compiled them. On the bright side, some of the added features make the modifications easier.

WIBASIC uses a command shorthand similar to that of NEWDOS80's extended Disk Basic. You can abbreviate the List, Delete, Edit, and Auto commands to their first letters. See Table 5 for additional single-key commands. With WIBASIC, you can reference lines by name as well as by number through the Name command (see Program Listing 2).

WIBASIC's PRINT# command

| Command      | Status | Command          | Status  |
|--------------|--------|------------------|---------|
| ABS(exp)     | Res    | Merge            | Res/Ext |
| ATN(exp)     | NA     | MID\$(exp)       | Ext     |
| ATN(exp)     | NA     | MKD\$(exp)       | NA      |
| CDBL(exp)    | NA     | MKI\$(exp)       | NA      |
| CMD(exp)     | Ext    | MKS\$(exp)       | NA      |
| COS(exp)     | NA     | Name             | New     |
| CSNG(exp)    | NA     | PEEK(exp)        | Ext     |
| CVD(exp)     | NA     | POKE             | Ext     |
| CVI(exp)     | NA     | Resume           | NA      |
| CVS(exp)     | NA     | SQR(exp)         | NA      |
| DEFDBL(exp)  | NA     | System           | New     |
| DEF FN(exp)  | NA     | TAN(exp)         | NA      |
| DEF LEN(exp) | New    | Using            | NA      |
| DEFS(exp)    | New    | USR(exp)         | Ext     |
| DEFSNG(exp)  | NA     | FRE(exp,exp)     | Ext     |
| ERL          | NA     | Get exp,exp Next | Ext     |
| FN<(exp,exp) | New    | LSET(exp)        | NA      |
| FN>(exp,exp) | New    | LOG(exp)         | NA      |
| FNS          | New    | PRINT#           | Ext     |
| Field        | Res    |                  |         |

Key to abbreviations: Res = Restricted operation in compiler  
NA = Not available in compiler  
Ext = Extended from Level II/Disk Basic  
New = Not found in Level II/Disk Basic

Table 4. WIBASIC commands that differ from Level II Basic.

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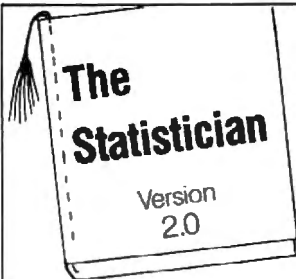
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## REVIEWS

has been extended to include limited device routing. For instance, if you specify PRINT#0 in a program, the output goes to the video display (like PRINT). PRINT#1 is still the cassette port, but a PRINT#2 routes the output to the line printer. The number after the PRINT# command may be a variable to allow dynamic output routing. The LPRINT command is still available and allows tabbing past column 64.

You can combine WIBASIC easily with Assembly language to form a hybrid compiled program. The WIBASIC program can call the assembler (through user routines), and the assembler can, in turn, call the WIBASIC routines (though this is a little trickier). Variables used in WIBASIC can be easily defined in your assembler code due to the structure of the WIBASIC variables. This isn't so in other compilers that maintain the same format as Disk Basic, for instance. A file on the master disk includes all the WI-

| Key | Function                           |
|-----|------------------------------------|
| :   | Lists lowest numbered program line |
| /   | Lists last program line            |
| .   | Lists current program line         |
| ,   | Edits current program line         |
| ↑   | Lists previous program line        |
| ↓   | Lists next program line            |

Table 5. Single keystroke functions.

BASIC entry addresses so you can use them in your Assembly routines.

You can see the power of this compiler for complex programming tasks.

### Limitations

I've found nothing really wrong with WIBASIC. The application you have in mind for the compiler will determine its limitations.

WIBASIC doesn't support the Print Using statement function of Level II Basic, nor does it include an ON ERROR GOTO type of statement.

WIBASIC uses a sequential access file system. Although some of the random access commands are available, they function somewhat differently. For instance, the Field command tells the compiler how many buffers to set aside for disk access, and has nothing to do with random access.

| Feature                                       | MS  | WIBASIC | ZBASIC  |
|-----------------------------------------------|-----|---------|---------|
| Ability to link to other languages            | Yes | No      | No      |
| Level II/Disk Basic compatible                | Yes | No      | Limited |
| Ease of use (1 = easy 5 = hard)               | 4   | 1       | 2       |
| Random I/O                                    | Yes | Limited | Yes     |
| Extended commands                             | Yes | Yes     | Yes     |
| Floating-point math                           | Yes | No      | Strings |
| Coresident interpreter/compiler               | No  | Yes     | Yes     |
| Instruction manual clarity (1 = good 5 = bad) | 3   | 1       | 2       |
| Stand-alone object-generated                  | No  | Yes     | Yes     |
| Clarity of error messages                     | 2   | 4       | 3       |
| Ability to optimize compiled code             | Yes | No      | No      |
| Ease of using hybrid code                     | 4   | 1       | 4       |
| Ease of learning system                       | 5   | 1       | 3       |
| Supports cassette I/O                         | No  | Yes     | Yes     |
| Supports transcendental functions             | Yes | No      | No      |
| Supports long variable names                  | Yes | No      | No      |
| Supports line labels and numbers              | No  | Yes     | No      |

MS = Microsoft Basic compiler; Microsoft Inc.

WIBASIC = Trademark of WittSoft Inc.

ZBASIC = Trademark of Simutek Inc.

Table 6. Comparison of WIBASIC, ZBASIC, and the Microsoft Basic compilers.

You can execute a pseudo-random access by using the Get and Put commands along with associated position test functions. Each file is character-oriented from zero to 65,535 positions. You can determine your position by using the Locate command. Then you can read or write at a specific character position using the Get or Put commands. Although file size is limited only by the physical disk size, anything larger than 65,536 characters is impractical for random access because of the integer math restrictions.

Since this compiler was designed to be used to create new programs rather than just compile old ones, WittSoft could have done a better job on some of the command extensions and additions. Commands to help the programmer create graphics and sound would have been useful for those who want to write game programs, especially since WIBASIC seems to have been targeted for that type of programming.

### Compilers Compared

The chart in Table 6 comparing WIBASIC, ZBASIC, and the Microsoft Basic compiler shows applications to which each compiler would be better suited.

If you're compiling an existing Disk Basic program that uses floating-point math, or if you need advanced linking capability, you'd be better off with the Microsoft Basic compiler. If you're writing a program from scratch and need random and sequential input and output, floating-point math, or extended Basic/machine-language commands, then ZBASIC is probably quicker and easier. Finally, if you're writing a program from scratch and only need limited random I/O or integer math, but want an easy-to-use system with a built-in interpreter that executes all compiler commands, programming extensions, and machine-language flexibility, then WIBASIC is the one to use.

| Parameter                   | WIBASIC     | ZBASIC      | Microsoft    |
|-----------------------------|-------------|-------------|--------------|
| Compiled program size       | 1,150 bytes | 1,679 bytes | 5,118 bytes  |
| Library size                | 2,304 bytes | 1,879 bytes | 14,336 bytes |
| Total machine-language size | 3,454 bytes | 3,558 bytes | 19,454 bytes |
| Compile time                | 10 seconds  | 3 seconds   | 60 seconds   |
| Execution time              | 54 seconds  | 38 seconds  | 168 seconds  |

Table 7. Benchmarks run on the three compilers.

# Before this happens, call SAFEWARE

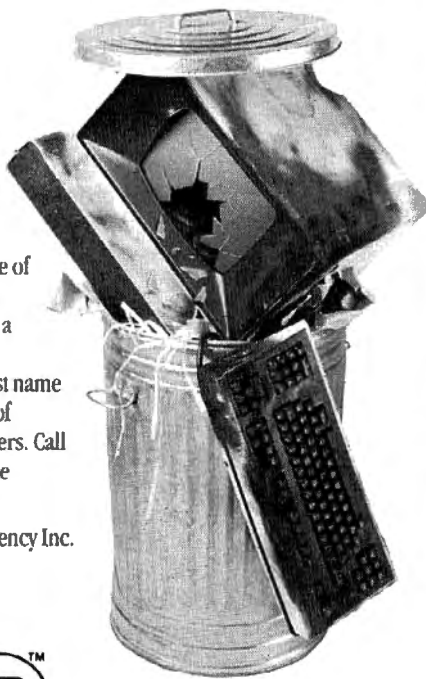
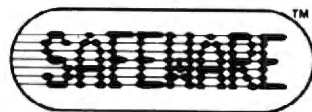
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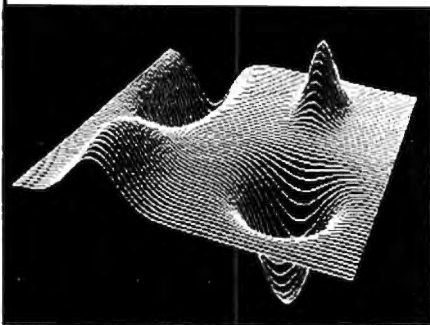


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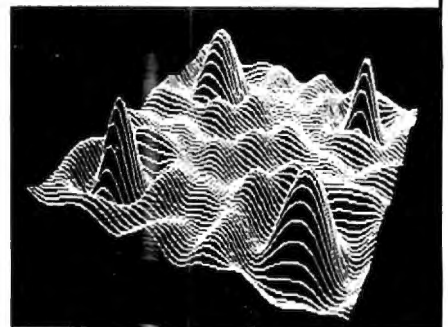
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Important criteria by which to judge compilers are speed and efficiency of the compiled code. All compilers have machine-code overhead in the form of a library. WIBASIC and ZBASIC automatically append the library to the program code. The Microsoft Basic compiler needs a run-time library that is added before every execution.

To gauge what this means to an average program, I ran a benchmark on each of the three compilers (see Table 7). I used the sample program included in the ZBASIC advertisements to show the difference between an interpreted program and a compiled program.

I found ZBASIC to be the fastest in execution time, while WIBASIC produced the most compact code. But, in all fairness to ZBASIC, there are three versions available: the basic version, one with disk I/O, and one with disk I/O and math functions. I used the latter version. The stripped-down version would have required only 2,733 bytes.

**Documentation**

The documentation package is extensive (about 100 pages). The table of contents is good, but lacks an index. You sometimes have to search to find a specific piece of information. A quick-reference card would also have been handy. The sample program included to demonstrate WIBASIC's power and to show off its speed is impressive. It's a simple graphics demo that shows WIBASIC's capability to do arcade-type graphics and demonstrates some of the extensions available, such as the availability of line names for such commands as GOTO and GOSUB.

The manual includes a sample session, and a tutorial for first-time users. It is such a good introduction that I was able to compile and run my first program in a matter of minutes. ■

**Camera-Ready Copy  
From Your Daisy Wheel**

by Charles R. Perelman

**M**agicBind, an impressive print-formatting and file-merging program, creates documents of near-typeset quality. Combined with your

word processor and a daisy-wheel printer with a proportional print wheel or thimble in regular WP sequence, MagicBind produces camera-ready copy for manuals or other documents requiring proportional spacing.

In addition, MagicBind offers sophisticated merge functions like those found in the latest version of Mailmerge. (It does not support nesting, however.)

MagicBind's dot commands for print-time formatting do not affect



files. A single command embedded in your text line changes parameters such as proportional spacing, line length, character pitch, page length, and space between lines easily and quickly while printing. Your document retains all word processor or MagicBind commands in place.

**Formatting Your Text**

Formatting features are typical of advanced word processors (see Tables 8 and 9). Backward movement of the platen facilitates multicolumn printing; widow and orphan control assures a minimum number of lines in a paragraph at the top or bottom of a page.

The program maintains compatibility between MagicBind and your word processor. For instance, I used MagicBind with WordStar for this review (see Table 10). MagicBind uses the same commands for almost all of WordStar's control-P commands for popular functions like underlining, boldface, and double-strike.

MagicBind dot commands entered in the file-start with two periods and are ignored when you print with WordStar. Most regular WordStar dot commands have no effect on MagicBind; you add a third period for non-printing comments to prevent MagicBind from printing a section of text. Differences in the two systems require conforming to one or the other before you print your final document. Software other than WordStar requires a slightly different control sequence.

Multiple-line footers and headers, footnotes, and automatic third-level sequential numbering of chapters and sections are additional pluses. Unfortunately, you can't subdivide the numbers; that is, each level starts with a 1 rather than a 1.1 or 1a for the second level.

**File Merging**

File-merging capabilities are extensive. Fill in forms for automatic completion from a data file or for manual entry with screen prompts, and MagicBind creates documents calling boilerplate provisions for insertion.

With the wide range of other features included in MagicBind, any WordStar user considering an upgrade to Mailmerge 3.3 (which requires WordStar 3.3 as well), the first Micropro implementation of selective printing, should seriously consider MagicBind instead.

MagicBind's selective printing is based on equal-to, greater-than, and less-than logical comparisons of a field (which may be coded into categories) to your selector. You can combine two selection criteria with logical AND/OR operators and print a series

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MagicBind has a unique verification function for checking the number of fields in each data file record or the

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*Table 8. Some word processors compatible with versions of MagicBind. The author used WordStar for this review.*

Backward platen movement  
Boldface (shadow print)  
Centering  
Doublestrike  
Flush-right printing  
Horizontal spacing control  
Overstrike  
Subscript  
Superscript  
Underlining  
Variable location of page numbering and tiling  
Vertical spacing control  
Widow and orphan control

*Table 9. Formatting features available with MagicBind.*

Quick print-time formatting without reediting file  
True proportional printing  
Half-line spacing by a single command  
Fractional space-centering that accurately balances an odd number of characters  
Centering of multiple lines with a single command  
Flush-right printing for inside addresses, dates, and figures  
Adjustment of varying character widths within a line  
Automatic widow and orphan control  
Outdent, permitting placement of numbers or headers outside normal margin if necessary  
Choice of solid or broken underline  
Automatically placed footnotes  
Headings numbered automatically  
Reforming an entire document with a single dot command  
Multiple line headers and footers  
Selectively printing only certain pages of a file for merging  
Automatic handling of empty fields when merging

*Table 10. Formatting advantages when WordStar and MagicBind are used together.*

number of characters in a specific field such as telephone or zip code numbers. If you've ever changed a data file and inadvertently eliminated a field or delimiter that showed up halfway through your printout of labels or form letters, you'll appreciate this feature.

A label-printing program prepares any number of mailing labels, from one to eight across. Respond to a couple of menu prompts, load your labels, and away you go.

MagicBind's screen preview function leaves something to be desired. Dot command errors result in a screened message, a good file review and verification technique. However, the odd appearance of the file—with doubled letters for boldface and double-strike and interspersed underline—makes proofreading difficult. Besides, a page at a time zips by, requiring digital dexterity with control-S to stop each screenful of material before the page ends.

When merging, you can concatenate sequential files, but nesting isn't possible. You must number footnotes manually, although you can number automatically either in the text or in the footnote itself (but not both) if you don't use it for chapter or section designations.

### Documentation

The handsome manual, formatted with MagicBind, has a good table of contents and index and is reasonably understandable. A sufficient number of examples and several tutorial files

on disk clarify most ambiguous areas. Program prompts and error messages are precise. Memory locations for the character width table and default settings let you customize MagicBind. The summary of commands on both sides of a single sheet was apparently added as an afterthought and would have been more helpful if printed on heavy paper or cardboard.

### Product Support

EdiType promises customer support only when your dealer fails to furnish adequate help. But if you have worked with a micro word processor or text editor before, you'll have no trouble making MagicBind perform as promised. ■

## DiskDISK: Software That Adds Drive

by John B. Harrell III

**A**dding the equivalent of another disk drive to your Model I, III, or 4 is easier—and cheaper—than you might think. DiskDISK is a useful software package that partitions a single disk into files that your operating system treats as individual disk drives. Each of these "drives" has its own directory, and the operating system works with them as independent entities.

Also, because DiskDISK's minimum file allocation is smaller than the operating system's, each file within a "drive" takes up less disk space, making this ersatz multidrive configuration possible.

### DiskDISK Concept

DiskDISK creates a mirror-image back-up disk from a disk drive with a larger storage capacity. For example, you can use an 80-track drive or a hard disk to make a mirror-image copy of a smaller 5¼-inch disk with the Backup command.

Backup operates in two modes: mirror-image copies the disk track by track to the new disk; and backup-reconstruct moves each file just as the Copy command would. Disks with different physical parameters do not support mirror-image backups. By using DiskDISK you can construct a

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smaller logical disk with parameters identical to the drive you want copied. You can then use this smaller logical disk to emulate any functions the original disk requires.

DiskDISK also lets you create a partitioned file structure with multiple logical disk units on a hard disk drive, similar to the hierarchical structure of MS-DOS. This provides a nice method of splitting up hard drives into more manageable logical units of smaller capacity and overcomes the limited directory size on the large volume.

### Routines

Logical Systems supplies two routines with DiskDISK: DDFORM /CMD and DD/CMD. DDFORM /CMD creates the disk file structure on the designated disk according to the parameters you prescribe. This routine allocates space for the simulated disk and saves information about the structure and location of the "disk" for future use by the second routine, DD/CMD. This routine installs the "disk" driver in memory and enables the DiskDISK drive.

DDFORM provides for four types of simulated drive formats: The first type's optimized storage allocation uses the least amount of space possible for files. In this mode, files are allocated using one sector per granule and 8 granules per cylinder. The maximum size of a type 1 file is 192K bytes (a limitation imposed by the maximum number of cylinders—96).

|          | Number of text files | Bytes required on standard disk | Bytes required for storage | Percentage of bytes used |
|----------|----------------------|---------------------------------|----------------------------|--------------------------|
| DiskDISK | 23                   | 72K                             | 58K                        | 34.3                     |
| PaDS     | 23                   | 72K                             | 54.8K                      | 31.5                     |

*Table 11. Text file storage—DiskDISK and PaDS.*

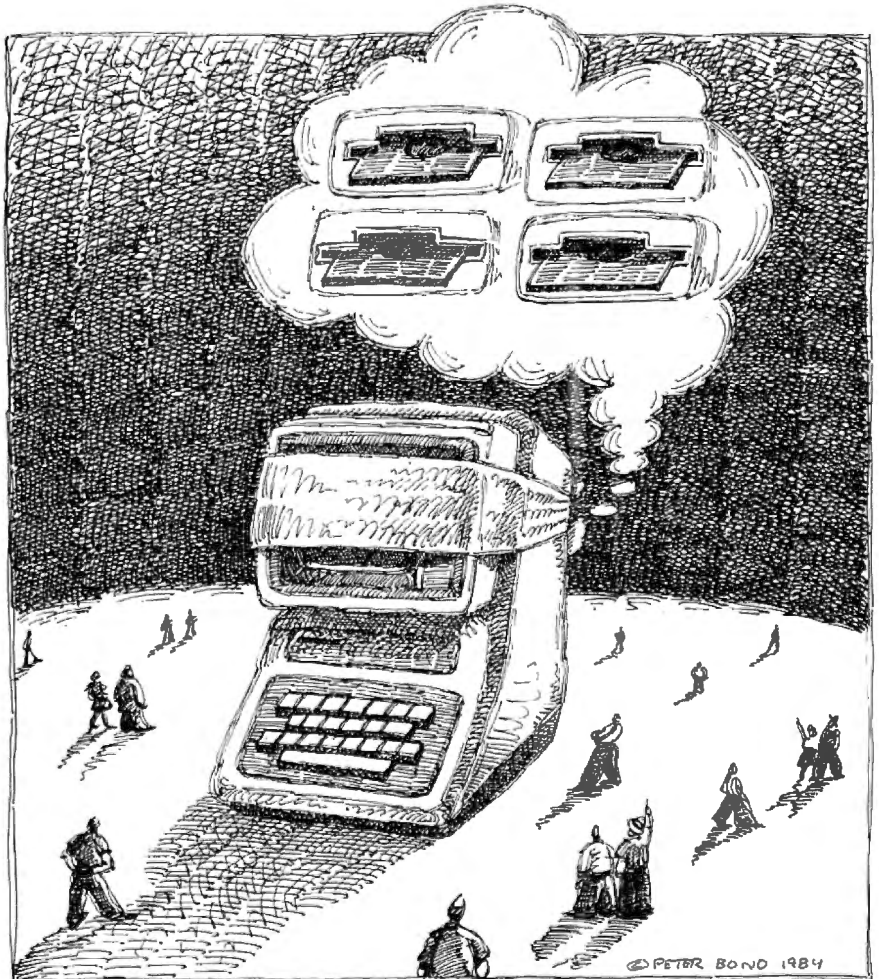
Type 2 files let you address more space on the "disk"—up to twice as much as with a type 1 file. Allocation is the same as above, with two sectors per granule and 8 granules per cylinder. In both cases the directory is limited to one cylinder. Type 1 "disk" limits you to 36 directory entries (six File Primary Directory Entries in each of the six allowed sectors); type 2 "disk's" limit is 84 entries, compared with the 96 entries allowed on a standard double-density 5¼-inch disk.

The remaining two "disk" types let you select a partitioning that corresponds with the normal 5¼- and 8-inch disks. With each of these selections, you can also choose the number

of "sides" and the "density" of the "disk."

After you create the "disk" using DDFORM, you can activate the driver with DD/CMD. This program installs a driver in high memory for LDOS 5.1.X (low memory for TRSDOS 6.X), which uses the information recorded in the file created by DDFORM to implement the "disk" drive. You can also "sysgen" (system generate) a DiskDISK file—if you do, the file must be on the same drive as when you did the "sysgen" and must be in exactly the same physical location on the drive.

Both DD/CMD and DDFORM /CMD prompt you for the parameters



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necessary to complete the creation/installation of the "disk" drive. In essence, the command line requires no parameters, and user-friendly prompts ensure that all required information is present.

## Performance

Having used DiskDISK for some time now in both Model I and Model 4 applications, I find no appreciable deceleration when implementing a single disk drive within another drive. There is a noticeable decrease in file access time that would be minimal with a real drive when using more than one DiskDISK "drive" on a single physical unit. This situation is much more pronounced with floppy drives than with a hard disk and is due to the required movement of the disk head while reading from the separate "disks" maintained on the same drive. You'll notice a slow-down when reading sequentially from one "disk" to another, because the head looks for files for each separate read/write operation.

Compared with FILEDISK, a similar routine distributed with DOS-PLUS 3.5, DiskDISK really stands out. While accessing the simulated drive with FILEDISK, I noticed a delay that is not apparent with DiskDISK. In addition, unlike DiskDISK, FILEDISK had problems while accessing nested simulated drives—a logical drive within another logical drive.

## File Size Comparisons

I used the optimized storage method (type 1 file) to store 36 small files from one of my libraries by creating an 86-track "disk"—the largest a double-density blank formatted disk could hold. After I had created the "disk" file, 169K RAM were available—compared with the normal 174K on a blank formatted disk.

The library disk containing the original 36 files had only 39K (22.4 percent) remaining free space. After transferring these files to the DiskDISK, I had 56.2K remaining free space (33.3 percent). For files that do not completely fill the last sector, you should achieve a similar savings of file space. For a grouping of files whose size is appreciably smaller than 1 granule, the savings in disk space can be far greater than I've mentioned.

You might wonder why you shouldn't use a utility like Misosys Inc.'s PaDS to maintain a partitioned data set and keep files in the smallest configuration (stored by bytes). Table 11 displays the results of a comparison I made between DiskDISK and PaDs.

While PaDS consumed fewer bytes of the original disk than DiskDISK required of the simulated disk, I'd still recommend DiskDISK because the disk you create with it behaves like another drive within your system. When you use PaDS, maintaining your library is time-consuming, and you still must copy files from the PaDS to a normal file before the operating system can use them. ■

## SoftPac: Jack-of-All-Trades

by Wynne Keller

**S**oftPac, an integrated software package comprising a data base, a spreadsheet, a terminal package, and a word processor, puts integration ahead of quality, and the result is a very limited group of programs.

Ideally, integrated systems should save time and money: You save time by entering data only once, even if you need it for several purposes. You can save money when, as in this case, the integrated package cost breaks down to \$75 per module—less than these

programs would cost if bought individually.

But when programs purchased separately significantly outperform those in the SoftPac integrated package, you may feel that you're better off spending more and having truly useful software.

The SoftPac programs are on a formatted TRSDOS disk. Softronics doesn't recommend using other DOSes. The manual suggests that you should put a clean system disk in drive zero, and the SoftPac disk in drive 1 at all times. All user's files should go on the drive zero disk. The programs are compiled from Basic with the ZBASIC compiler from Simutek.

## SoftBase 3.0

The data base program in the package is unusual. You can structure your records as you would in a normal data base, or leave them as unstructured text. The program uses eight lines of the screen (512 characters) for the body of each record. Every record also needs a title, and has an optional summary. The title and summary are really fields, so each record ends up with three fields: title, description, and summary. If you choose to further subdivide the description into fields, you can design various overlay forms for the screen that are not true subdivisions of data, but are merely cosmetic. When adding records, you can type right over field headings on your form; you aren't forced to keep a pre-set field length.

To avoid using computer terminology, the SoftBase manual calls each record a "file." However, this creates some confusion, because even beginners know that a group of records on disk is a file. In this review, I use the standard terminology: A field is the smallest unit (a section of data such as name, street, zip code); a record is a group of related fields; and a file is a group of records.

A search of the title or summary fields is rapid, because these fields are short. A search of the description fields is more time-consuming so the manual suggests that each record have a title and summary.

You can add, delete, or change records as with any data base, but to access the records for deletion or change you must first know the record number either from a reading of the file on

### SoftPac 3.0/3.2



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screen or from a printout. There is no sort option.

Reports, available for a range or for all records, consist of all the data, or just title and summary. Even if you have subdivided the description field with a form, you may not print just part of the description. You can't print mailing labels because there's no control over spacing within and between records. The printout is eight lines of description per record, whether or not all the lines have data; further, you can't suppress the title and summary line.

SoftBase's greatest problem is capacity: Only 20 records fit in memory at one time. Even worse, you must save these records to a single file; you can't append to a file on the disk to build a larger file. No directory is available from within the program, so in a short time you'll have many small 20-record files on the disk. Remembering all their names could be difficult.

And what is the use of a 20-record file? Data base programs are supposed to simplify data management. If they don't have large capacity, then they only create more work without saving time.

But what about transferring data to the other programs—surely that's an advantage? Not really. You can pass only one record at a time to SoftWriter by loading SoftBase, loading the file, selecting a record, placing the record in the buffer, loading SoftWriter, and retrieving the record from the buffer. You must repeat this six-step process to transfer another record.

SoftBase is not well error-trapped. You can easily lose a file by not saving it before exiting the program, by bringing another one off the disk before saving the one in memory, or by writing over an existing file on disk.

### SoftCalc 3.2

SoftCalc, a program for visible calculations, creates a spreadsheet matrix 26 columns wide by 50 rows deep. Any slot in the matrix can store a number or a title, and the arrow keys allow access to any part of the matrix.

SoftCalc uses letter abbreviations for the major functions—14 in all to remember. It would be nice to have a summary card to keep handy. The major functions include: average, calculate, delete, sort, graph, move,

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**SoftBase** . . . Setup files using customized forms. Setup multiple forms. Use all or part of a form in a file. Select full screen text editor mode for data entry. Read files using file name or wild card. Correct files instantly using full screen editor mode. Search for a file by letter, word or sentence. Review selected portions of 10 files on screen. Insert text from any SoftPac program into a SoftBase file. Transfer text from any SoftBase file to other SoftBase programs. Print mailing labels and merge SoftBase files with SoftWriter text to generate form letters. Complete error trapping routines.

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print, project, and total. You can save spreadsheets to disk and retrieve them later, or pass portions of them to SoftWriter.

Lowercase is supported inconsistently. You can use it to call up any of the 14 functions, but then it cannot specify column locations, such as A12. You won't see an error message—the program just appears to be locked up. Even if you set the computer in permanent uppercase mode to avoid this problem it may occur anyway, because after a file save and load (automatically in uppercase) the program puts the computer back into lowercase.

As with SoftBase, there are severe limitations. First, SoftCalc supports only integers and allows only five digits per column. Consequently, you can't use the spreadsheet for serious math, but only for rough calculations. A floating-point version is available, but it doesn't integrate with the other programs. Equally crippling is the lack of formula support. The program accepts only numbers, not formulas. Two "formulas," average and total, are built in but are cumbersome to use. To average or total a row or column, you must enter the start and end coordinates, and the coordinate where you want the result placed. If you change any values later, the average or total will be incorrect and must be recalculated. Further, if the total exceeds five digits, the answer will be invalid and there is no warning that this has occurred.

The sort rearranges numeric data within a column or row in ascending or descending order. It doesn't sort titles. The Move command relocates entire rows or columns.

The Graph command is rapid. It draws a bar graph with columns A-Z across the screen bottom and the rows up the left side. But you can't select which data to use in the graph. So if the spreadsheet has totals or averages, they will be included in the graph along with the source data. SoftCalc prepares graphs by first totaling the columns. If a total value goes over 99,999, SoftCalc ignores the excess and the graph results will be inaccurate.

You can perform the four basic math functions between any two matrix coordinates. You enter the math operation sign, then the two locations,

and the location for the result. A future value function works similarly. Add, subtract, multiply, or divide repeatedly any value to a matrix value.

SoftCalc prints portions of the spreadsheet. You must specify beginning and ending rows and columns. Eleven columns fit on an 80-character printer.

SoftCalc cannot receive data from any other program in the package, nor can it transfer data to SoftTerm or SoftBase. It can transfer only to SoftWriter. You can transfer only one window (8 columns, 14 rows) at a time. From SoftWriter, you can move data to the other programs, if necessary.

### SoftTerm 3.2

SoftTerm is the best program in the package. Communications is not an easy subject for the novice, and the manual does a good job of explaining all the features. Unfortunately, one glaring typo misstates the control key sequence (shift/down-arrow) for the program. Beginners might have difficulty with this error.

Most of the important features of a good terminal program are here. There is one substantial problem, though: The program has only a 10K buffer. Ten thousand characters are the most you can receive or transmit at a time, a limitation that could easily cause problems when sending or receiving word processor documents or Basic programs. All data transfer is in ASCII, and a modest Basic program, when converted to ASCII, can easily exceed 10K.

Through the command mode menu you can set the printer on or off, set screen size, carriage and line-feed suppression, upper- or lowercase, number of nulls, display scroll, and keyboard echo. You can save the 10K buffer to and from disk. Baud rate, word length, stop bits, and parity—terms that are fully explained—are all adjustable.

The SoftWriter and SoftTerm programs both use the same buffer. You can prepare a document in SoftWriter, then go to SoftTerm to transmit it. You can also load any other document into the buffer, even if not prepared by the word processor. Files must be in ASCII format before you load them. A special utility program on the disk converts binary files (machine-



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language programs) into ASCII for transmission.

SoftTerm provides translation tables through which you can change the ASCII value of any incoming or outgoing character. The autodial feature is handy for redialing a busy number. You can also store frequently called numbers. A modem loop test checks if the RS-232 interface is functioning.

**SoftWriter 3.2**

At its price, SoftWriter is an adequate word processor. Like SoftTerm, the limit on document size is 10K—fine for letters, but too short for many manuscripts.

You'll want to use the special cursor-control sequences because simply pressing an arrow and holding it down results in slow cursor movement. There is no command to take the cursor directly to the beginning or end of a document, or to the left and right margins of a line. There is a function to go to the top and bottom of memory within the 10K storage area.

However, using the Top Memory command will not necessarily put the cursor at the very beginning of the document; rather, it jumps to any position in the first screen. Going to the end of memory may or may not be anywhere near the end of the document. Having cursor movement to the two ends of the document would be especially helpful because printer control codes must be embedded at these locations before anything can be printed.

Most of the word processor functions use the control key on the Model 4 or shift/down-arrow keys on Models I and III, and, occasionally, the clear key. Some of the controls are logical, such as control-D for delete. But with Delete, you press the L key to delete a character, and the R key to delete a line—no logic there; nor is there any logic to control-E for insert.

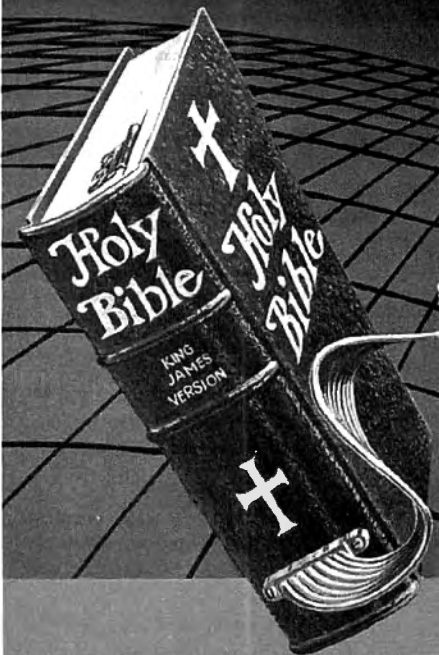
The insert function is very slow, and should not be attempted for more than a few characters. If a lot of text is to be inserted, first open up space by inserting blank lines, then type as usu-

al. The typing speed allowed by the program in edit mode is more than adequate for speed typing.

You can type text with or without word-wrap, but if you turn it off you must watch the screen and press the enter key at the end of a line, or risk words breaking in the middle. With wraparound on, words move intact to the next line automatically. This is very rapid, but there are limitations. When the program takes a word to the next line, it apparently inserts spaces at the end of the first line. As long as you stick with the original format, this is fine. But if you make the margins longer on a printout, these extra spaces will remain in the text. Also, if text is copied from one position on the screen to another, the wraparound spacing will remain as before.

Right justification is available on screen and in the printed document provided the margins are not changed from the screen size. At a screen width of 64 characters, the TRS-80 is actually about right for most documents, so this limitation may not be a problem.

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Global search is fast and supports wildcards but Replace has a bug in it: If you substitute a long word for a shorter word, the excess characters remain in the document, tagged onto the end of the replacement word.

SoftWriter's useful features include: automatic uppercase for typing file names when saving and loading, a disk directory available from within the program, and the ability to scan 12 lines of any document without disturbing the program in memory.

An unusual command counts the length of a document in characters, words, and sentences. On screen at all times is a display of current cursor position, in number of characters from the beginning. The position in the line from the left margin is also continuously displayed. The line number is not given.

SoftWriter fully supports Okidata, Gemini, and Epson printers. A "standard" parallel driver handles most other brands, but not with special features like underline or bold.

Before printing, you must mark the

*An unusual command counts the length of a document in characters, words, and sentences.*

document's beginning and end. There is no default; an unmarked document will not be printed. The end of printing mark may be of several types: stop with form feed, stop with line feed, and stop with printer head frozen. With these commands, you can patch together sections of a document to print as a unit. Automatic pagination is available.

You can change printer defaults of page length, left margin, line length, line space, and so on. But beware of changing line length because of the previously explained justification and

word wraparound problems.

SoftWriter can exchange eight lines of text at a time with SoftBase. With SoftCalc, it can receive 14 rows and eight columns of data; it cannot send data to SoftCalc. SoftWriter may send/receive all 10K of buffer to Soft-Term.

**Documentation and Support**

The program manual is attractively bound in a small size three-ring padded binder with a separate section for each program. The print is small and difficult to read because of blotchy letter quality. The manual appears to have been photostatically reduced from dot-matrix print.

The manual's content is sufficiently detailed, but could be improved with more summary tables, listing program commands in one place. Headings are difficult to pick out from the text. There are a large number of typographical errors. A complete glossary of computer terms in the back is a nice feature.

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program are free to registered owners. This unusual policy includes enhancements as well as updates to correct errors.

Two disks are provided in the package because the software is copy-protected. If one disk is damaged, return it and use the other in the interim. A phone number for a user bulletin board lets you leave questions for help from the technical staff. ■

## Quick Copying With Clone III

by Bradford N. Dixon  
80 Micro Technical Editor

Clone III isn't, fortunately, a generic copy of Radio Shack's Model III. Instead, it's a Model III disk-duplicating utility that substantially decreases the time it takes to back up disks. Yet the promises the manufacturer makes beyond simple back-ups, like being able to duplicate disks with unusual formats, are largely unfound-

ed, and I don't recommend the product's ability to do more than make fast back-ups.

### How Clone Works

Clone III works only with a two-drive system. As the documentation points out, the time you waste swapping disks doing a one-drive back-up negates the advantage of using Clone III.

Clone III (and its Model I brother, Clone I) copies disks in any DOS format faster than the back-up utilities already on your DOS disks can. In situations where speed and accuracy are important, Clone III is very useful. In a head-to-head test, Clone III copied a TRSDOS 1.3 disk in one minute and 25 seconds; the system's back-up utility took four minutes.

The reason for this difference is that Clone formats each sector just before it copies data to it. So you can take a blank disk and back up your original without having formatted it beforehand. I used Clone III to back up disks of many operating systems besides

TRSDOS, including DOSPLUS, MULTIDOS, LDOS, and ULTRADOS—all with the same reduction in back-up time.

Clone III is easy to use as well as fast. A simple menu guides you

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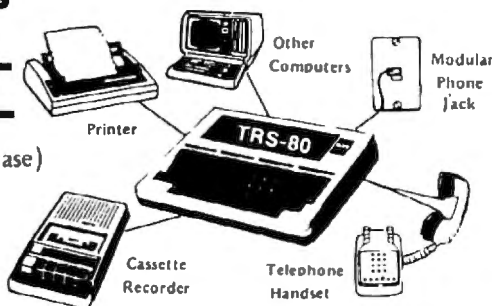
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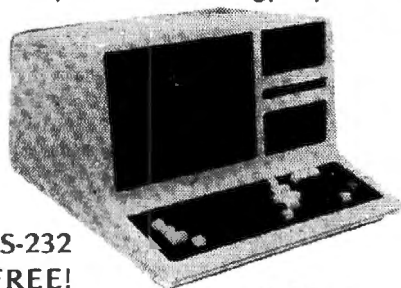
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## REVIEWS

through the process. The utility lets you know the default values for source disk, destination disk, and track count as you respond to the prompts. If your source or destination disk is flawed, Clone III stops duplicating, alerts you to the problem, and identifies the disk on which it occurred. You can find a summary of all the possible errors and their meanings at the back of the Clone manual.

When a disk problem occurs, Clone III asks if you want to retry the back-up, quit the back-up, or proceed from the stopping point. If you want Clone III to proceed, it takes a best guess about what the data should be and continues the back-up.

You'll find the manual equally helpful and understandable in getting the program to back up system and data disks.

### Clone Groans

Beyond the above-mentioned advantages, a number of things about Clone disturbed me. First, the manual implies that Clone III also copies



disks—game disks, for example—with unusual formats. This isn't so. I tried to copy game disks from Computer Shack, Adventure International, and Trend Software—all without success. So if you have specially formatted disks that don't come with a back-up utility, you're out of luck: Clone won't duplicate them. As a matter of

fact, Clone won't even clone itself.

Also, the manual portrays Clone III as being able to copy any disk regardless of density, password, or copy protection. It even goes so far as to imply that you can use Clone III to make copies of Atari 400/800 disks and TRS-80 Color Computer disks on your Model III—a pretty ambitious undertaking, I thought. So I tried backing up a Color Computer disk and found that my suspicions were correct: I couldn't back up a CoCo disk on my Model III. For this review I didn't venture to copy Atari disks, but I suspect the results would have been the same.

As if the misleading implications about Clone III's abilities weren't enough, the manual includes a one-page glossary of badly defined computer terms (for example, "bit" is defined as a binary number [base two]) in an effort to help you get more from the product. In essence, the glossary adds nothing more than another page to the program's simple operating instructions. ■

## REVIEW DIGEST

**Portacalc**, Skyline Marketing Corp., 4510 W. Irving Park Road, Chicago, IL 60641, Model 100, \$69.95.

"...The...package is, in fact, a 3-in-1 software set. In addition to the spreadsheet, two utility programs—a file formatter and printed text formatter—are included.

"...Although Portacalc's operation is simple and straightforward, the program is slow...it's a large program (7K bytes) written in BASIC. Even worse, loading the program is a time-consuming process." *Popular Computing*, May, p. 174.

**TRS-80 Model 4P**, Tandy/Radio Shack, One Tandy Center, Fort Worth, TX 76102, \$1,799 (64K, two floppy-disk drives).

"...This compact transportable computer is an excellent performer, able to use both Radio Shack's TRSDOS and third party CP/M 2.2.

"...The Model 4P's cabinet has to be the best-thought-out design

for a transportable computer anywhere.... The keys have the sculpted look of the IBM Selectric II typewriter keyboard and have a very satisfactory 'feel.'

"...Our only complaint...is the same as for most other computers in which thin-line disk drives are used. These drives depend on a mechanical system to pop out disks, which does not always work.... Otherwise, the 4P is a magnificent machine. It runs quietly, without a trace of heat, and is convenient to use and transport." *Computers & Electronics*, May, p. 42.

**DMP-2100**, Tandy/Radio Shack, One Tandy Center, Fort Worth, TX 76102, Centronics parallel interface, \$1,995.

"...The DMP-2100's self-test demonstrates the printer's two strongest assets—its print speed and the high quality of its type fonts.... This machine can print up to an incredible 192 characters per second.... Their resolution is fine enough that you probably need

a magnifying glass to be certain that they are dot-formed instead of typed.

"...This is not a quiet machine. If you are going to use it for fairly constant printing, either in an office or at home, you will definitely want to invest in some type of acoustic enclosure." *Computer User*, March, p. 55.

**Delta-10**, Star Micronics Inc., P.O. Box 612186, Dallas/Fort Worth Airport, TX 75261, \$649.

"...The Delta-10 has a printing speed (in the normal printing mode) of 160 characters per second (cps)...[and] a built-in random-access memory (RAM) that you can program to hold 192 characters of your own design....

"...The Delta-10 is a super-Gemini-10X. It runs 25 percent faster, is rated for continuous duty, has a built-in 8 KB buffer, comes with a serial interface, and can download twice as many characters...." *Computer User*, April, p. 71.

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 MT160L (160cps,serial&parallel) \$557

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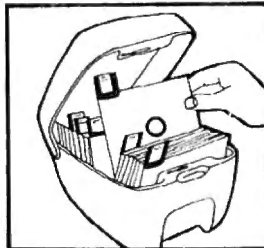
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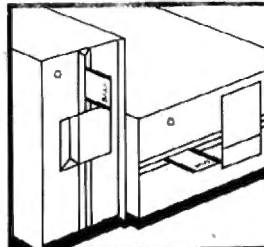
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DISK TABS increase the life of your floppy disks by providing a safe area to write and handle.



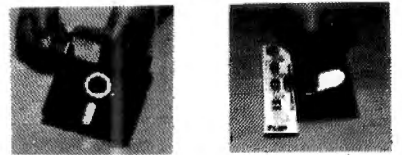
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### Model 16B Programs Available

Tandy Corp. has released three software products for the Model 16B, its multi-user Xenix-based business machine. They are Profile 16 Multi-User Data Base Manager (catalog number 26-6412), Scripsit 16 Multi-User Word Processor (catalog number 26-6431), and Unify, a high performance multiuser relational database manager.

Unify (\$750) is a product of Unify Corporation. Profile 16 and Scripsit 16 (\$499 each) are products of the Tandy Corporation, 1800 One Tandy Center, Fort Worth, TX 76102.

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### Connections

If you find yourself frustrated by switching cables from peripheral to computer and computer to peripheral, you need a Data Director port traffic cop.

With Data Director, a port expander with A-B-C switch routing, you can plug up to three devices into one port, or one device into any of three ports.

The Data Director is available in three models each in its own cabinet with a 19½- by 13½-inch footprint. Model Q23 has a DB25 female RS-232 serial port interface, Model Q24 has the male RS-232 connector. Model Q25 offers a 36-pin Centronics-style interface.

Each model costs \$199 and is available from Computer Accessories, 7696 For-



With Data Director, switching peripherals is as easy as A-B-C.

mula Place, San Diego, CA 92121, 619-695-3773.

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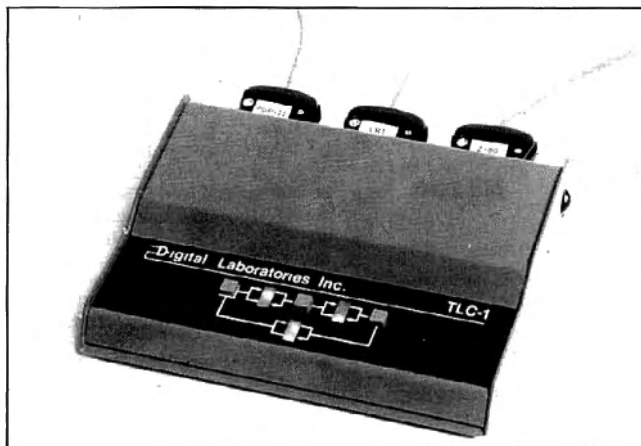
### Mailing List Program

Mail Pro (\$39.95), a Model I/III mailing list program, is designed for small businesses, clubs, and organizations with mailing lists that exceed one disk. With fast B-Tree file structure, it holds approximately 1,400 names per 40-track, double-density disk.

Mail Pro handles five- and nine-digit zip codes as well as Canadian zip codes. Features include a batch addition mode for rapid input, a repeat key for input of repetitive information, global search and replace for massive corrections, machine sort capability for individual lists, and two remark code fields.

Mail Pro is available from Cushman Publishers, 7220 Brandeis Way, Springfield, VA 22153. Virginia residents add 4 percent sales tax.

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The TLC-1 is a three-port active data switch for RS-232 devices.

### Sharing Unlikes

The Digital TLC-1 three-port active data switch lets two RS-232 devices share a third and also communicate with each other. Simple to use, it accommodates any transmission format at any rate up to 19,200 baud. A six-button control panel controls connections without switching transients.

The TLC-1 (\$245) makes proper connection between the transmitted and received data pins for any combination of data communication equipment and data terminal equipment. It permits 64 possible connection combinations, and monitors all data paths by six LEDs.

For more information, contact William Kahn, Digital Laboratories Inc., 600 Pleasant St., Watertown, MA 02172, 617-924-1680.

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### A Real CAD

T.CAD software, designed for draftspersons, engineers, architects, and students, gives you computer-assisted drafting (CAD) capability at the cost of a word processor. It runs on a two-disk Model III, 4, or 4P equipped with Tandy's high-resolution screen option.

Developed by an architectural/engineering firm, T.CAD lets you create scale drawings, accurate to 1/160 of an inch, on your micro screen using single key-strokes instead of cumbersome digitizers, light pens, or mice.



# RUN BASIC PROGRAMS AT SUPER SPEED WITH ZBASIC 2.2.

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- ZBASIC 2.2 is now a super tool for business programmers: RANDOM ACCESS FILES, and PRINT USING statements are supported as well as a HIGH PRECISION MATH package (with no rounding problems).
- Special BUILT-IN MACHINE LANGUAGE COMMANDS to increase program operation by as much as 1000 times! Special commands are implemented for fast memory searching (CPDR, CPIR), block memory moves (LDIR, LDDR), inputting and printing HEX numbers, inserting MACHINE LANGUAGE into COMPILED CODE, disabling and enabling interrupts, inverting memory, 16 bit PEEKs and POKEs, and stack control, debug and much more.
- ZBASIC 2.2 compiles the ENTIRE PROGRAM into Z-80 machine language. (Not 8080 code or a combination of BASIC and machine language like some other compilers.) Clumsy LINKING LOADERS, and RUNTIME MODULES are not needed; ZBASIC 2.2 creates a ready to run MACHINE LANGUAGE program.
- NO ROYALTIES imposed on registered ZBASIC owners.
- Typical COMPILATION TIME is TWO SECONDS for a 4K program.
- Use TRS-80 Basic to write ZBASIC programs!
- Compile some existing programs with only minor changes. (BASIC programming experience is required.)
- Fully compatible with both the Model I and the Model III. Mod I compiled programs work on a MODEL III, and vice-versa. ZBASIC works with NEWDOS-80, NEWDOS+, DOSPLUS, LDOS, MULTIDOS, ULTRADOS, TRSDOS etc. (Not TRSDOS Mod I double density)
- BUILT-IN and much improved MUSIC and SOUND EFFECTS commands.
- Improved CHAINING for disk users
- TIMES now available on DISK version. (Mod I only)
- ZBASIC 2.2 now has an INPUT @ command (similar to PRINT @).
- The TAB function will now tab 255 columns on a printer. (BASIC cannot tab past column 64.)
- NEWDOS 80 2.0 USERS can use the CMD "dos command" function! (DOSPLUS may use name "dos command")
- NEW and EASIER to use USR COMMANDS.
- New math functions to calculate XOR and INTEGER REMAINDERS of a DIVISION.
- Logical STRING COMPARISONS are now supported.
- The disk commands INSTR, MIDS ASSIGNMENT are now supported on both DISK AND TAPE ZBASIC.
- DEFSTR is now supported.
- Eight disk files may be opened simultaneously; random, sequential or mixed.
- LINE INPUT#, is now supported.
- Invoke the compiler by simply hitting these two keys: "-"
- NEW 60+ PAGE MANUAL WITH DESCRIPTIONS AND EXAMPLE.
- ZBASIC 2.2 Comes with CMDFILE/CMD program from MISOSYS, to allow appending or merging compiled programs and machine language programs from tape or disk.

## ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

- ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
- ERROR. ON ERROR GOTO, ERL, ERR RESUME.
- No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
- Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
- Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
- SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
- MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

## ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

## ZBASIC 2.2 DEMO PROGRAM

|                                          |                  |
|------------------------------------------|------------------|
| Time to compile and run complete program | : 0 MIN. 2 SEC.  |
| BASIC Execution speed MOD 1, LEVEL II    | : 7 MIN. 34 SEC. |
| ZBASIC Execution speed MOD 1, LEVEL II   | : 0 MIN. 18 SEC. |
| BASIC Program size (WITHOUT VARIABLES)   | : 895 BYTES      |
| ZBASIC Program size (WITHOUT VARIABLES)  | : 2733 BYTES     |

(Remember that the ZBASIC program includes an 1879 byte sub-routine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```

10 ***** ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST*****
20 CLS: CLEAR100: DEFINT A-X: DEFSTR Z: DIM AA(64,24), Z(10): RANDOM
30 AA=100: BB=-1000: CC=3: DD=-3: EE=-9999: ST$="START TIME "+TIME$
40 FOR I=1 TO 127 STEP 2 : FOR J=47 TO 1 STEP -3: XX=POINT(I,J): SET(I,J)
50 XX=(I-J)/CC*(7+I+J) : XX=ABS(INT(RND(I*J)-AA)+7) : RESET(I,J)
60 XX=PEEK(I+J) : POKE15360+I+J, J : OUT255, J AND (3*J): XX=INP(I)
70 ABS=STR$(I+J) : BA$=LEFT$(ABS, 2) : AA(I/2, J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(ABS, RND(3)) : XX=INSTR(1, BA$, "9") : XX=SOR(I*J)
90 BA$=MID$(BA$, 2, 2) : MIDS(BA$, 1, 1)=2 : IF XX THEN 100 ELSE CLS
100 IF LEN(BA$) > 3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT "+++"
110 IF POS(0) < 62 THEN TRON: TROFF: PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$: IF A$="Y" OR A$="y" AND I < 120 THEN PRINT "TRUE.."
130 RESTORE : READA, C, Z(J), D: GOSUB170: GOSUB170: GOSUB170: GOSUB170
140 NEXT : PRINT "": NEXT I: CLS: PRINT$12, ST$, "STOP TIME "+TIME$
150 STOP ***** END OF MAIN TEST LOOP *****
160 DATA 12345, -1, "TEST", -9999
170 ON RND(6) GOTO 180, 190, 200, 180, 190, 200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180, 190, 200, 180, 190, 200, 180, 190, 200
220 GOTO140
    
```

NOTICE ZBASIC 2.0 OWNERS: you can upgrade your ZBASIC 2.0 for no charge. Just send us your original diskette/cassette and \$15.00 with your registered serial number and copy of your invoice. We will send your ZBASIC 2.2 and updates to your manual.

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TRS-80 is tm of Radio Shack, a Tandy Corp.

T.CAD offers a basic version for \$249.95 and an extended version (\$449.95) with professional features such as overlay drafting and zoom.

You can save your plans to disk and edit and reuse them with ease. For precise printouts, T.CAD drives Houston Instrument DMP plotters.

For more information, contact Chris Brozek, CB Microdex, 1212 N. Sawtelle, Tucson, AZ 85716, 602-326-3502.

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## More Games for the II/12/16

All business and no pleasure makes you and your microcomputer a dull couple. So, Kuzel Computer Services (8654 W. Berwyn Ave., Chicago, IL 60656, 312-399-0273), makers of Wormy and 13 other coffee-break classics, has introduced two new games for the Models II, 12, and 16.

Dogfight puts you and an opponent in a battle to rule the skies. Shoot down your opponent's plane or bomb his territory for points while staying clear of mountains and clouds.

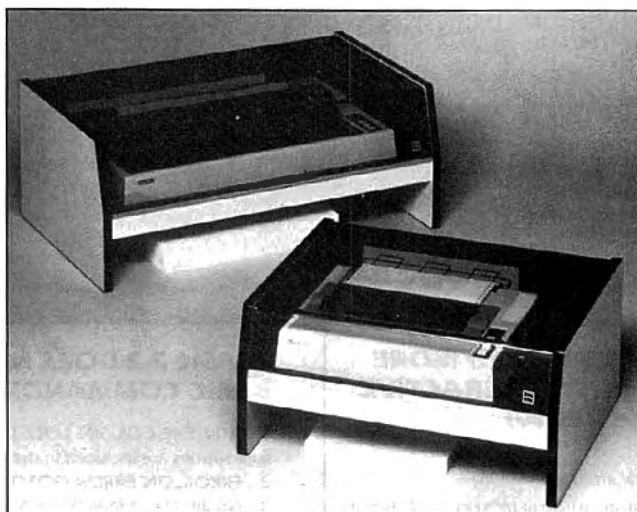
K'Tucky Derby combines greensheet comments, tote-board odds, personal win/place/show wagers, and a graphics simulation horserace to create the excitement of the track.

Each game sells for \$19.95 (\$29.95 for both) on an 8-inch disk.

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## Classy Classifieds On-Line

Dial up the Collector's Data Service, an on-line data base for collectors and connoisseurs of rare and sought-after items, to peruse the stock of a Cairo rug



*If printer noise drives you nuts, consider an accoustical cover for your Epson printer.*

merchant, select your island in the Caribbean, or arrange the sale of a valuable painting.

After verifying your credit card, the service instructs you in accessing any of 20 categories. To make a transaction, leave a message for the seller or contact the owner directly.

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For more information contact Collector's Data Service Ltd., 420 W. Mercer, Seattle, WA 98119, 206-281-7273.

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## Text Power 100

Text Power 100 (\$49.95) is a machine-language print/format program that adds 37 features to the Model 100's text processor.

In 2,504 bytes, Text Power 100 gives your computer automatic vertical centering, page plotting, page break display, merge text, direct exit to edit mode, file memory and parameter memory capabilities. It formats text at 5,000 characters per second.

A disk version (\$59.95) is also available from The Covington Group, 310 Riverside Drive, Suite 916, New York, NY 10025, 212-678-0064.

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## Quiet the Riot

The Quiet-Write Acoustical Cover/Printer Stand dampens sound produced by your Epson dot-matrix printer and raises the printer to provide space for a supply of continuous-feed paper.

The Quiet-Write has a smoke-tinted acrylic cover with a putty-colored laminate base, and comes in two sizes. Model AC0080 (\$89.95) fits MX-80 and FX-80 printers. Model AC-0100 (\$129.95) fits MX-100, and FX-100 printers.

For more information contact Ring King Visibles Inc., 2210 Second Ave., P.O. Box 599, Muscatine, IA 52761, 319-263-8144.

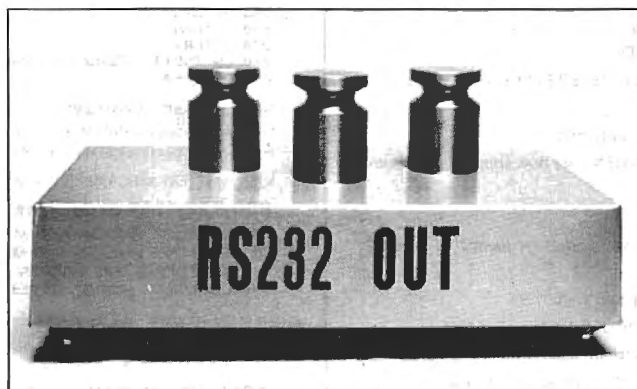
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## Your Weight Here

International Computing Scale Inc.'s new electronic weighing platform determines the weight of anyone or anything up to 200 lbs. The platform, SM232, attaches to your computer through an RS-232 port to give accurate digital output, and comes with application notes on writing your own application program.

It comes in standard weighing capacities of 20, 50, 100, and 200 lbs. or their metric equivalents. Other capacities from one pound to 20,000 lbs. are available from ICS, 23011 Moulton Parkway, Building E-6, Languna Hills, CA 92653, 714-951-9658.

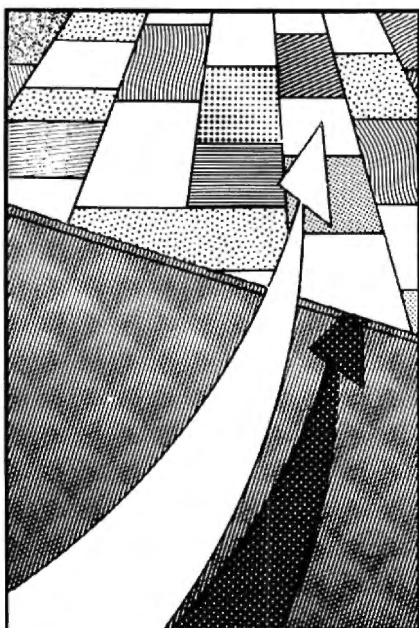
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*Give your TRS-80 point-of-scale capabilities with this RS-232 weighing platform.*

## Game Packages for the Model 100

Micro Software Systems is offering five new game packages for the Model 100. Each package contains three games.



## NEW FIELDS with SBE

Novice or expert programmer: Break new ground with SBE. Southern Software's machine code development system, the compiler's compiler (the ACCEL family of compilers are written in SBE).

- A generalized assembler, easy to learn and to use.
- Programs developed in Basic text buffer using standard tools (such as EDIT, full-screen editor).
- Source files upwards compatible with SBE/IBM PC to produce 8080 (80186) machine code.
- A gold mine of info on ROM; how to build Basic USR routines, or even create new Basic or DOS commands.
- SBE produces relocatable, link-editable, directly running machine-code modules.
- Includes symbolic SBE Debug.
- Translator utility reads existing Z80 machine-code into SBE language.

Write code you can build on! SBE/TRS programs are upwards-compatible with SBE/IBM PC. This is the way to go.

### Don't Delay!

✓ 136

SBE/TRS 48K (all DOS) \$100 + \$3 s/h  
 EDIT/TRS (all DOS) \$40 + \$1.50 s/h  
 SBE/PC (PCDOS) \$160 + \$3 s/h

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# WHAT THE HECK! IS THIS MANUAL TRYING TO SAY?

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**BASIC®** most often used Mod III Disk commands with details, samples, examples ..... \$4.00  
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✓ 175

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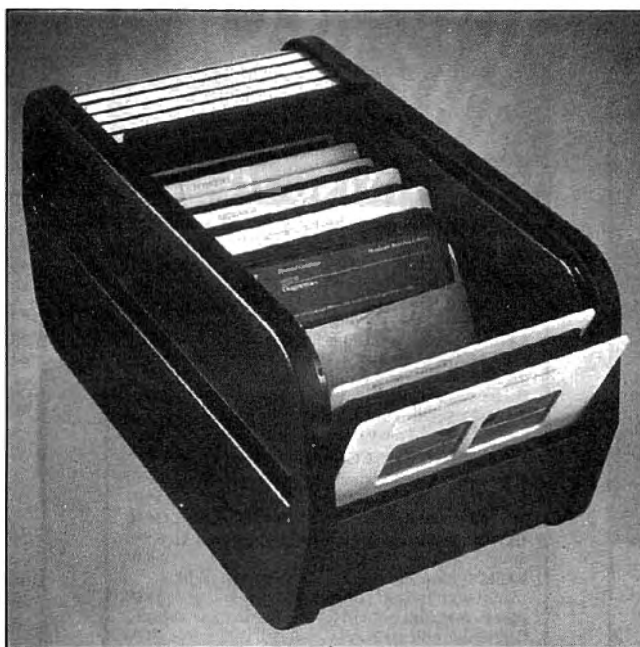
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A preview pack (manual only) is available for \$10. For more information or to order, contact CompuQuote, 6914 Berquist Ave., Canoga Park, CA 91307, 818-348-3662.

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### Portable Plotting

The Portable Statistician (\$99) converts a 24K or 32K Model 100 and a CGP-115 Color Graphics Printer into a portable statistics/graphics workstation.



*This rolltop disk file holds 120 disks and 10 labeled dividers.*

The menu-driven program handles descriptive statistics; t-statistics; one-way, two-way, and repeated measures ANOVA; linear, nonlinear, and multiple regression; chi-square; Fisher's Exact Test; and estimation of the parameters of a mixture of two normal distributions.

In terms of graphics, the program provides histograms, scattergrams, bar charts, line charts, linear and nonlinear regression plots, and normal distribution plots. The program includes a data base to modify and add to records.

For more details, contact Statware, 7413 Lake St., Morton Grove, IL 60053, 312-248-8836.

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### The Switch Is On

T-2000 Converter (\$59), an Assembly-language software package, is guaranteed to convert Model II/12/16 Basic programs to run on the Model 2000 and other MS-DOS machines.

The Z80-based program operates under TRSDOS 2.0. It converts Basic commands and rennumbers all

the line pointers to accommodate the expanded commands of the 2000's Microsoft Basic. You then store the revised ASCII files on a Model 2000 disk.

For more information, contact Grant Communications, 10622 Decatur, Omaha, NE 68114, 402-493-6413.

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### Rolltop Disk File

Keep your disks under-cover and dust-free with the Rolltop 100 Executive (\$39.95). Molded of textured black high-impact plastic, the body holds 120 disks under the rolltop cover. It comes with 10 dividers and color-coded labels.

A locking model is also available for \$49.95 from MicroComputer Accessories Inc., 5721 Buckingham Parkway, Culver City, CA 90230, 213-641-1800.

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### Sixty Educational Programs

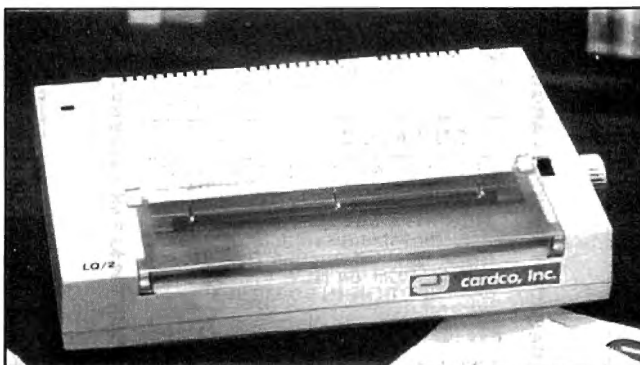
The Ontario Educational Software Project has compiled 60 TRS-80 educational programs from the public domain and added Auto-load, Menu, and Help sub-routines. The programs are catalogued and come in a binder with 11 disks.

For information on how to receive the programs, write William McIlroy, 525 Prince Edward Drive, Toronto, Ontario M8X 2M6, Canada, or Gary Stevenson, Box 163, Bancroft, Ontario K0L 1C0, Canada.

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### Daisy-Wheel Printer

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*Continued on p. 216*



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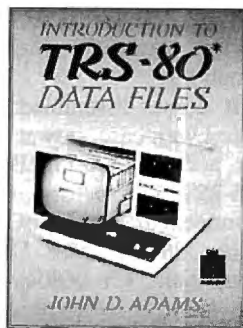
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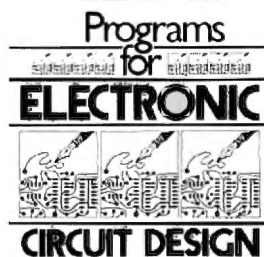
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Continued from p. 212

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The CmC BUSSter RGA connects up to 15 IEEE-488 devices with your computer.

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the magazine for TRS-80\* users

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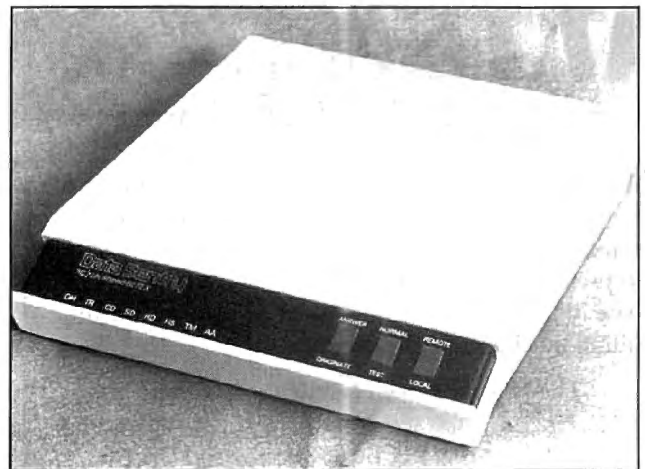
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## NEW PRODUCTS



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an inch to 1 inch, and it can magnify text until each letter fills one page. You can also mix type fonts.

To learn more about Dotwriter 4.0, contact Prosoft, Box 560, N. Hollywood, CA 91603, 818-764-3131.

Reader Service ✓ 567

to stop even the most intricate intruder.

An optional remote-control device (\$145) lets you turn the system on and off by telephone from distant locations. Data Sentry acts as a standard intelligent modem in the nonsecure mode.

For more information, contact the Public Information Office at Lockheed-Georgia Co., Marietta, GA 30063, 404-424-2701.

Reader Service ✓ 576

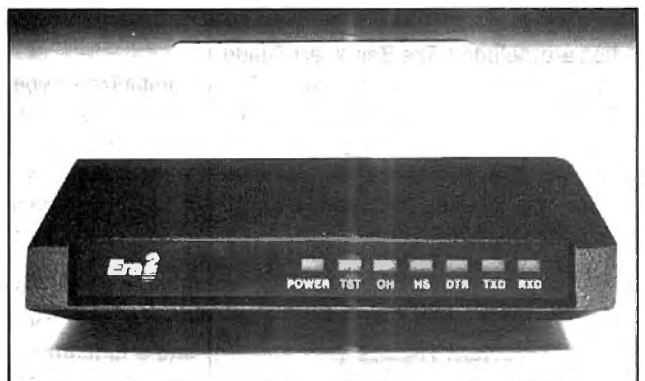
### Trust Buster

Data Sentry (\$895), a 300/1,200-baud, full-duplex, asynchronous, intelligent security modem, puts you one step ahead of hackers and data thieves who try to penetrate your system.

The unit features auto-dial, auto-answer, and auto-speed, and parity selection. In addition, it uses a sophisticated system of call-ups, dial-backs, and passwords

### Correction Connection

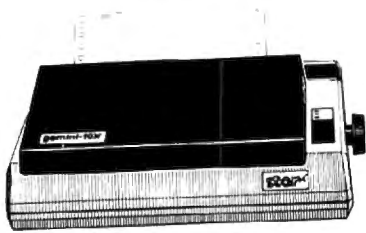
Microcom's 1,200-baud SX/1200 error-correcting modem lets dissimilar terminals, personal computers, minicomputers, mainframes, and other information utilities supporting Microcom Networking Protocol (MNP) communicate.



Microcom's SX/1200 is an error-correcting modem.

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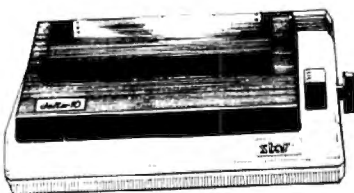
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Same great features as above  
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| PAGT 6 ft. 36/16 pin parallel<br>for TI-99/4A         | 25.00             |
| RS10A 10 ft. 25 pin<br>standard RS-232C (full loaded) | 25.00             |
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| GRAPPLER PLUS                                         | 105.00            |
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The Rapid Disk Duplication Program can copy and verify a full 40-track double-density diskette in just 26 seconds. It can format, copy, and verify a diskette in 42 seconds. The program also accepts parameter changes for number of tracks, stepping rate, diskette name, password, and date.

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RAPIDDOS is a new disk operating system that has the ability to read or write an entire disk track in a single revolution of the drive. Versions of RAPIDDOS are file format compatible with Model I TRSDOS 2.3, Model III TRSDOS 1.3, and Model 4 TRSDOS 6.0.

Sample execution times:

|                      | Model I | I  | III | 4    |
|----------------------|---------|----|-----|------|
| Tracks               | 40      | 35 | 40  | 40   |
| Format/Verify        | 28      | 27 | 26  | 26   |
| Backup/Verify        | 30      | 28 | 26  | 25.8 |
| Format/Backup/Verify | 45      | 43 | 42  | 41.8 |

The above execution times assume error-free operation of the disk system. But if there are errors, the Rapid Disk Duplication Program attempts recoveries and displays complete error messages.

The Rapid Disk Duplication Program comes with a manual containing program operating instructions, explanations of error messages, causes of errors, and a description of the operating system.

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Requires 49K Disk System. Specify Model I, III, or 4.  
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| MODEL IV P 1469.00     | ONE DISK       | 2339.00   |
| MODEL 2000 2299.00     | COLOR COMPUTER |           |
| w/HD 3599.00           | 64K            | 259.00    |

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| COLOR DISK 1 | 229.00    |

## PRINTERS

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| GEMNI 15X   | 380.00 |

|         |           |          |           |
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| DMP-110 | \$ 299.00 | DMP-120  | \$ 399.00 |
| DMP-200 | 535.00    | DMP-400  | 999.00    |
| DMP-500 | 1159.00   | DMP-2100 | 1659.00   |
| DMP-420 | 719.00    | DWP-210  | 629.00    |
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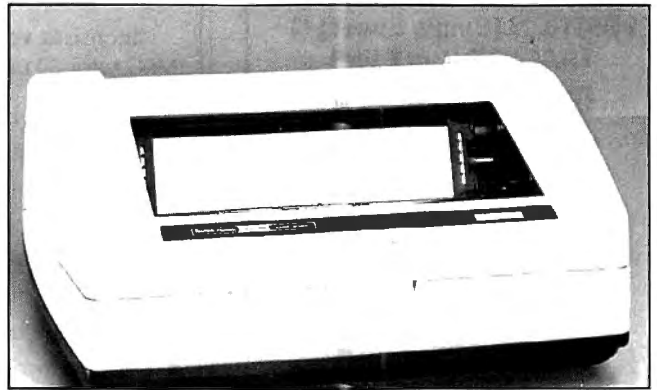
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## NEW PRODUCTS



The DMP-110 triple-mode dot-matrix printer boasts high resolution, bit-image graphics, correspondence-quality and data processing modes for \$399.95.

Use the SX/1200 for data entry, programming, time-sharing, transmitting sensitive data, and using public data networks. Its auto-dial/auto-answer feature stores up to nine telephone numbers.

For more information, contact Microcom Inc., 1400A Providence Highway, Norwood, MA 02062, 617-762-9310.

Reader Service ✓ 577

The less expensive DMP-110 prints 10 or 12 cpi or proportional spacing at 25 cps in correspondence mode. In the data processing mode it runs at 10, 12, or 17 cpi, up to 50 cps in elite, standard, or condensed mode. Graphics mode produces up to 960 dots per line, with dot-addressable 7- or 16-dot columns. It accepts 4- to 10-inch fanfold or single sheet paper.

The LMP 2150, built for heavy-duty processing, accommodates bar codes, labels, enlarged characters, and reverse images. The unit accepts 3- to 16-inch fanfold paper and uses a 1-inch wide ribbon (catalog number 26-1287, \$12.95) good for printing 15 million characters.

See both printers at your local Radio Shack store.

Reader Service ✓ 578

## Two Radio Shack Printers

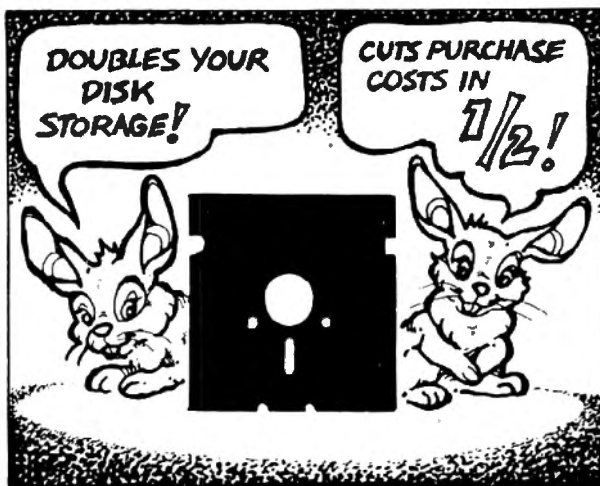
Radio Shack has introduced two printers to meet two segments of the printer market. For the low-end market the DMP-110 triple-mode dot-matrix printer (catalog number 26-1271) runs at 50 characters per second (cps) and offers correspondence-quality printouts, data processing and high-resolution, bit-image graphics, and the widest font selection of any printer in Radio Shack's corral for \$399.95.

For the high-end market the triple-mode line-matrix LMP 2150 (catalog number 26-1272, \$3,995) uses HammerBank technology to print 150 lines per minute (lpm) in data processing mode (80 lpm in correspondence mode).

## Measure Voltage with a Model 100

Humphrey Instruments Inc. (35 Cold Soil Road, Lawrenceville, NJ 08648, 609-896-1612) has devised an add-on to the Model 100 that turns it into an analog voltage reader. The Model 100 A/D (\$580) measures analog voltages with 1 millivolt resolution, accepts digi-

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# The only way to WIN is to ENTER:

## 80 Micro's Young Programmers' Contest 1984-1985

**Grand Prize \$300 and publication**

- 3 1st prizes—\$200 each and publication
  - 3 2nd prizes—\$100 each and possible publication
  - 3 3rd prizes—\$50 each and possible publication
  - Honorable Mentions—Free subscription to 80 Micro and possible publication
- (These prizes are in addition to our regular article price.)

If you're an aspiring programmer, 18 years or younger, enter 80 Micro's 3rd Annual Young Programmers' Contest. Your entry must be for the TRS-80 Models III, 4, or 4P only. Programs will be judged on originality, documentation (more on this below), and program elegance. The age categories are 11 and under, 12 through 14, and 15 through 18. All entries will be judged by the 80 Micro staff.

### Rules

1. Final entries must be received by October 1, 1984.
2. All entries must be submitted in a 10 x 13" envelope and must include: typewritten, double-spaced documentation; a printed copy of the program listing; a magnetic disk or cassette containing the program listing, the documentation, and any figures or tables; and a completed entry blank.
3. Documentation should consist of an explanation of the program, its purpose, how to use it, and the necessary software and hardware needed to use it, including disk operating system (DOS) and memory requirements. (If your entry requires unusual hardware configurations, query us before submitting.) Good documentation also points out the interesting algorithms and program techniques used without giving a line-by-line account.
4. Entries must be original and unpublished.
5. All winning entries become the property of 80 Micro.
6. Your age as of October 1, 1984 will determine the category in which you will be judged. You must not have turned 19 by that date.
7. You may submit as many entries as you like; however, each one must be submitted separately and must include all of the information and materials described above.



### The 80 Micro Young Programmers' Contest

Name \_\_\_\_\_

Age \_\_\_\_\_ Date of Birth \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_

Machine  
(circle one)

- Model III
- Model 4
- Model 4 P

Include this  
form with your  
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Young Programmers' Contest

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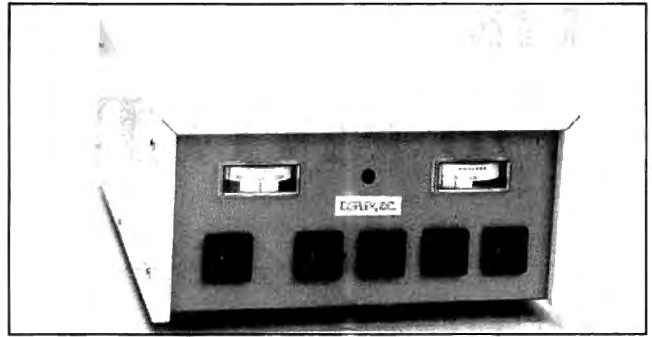
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Displex Inc.'s ac line conditioner eliminates line noise, power drops, and spikes.

tal data 1 byte at a time, outputs single bytes of digital information, or shakes hands with external analog or digital devices—all from Basic.

The unit accepts up to 16 inputs from zero to +4.095 volts through a terminal strip on its front panel. It provides 12-bit output data from its integrating A/D converter. The terminals register +15 volts, -15 volts, and a +1.22 volt potential. Digital inputs, outputs, and four strobe signals, as well as analog input channel 14, are available through a 24-pin socket on the front panel.

The Model 100 A/D comes with logging and test software, a manual with program listings, a 40-pin ribbon cable for connection to the 100's buffered bus, and a plug-in power supply.

Reader Service ✓ 568

structure, and Basic language statements. It also includes a 10-page glossary of more than 170 technical terms.

*Learning and Teaching* is published by Howard W. Sams & Co. Inc., 4300 W. 62nd St., Indianapolis, IN 46268, 317-298-5400.

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### Catch a Wave

Displex Inc.'s ac line conditioner produces clean sine wave outputs by regulating voltage and cutting line noise, surges, and spikes. The units are available with 1KVA (\$775), 2KVA (\$875), and 3KVA (\$1,295) power ratings for 110 and 220 volts, 50 and 60 Hz in single-phase and three-phase configurations.

The unit shuts off power automatically when voltage input goes above or below a preset level. Volt meters and ammeters are available.

For more information, contact Cliff Danielsen, Sales Manager, Displex Inc., Alexander Place, Glen Cove, NY 11542, 516-671-4400.

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### Programming Book

*Learning and Teaching Programming Using the TRS-80 Model III* (\$10.95) by Nancy Lee Olsen, is a no-nonsense course in Basic programming that's simple enough for novices or grade-schoolers to understand, yet sophisticated enough for teaching purposes.

The book describes how to run prepared Basic cassette software, then explains keyboard features, program

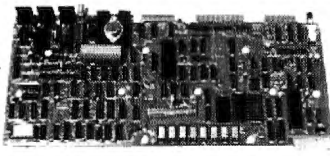
### Brokerage Service Via Modem

Fidelity Investments has unveiled a comprehensive home brokerage service called Fidelity Investor's Express. It lets you trans-

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\*\*RS-232 is optional \*TRS-80 is a trademark of Tandy Corp.

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# SOFTRENDS

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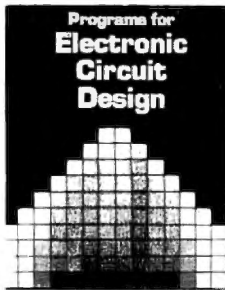


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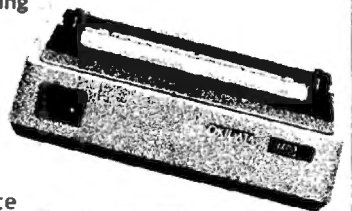
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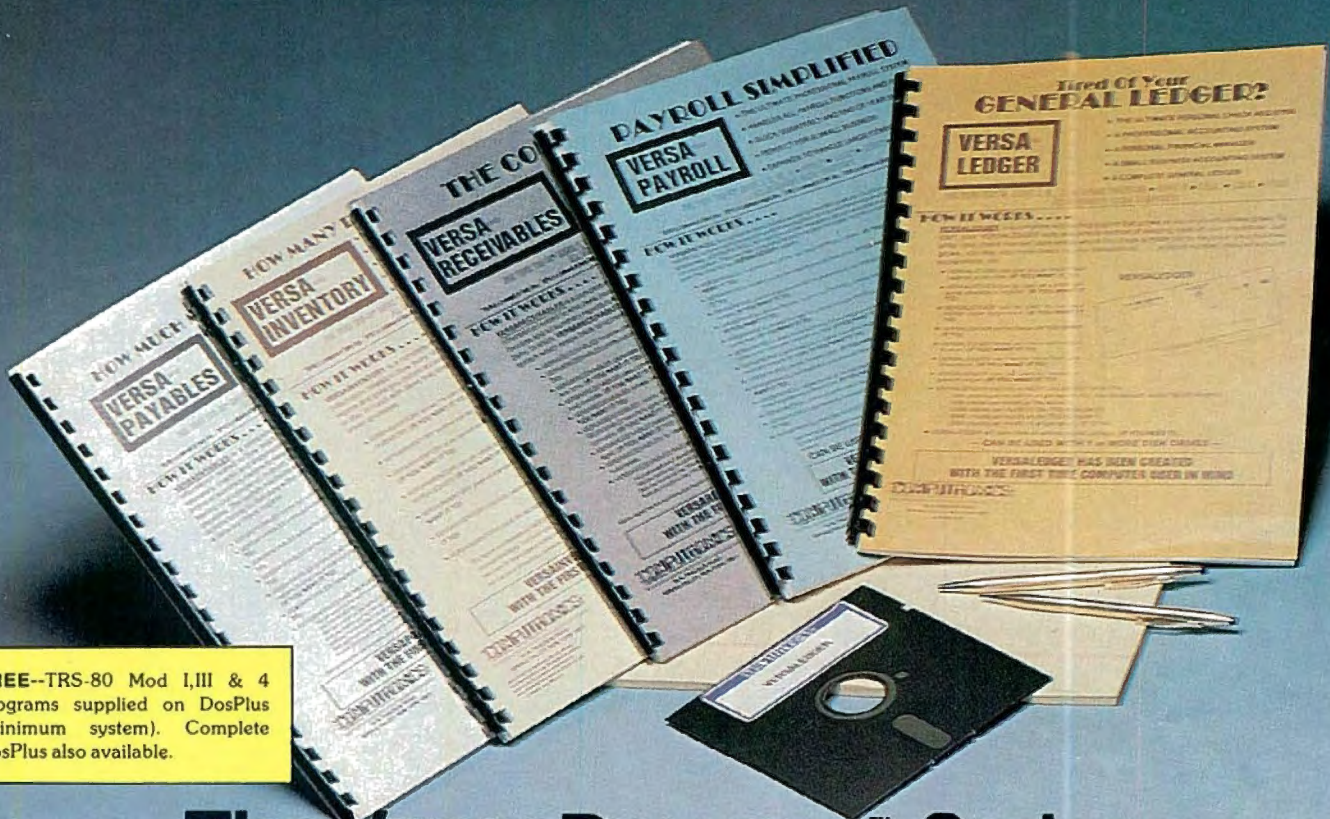


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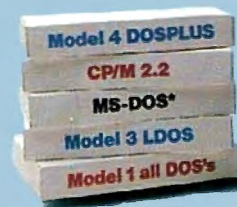
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