

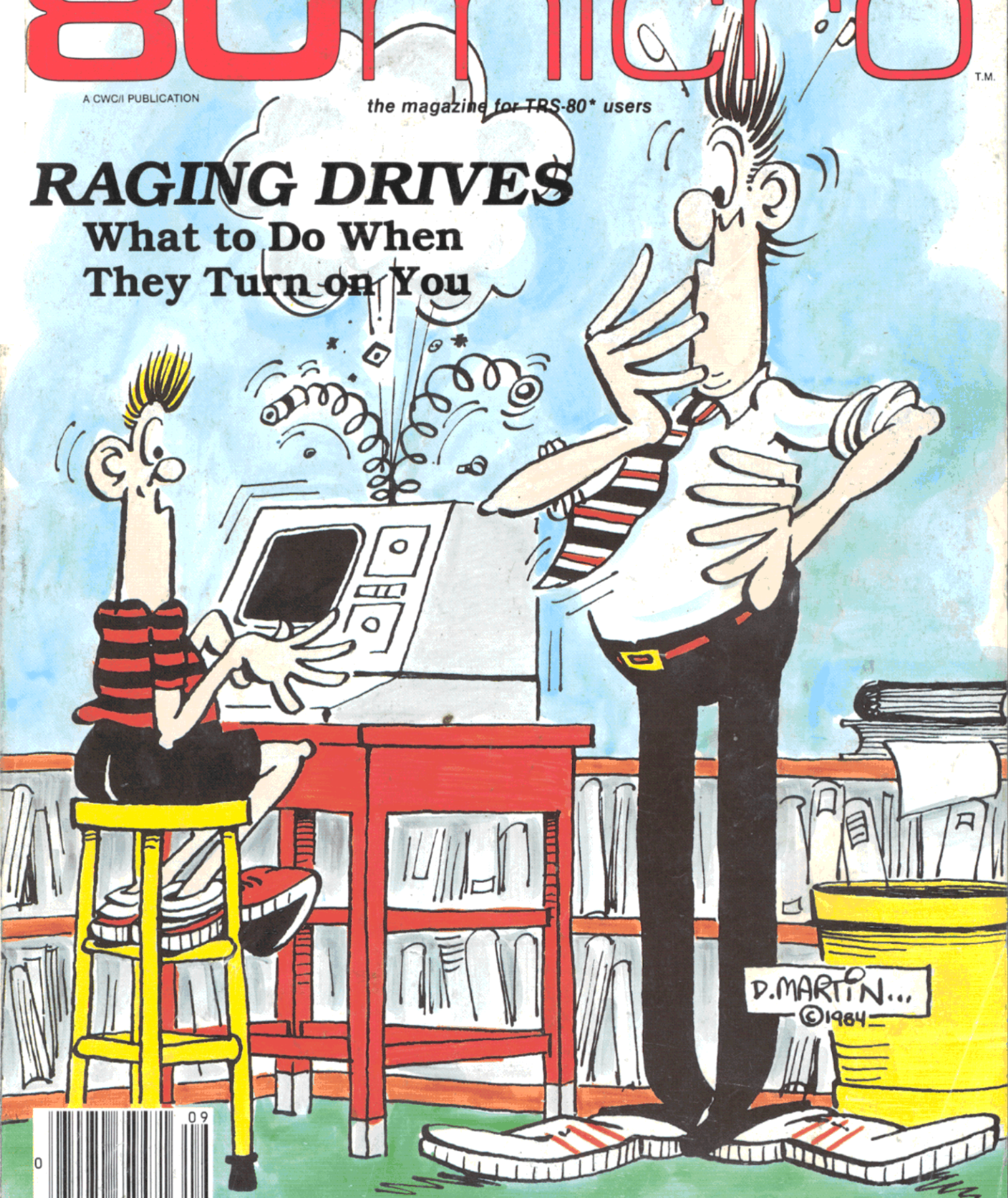
80micro

A CWC/I PUBLICATION

the magazine for TRS-80* users

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They Turn on You



ANNOUNCING



Model 4
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129900

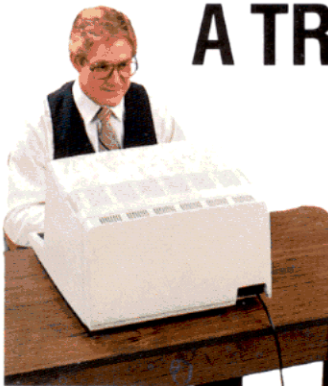
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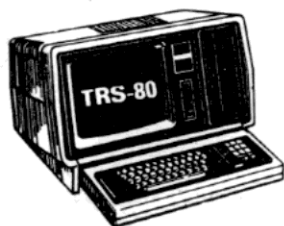
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The left bracket, [, replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in 80 Micro, you should make this change.

80 formats its program listings to run 64 characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of "How to Write for 80 Micro." Payment for accepted articles is made at a rate of approximately \$50 per printed page, all rights are purchased.

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How to do your own simple disk drive repairs—and how to avoid repairs in the first place.
- 72. Keeping Time** by Mark D. Goodwin
Isn't it time you checked up on your disk drive speed? (Models III and 4; Load 80)

Features

- 58. Making Your Selection: Choosing the Right Editor/Assembler** by Hardin Brothers
A consumer's guide to nine popular packages for the TRS-80.
- 86. Taking Stock** by Robert C. Bazzell
Keep your investment records straight and figure your profits and losses. (Models I and III; Load 80)
- 96. The Direct Approach** by Seth Monger
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LOAD 80

Load 80 gathers together selected programs from this issue of *80 Micro* and puts them on a magnetic medium for your convenience. It is available on tape or disk, and runs on the Models I, III, and 4.

Load 80 can be useful to you in several ways. First, all programs are ready to run, and can therefore save you hours of time typing in and debugging listings. Second, Load 80 will give you access to Assembly-language programs if you don't have an editor/assembler. And third, Load 80 can let you build a substantial software library for later reference and use.

Using Load 80 is simple. If you own a tape system, you load the Load 80 tape as per the instructions provided. If you own a Model I or III disk system, you boot the Load 80 disk and transfer the files to a TRSDOS system disk according to simple on-screen directions. If you own a Model 4, you must convert the programs from Model III TRSDOS to Model 4 disk using the Model 4 CONV command.

Not all programs will run on your system. Some Model III programs, for instance, will run on the Model 4 in the Model III mode, but not in the Model 4 mode. You should check the keybox that accompanies the article to find out what system configuration individual programs require.

Space permitting, we try to provide both the object and the source code for Assembly-language programs. The source code will let you examine and modify the program if you own an editor/assembler; the object code will let you run the program directly from your TRSDOS disk.

This page contains a list of this month's Load 80 programs. If you have any questions about them, call Keith Johnson at 603-924-9471.

Yearly subscriptions to Load 80 are \$199.97 for disk, or \$99.97 for cassette. Individual loaders are available on disk for \$21.97 or on cassette for \$11.47, including postage. Direct subscription problems or orders for Load 80 to Lori Eaton, c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

Directory

Timer

Article: Keeping Time (p. 72)

System: Models III and 4,

32K RAM

Language: Assembly

Test the timing of your Model III and 4 disk drives. Disk filespec: Model III: TIME3A/SRC (source code), TIMER3/CMD (object code). Model 4: TIME4B/SRC (source code), TIME4/CMD (object code). Source code requires EDTASM. Cassette filespec: Model III: TIMER3.

Stock

Article: Taking Stock (p. 86)

System: Models I and III, 16K

cassette, 32K disk

Language: Basic

Keep track of stock investments by entering buying, selling, and current-price information on your investments.

Cassette filespec: B. Disk filespec: STOCKVAL/BAS.

Sample

Article: The Direct Approach (p. 96)

System: Model 4, 64K RAM

Language: Basic

Access the Model 4 screen and keyboard without using PRINT@ statements or TRSDOS 6.0 Restart routines.

Disk filespec: SAMPLE/BAS.

List

Article: BBS Express (p. 122)

System: Models I and III,

48K RAM

Language: Basic

This BBS Express file management module stores bulletin board system information in sequential files.

Cassette filespec: C. Disk filespec: LIST4/BAS.

Macro

Article: The Next Step

System: Models I and III,

32K RAM

Language: Basic/Assembly

Add macros to standard source code from special library files.

Cassette filespec: D. LISTIN. Disk filespec: MACRO/BAS, MACRO/SRC (source code). Source code requires EDTASM.

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506

Mind Space vs. Retail Overload

Mind space. It's an interesting phrase, and it identifies one of the major problems facing computer retailers.

According to Ed Juge, Radio Shack's director of market planning, mind space is "the number of products a retail sales team can demonstrate and support in a professional manner." In other words, salespeople can only effectively sell so many products before they suffer overload.

Juge, writing in the June 18, 1984, *Micro Marketworld*, points out that retail managers can expect a salesperson to become familiar with 30 to 50 software/CPU combinations. And that, he feels, is "simply not a reasonable expectation."

The problem is all too familiar to many Radio Shack customers. Walking into a Radio Shack store is an adventure: You never know whether the salesperson will be knowledgeable or ignorant, helpful or rude. Even the ones who have some savvy rarely know everything about every TRS-80 computer, peripheral, and software product. Also, even when your salesperson knows his stuff, you can never be sure that he'll be there in a year when your system breaks down or you want to buy some support products.

Juge offers several possible solutions. First, he says, store personnel could each be responsible for a specific number of products. Second, stores could make available to customers commercial programs and documentation for hands-on examination. And third, Juge suggests self-running, in-store demonstration programs.

But each solution has its drawbacks. Dividing responsibilities among personnel doesn't work if you have a small staff. Demonstration software doesn't address the problems accompanying hardware. Also, as Juge points out, "the expertise for after-sale support is still missing."



And finally, this solution overlooks the natural desire people have for human contact. Would you want to go to a car dealer if no one was there to answer questions before and after the test-drive?

In the end, perhaps the only effective solutions are good training and quality control. Radio Shack salespeople should be required to demonstrate a working knowledge of the products they sell. And they should be required to show periodically that they've maintained their education.

Training is expensive and difficult for a company as large as Radio Shack. But the rewards are happy customers with a long-term commitment to Tandy products.

The Model 100 Market

The press coverage for the Model 100 has far exceeded that computer's success. The 100 was the first popular, truly portable computer. It's an elegant, well-made machine. But Radio Shack hasn't been able to sell it in quantity to the consumer market.

The reason why the 100 has received so much attention is simple. The machine is being used primarily by journalists. And journalists like to write about what's under their noses.

Tandy may have accidentally stumbled on a new marketing strategy. If you're going to pick a vertical market to sell to, pick writers. You may not sell as many machines as you'd like, but you'll get a heap of good publicity.

Ask Tandy

Coming soon in *80 Micro*: "Ask Tandy," a question-and-answer column that will let you query Fort Worth directly about their products and services. Heard a rumor about a new product? Want to know something about some aspect of Radio Shack's operations? This is your chance to find out from the guys who know the most. Address your questions to Ask Tandy, *80 Micro*, 80 Pine St., Peterborough, NH 03458.

Net Fever

Now for something completely trivial. I've been keeping a running list of company, product, and service names ending in "net." I'm up to 80. For what it's worth, here they are:

AGNET, Accunet, AllNet, Alternet, Applet, Arcnet, Arpanet, Avnet, B/C-Net, Biznet, C-Net, COMNET, Copynet, CSNet, Cullinet, Davox-Net, Deafnet, Decision Net, DECnet, EdNET, Edunet, Energynet, Ethernet, Execunet, Exo/Net, Fordnet, FundsNet, Futurenet, GAS-Net, GENet, Hamnet, Hermetnet, HiNet, IBS-NET, IDEANet, Internet, Lightnet, and Litho/Net.

Also, M/Net, Macomnet, Mailnet, MARK-NET, MCFIS/NET, MedNet, Miconet, MicroNet, MITRE-NET, Mouse-net, Multi/NET, Omninet, PACnet, Pacxnet, PerComNet, PCnet, PETnet, Phonenet, Photonet, Pixnet, Powernet, Primeret, Pronet, Rapidnet, Sharenet, SiteNet, Special-Net, Synet, Telenet, 10-NET, Terminet, Texnet, 3BNet, TRX-Net, 12/net, Tymnet, Video Net, Vim/Net, Wordnet, X-NET, Z-NET, and Zero-Net.

Try sorting that list with CMD "O". ■

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Small Is Better

Radio Shack's TP-10 printer would be useful if it had a parallel data feed to accommodate the Model 100. Although such a printer can't replace my Okidata 92, its quiet thermal technology would do a great job late at night when others are sleeping, and is ideal for a crowded office.

Pass the word to Tandy that small computers need small printers. Perhaps their market researchers don't know that some of us do little word processing, don't use spreadsheet programs, and aren't interested in insipid games driven by random number generators.

John L. Wright
Cortland, NY

Off the Mark

I welcome all benchmark timing articles, such as Beve Woodbury's "Marking Time" in the May 1984 issue (p. 96), but in one area most of these tests fail.

Microsoft Basic, used for these comparisons, has hidden features that can give misleading results. For example, the computer can store and process numbers as 2-byte integers, 4-byte single-precision numbers, or 8-byte double-precision numbers. However, it takes longer to process an 8-byte double-precision number than a 2-byte integer.

Most benchmark tests involve counting loops, so all the loops use 2-byte integers (or the most efficient variable type for the machine) for comparison.

Woodbury chose, like most other testers, to use the default variable type for the counting variable. This works, to the extent that the machine completes the process, but it isn't fair to machines like the Model 100 in which variables default to 8-byte double-precision.

This explains why the Model 100 showed poor results.

Merrill Cook
Masonville, NY



Kudos

I've been reading *80 Micro* since it started and have heard all kinds of problems with the Model I. I bought my Model I in July 1979 and have had only two problems with it: a video RAM chip that was under warranty and a bad power supply that cost \$21.10 to replace.

My Model I has been with me for four years and is more reliable than any other piece of electronic equipment I own. *80 Micro* and its advertisers have helped my system grow from infancy to adulthood. I have learned more about my computer from your magazine than any other source.

I guess I'm trying to say "Thanks." I wouldn't trade my Model I for anything.

Jim Bohan
Tucson, AZ

Electric Webster Redefined

In response to Mr. Scholl's letter in the May issue (p. 12), I'd like to clarify the operation of Electric Webster (EW) with SuperScript.

When you use EW with SuperScript, it displays all words that you choose to correct in the text before you can correct them. If you use the dictionary display feature to find the correct spelling, you must wait until the word appears in the text before making the correction.

In the optional Grammar and Style feature, EW limits you to marking

grammar and style errors for future correction instead of making the corrections instantly.

When ordering EW, it's important to specify the machine and word processor you are using.

Phil Manfield
President
Cornucopia Software

Mail-Order Kudos

With all the attention given these days to disappearing vendors and poor service, I'd like to comment on my good experiences.

Over the past three years I've bought hardware and software from more than a dozen *80 Micro* advertisers and received all goods promptly. Everything works as advertised, and communications with these companies is courteous.

Also, Hardin Brothers' "The Next Step" is an excellent column—probably the most educational feature ever presented by *80 Micro*. Roger Smith's contributions are also excellent. Please thank them for me.

Ronald R. Ostromecki
Erie, PA

Great Expectations

I have been reading *80 Micro* for several years now, and each issue shows evidence of the magazine's metamorphosis.

I've seen the loss of a few old friends such as Color Computer and Model II/12/16 support, The Gamer's Cafe, Fun House, and Reload 80.

Though I'm sad to see these go, I am happy to see some new features, including clearer typesetting, better organized table of contents, more and better articles on the Models I/III/4, and easier to understand product reviews.

As I sit back savoring each issue, I'm still intrigued—what changes will there be next issue?

Mark Rife
Baltimore, MD

What would you like to see?—Eds.

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Peelings II

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—Michael J. Miller, 12/83

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Don't Forget Montezuma

We enjoyed the "DOS Dilemma" article (July 1984, p. 48), but were astonished that you left out Montezuma Micro's CP/M 2.2, which was available for the 4/4P six months before Radio Shack delivered CP/M Plus. Our CP/M has received the highest ratings in reviews by the press and from our users.

Unlike Radio Shack's CP/M Plus, 2.2 fully supports double-sided and other types of drives; includes a communications program; can read, write, and format over 25 different manufacturers' CP/M formats; and can run most CP/M programs available. It has more disk and user memory space, is easier to use, and offers faster boot and back-up times.

Our latest release allows user-programmable keys, high-capacity data disks with standard Radio Shack drives, fast back-ups, and automatic memory disk drive on 128K machines.

The major advantage of CP/M 2.2 is that it lets users tap into the vast store of software available. It offers the user not just another DOS but another computer—he can run CP/M software written for such 8-bit systems as the Kaypro, Hewlett-Packard, and DEC. CP/M 2.2 is still the standard; we know of no popular software that requires CP/M Plus.

It is disappointing to see the bible of the TRS-80 world present only half of the facts to its readers. They've been deprived of the whole CP/M story as it applies to the Model 4/4P.

John Lancione
President
Montezuma Micro
Dallas, TX

Thanks for the information. Our intent was not to slight Montezuma's CP/M, which reviewer John B. Harrell gave five stars in our March 1984 issue (p. 94). Readers interested in 2.2 should refer to that review or write Montezuma at Redbird Airport, Hangar #18, P.O. Box 32027, Dallas, TX 75232.—Eds.

Rough Start

Radio Shack has duplicated its "exceptional" marketing of the Model 16 by selling an operating system for the

Model 4 that doesn't work as described, and for which no software is available.

CBASIC, advertised since last spring, is still unavailable. In addition, few of the escape sequences listed in the manual work.

The manual is especially misleading regarding CP/M Plus programs, since Radio Shack hasn't offered any programs for CP/M Plus. I'm having trouble finding other CP/M vendors that supply material for CP/M Plus.

I've written to Radio Shack numerous times and have yet to receive a satisfactory answer.

Nate Salisbury
New Bern, NC

It is true that Radio Shack's CP/M Plus has had problems since its long-awaited release. According to Radio Shack's Doug Dilhoff, the bugs will be fixed and an updated version available by the time you read this. With accurate instructions, the Escape sequences do work.

Dilhoff also notes that Radio Shack never said that they would provide additional software for CP/M Plus. He suggests calling an independent distributor such as Westico which sells CP/M software for the Model 4. Westico is located at 25 Van Zant St., Norwalk, CT 06855.—Eds.

Re-View

After reading Carl Oppedahl's review of my book, *Computer Buyer's Protection Guide* (June 1984, p. 218), I realize that many of his criticisms are judgement calls. This is evident in both his statement on finding the best price for goods and the discussion on non-goods software warranties.

With competition being what it is, the cost difference between a store with a toll-free number and one without is minimal. After you add in the cost of calling long-distance to discover the best possible price, any savings that might have existed have disappeared.

As for non-goods software, Oppedahl feels that I failed to explain the rights of non-goods software buyers. Non-goods software is custom software, which is not widely offered in the micro world.

The Uniform Commercial Code (UCC) does not apply to custom software as it is considered a service. Therefore, the buyer's rights depend solely on the negotiated contract between the two parties.

Contrary to Oppedahl's review, Radio Shack can't disclaim all warranties by stating that its software is sold "as is" or "with all faults."

Express warranties are created in a variety of ways. The most prevalent is by affirmation of a fact promise. This affirmation does not have to be in the form of an explicit promise, but rather can be created by advertising literature, trade journals, and instruction manuals, to name a few.

Regarding buyer recourse when a product doesn't work as stated, I outline an effective policy in my book, aimed at protecting the consumer. I strongly suggest that Carl Oppedahl reread *Computer Buyer's Protection Guide*.

L. J. Kutten
La Jolla, CA

I'd like to clarify some specific issues Kutten raises. First, I reject Kutten's proposed boycott of merchants without 800 numbers. Toll-free numbers are expensive, and oftentimes the best prices are found at stores without 800 numbers.

Because Kutten devotes three chapters to the legal rights provided by the UCC, I am concerned that the reader will incorrectly conclude that all buyers are protected by UCC rights. Unfortunately, UCC rights apply only to consumers who have bought "goods," a term defined before microcomputers existed.

In terms of "as is" warranties, I simply meant to point out that these words are used often, rather than seldom. Radio Shack, for instance, routinely uses such language.

In closing, I will reassert my original conclusion that "shortcomings notwithstanding, the Computer Buyer's Protection Guide is well-written and informative."

Carl Oppedahl
New York, NY

Send correspondence to Input, c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

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Q■ It appears that E.F. of Augsburg, Germany (January 1984, p. 28) has the same machine as I: a Model III with VR Data drives and controller. I converted mine to work on a 220-volt, 50-cycle current.

To do so, you should first step down the local voltage to 110 volts with a step-down transformer.

Second, rearrange several video sync circuit straps/jumpers. According to the Radio Shack service manual and my experience, you must make the following strapping arrangement on the main circuit board: Jumper A to B, D to E, M to L, and G to H. It might be necessary to strap V to W and CC to BB. These straps are small, about 1/8 by 3/8 of an inch, with the long dimension standing out from the circuit board. They slide over two of three pins, either up/down or right/left. Make the changes under a strong light as it's difficult to read the designations on the circuit board.

The third change is the program HZ50/CMD. It modifies the TRSDOS clock to operate at 50 Hz instead of 60 Hz. TRSDOS 1.3 works without the modification, as does LDOS and NEWDOS. The clock loses time on each disk access, so HZ50/CMD is worthwhile only if you need an accurate clock and don't read/write disk files with your programs. (*J.L. Kissel, Isleworth, Middlesex, England*)

Like E.F., I had trouble with spurious disk activity after my computer arrived in Europe. I'd had a long history of reboots and nondestructive restarts caused by the J-4 (CPU power) connector, and shipping the unit was apparently the last straw. The solution was to reseal all the cables between the disk controller and the CPU board and to solder the wires onto J-4 from the computer power supply.

The switching power supplies in the Model III aren't sensitive to 50 Hz



power. They and the disk drives should operate normally with a step-down transformer. I've had only one problem: My nonstandard drive power supply is linear and the transformer's magnetic field causes the right half of the video screen to oscillate slightly at 50 Hz. (*CW3 Larry Bourne, APO NY*)

Over the last year or so I've read several letters about operating a TRS-80 in Europe. I'm a serviceman stationed in Worms, Germany, and I own a Model III with two drives, one a single-sided 40-track unit and the other a double-sided drive. With the aid of an external transformer (220V to 110V), my system works just fine. A friend living near Stuttgart has used a dual disk Model III for over 18 months on a transformer like mine without a problem. We feel you don't need fancy electronic solutions to operate in Europe.

Now for my question. A while back I began getting CRC errors on disks in drive 1; I think head alignment problems are the cause. Who in Europe can repair Tandon 40/40 drives? Radio Shack can't. If I'm forced to go stateside for repairs, whom would you recommend? (*Donald Brown, APO NY*)

A■ And there you have it, folks: four people using Model III's in Europe without problems. That should take care of that question.

To Donald Brown: Offhand, I can't help you with the double-sided Tandon drive. If you don't mind going into the machine yourself, and you have the technical manual for the Tandon, contact J & M Systems (137 Utah NE, Albuquerque, NM 87108) about their Disk Drive Analyzer. They sell the program on disk, and it comes with a special alignment disk for testing and fixing your drive's head alignment, motor speed, index hole timing, azimuth, hysteresis, and other important areas. I've seen this program in action, and it actually can replace an oscilloscope in troubleshooting your drive. The program costs \$79 for single-sided drives and \$99 for double-sided drives.

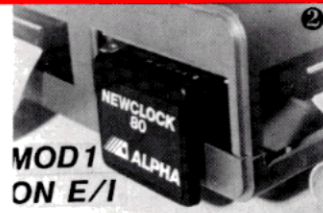
Q■ Have you heard of a program that monitors the line voltage and cycle my Model I is running on? I have to live with erratic diesel generators that usually run anywhere from 58 to 62 cycles and suffer from low voltage periods. Also, when I move to an area with regular power, will my disks still be readable? (*J.R. Lewall, Hartley Bay, B.C., Canada*)

A■ Monitoring the line voltage and cycles requires a hardware device between the supply and the computer, and a program to scan the hardware device for information. I don't know of any such device for the Model I.

You can buy power line monitors, but most run into the hundreds of dollars and only tell you what's happening; they don't do anything about it. Your best bet would be to buy an uninterruptible power supply (UPS) that monitors the power to the computer and uses its own battery for auxiliary power whenever the normal

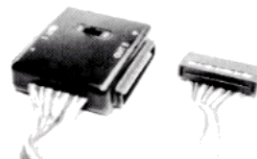
Newclock-80 \$69.95

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Printswitch \$59.00

Do you have 2 printers? Get a Printswitch. Stop plugging and unplugging those printer cables. With the Printswitch, you can have 2 printers connected to your computer and you can select either one at the flick of a switch. Works with any printer, plotter, or device that uses the parallel printer port. Simply plug the 14 inch Printswitch cable into your computer, and plug your existing printer cables into the Printswitch. This is the nicest unit on the market. Superior quality board with gold plated edge connectors. For Models I, III, 4 and 4P.



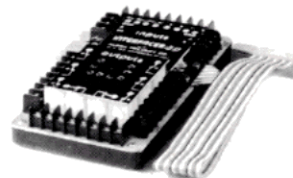
Alpha Joystick \$27.95

When it's time for fun, don't be without your Alpha Joystick. Do you know that most action games are Joystick compatible? Stop pounding on your keyboard and enjoy real arcade control. The joystick can also be used with BASIC programs; simply do J=INP(0) to read the joystick position (8 directions and fire button). Model I: plugs into keyboard or expansion interface. Model III, 4 and 4P: plugs into 50-pin I/O bus. The Alpha Joystick comes fully assembled and tested, ready to plug in and enjoy. (Specify Model I, or Model III, 4).



Interfacer-80 \$159.00

Low cost input and output device. The outputs consist of 8 relays (rated 2 Amp @ 125V), easily controlled using "OUT" commands. For example, OUT 0,0 turns all the relays off. Eight LED's show the states of the relays. The 8 inputs are optically isolated, so it's safe and easy to connect external devices (switches, sensors, thermostats, etc.). Simple "INP" commands read the inputs. Connection: Mod I: 40 pin bus. Mod III, 4, 4P: requires 50-pin I/O bus converter (\$39.95). plugs into 50-pin I/O bus. Comes complete with power supply, cable, and detailed manual. (Up to 8 interfacers can be connected to your TRS-80 using our Y- cables).



Analog-80 \$139.00

8 channel 8 bit Analog to Digital converter. Your TRS-80 can read voltages, temperatures, pressures, light levels, etc. • Input range: 0 to 5.1 Volts. • Resolution: 20mV. • Conversion time: 120 microseconds. In BASIC, you can take up to 100 readings per second. • Port address: selectable. Up to 8 Analog-80's can be connected to your TRS-80 for a total of 64 channels! Connection: Model I: 40 pin I/O bus. Model III, 4, 4P: requires 50-pin bus adapter (\$39.95). Comes complete with power supply, cable, and manual.



Special Cables

Disk drive extender cable (8")...C160:\$9.95

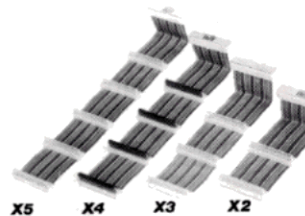
Y-Cable for Mod I bus (40 pin): • X2-40...\$29 • X3-40...\$44 • X4...\$59 • X5...\$74
Y-Cable for Mod 3 & 4 bus (50-pin): • X2-50...\$34 • X3-50...\$49 • X4-50...\$64

Disk drive cable (34 pin): • 2-drive...C162:\$32 • 4-drive...C163:\$45

Extension cable, 4 foot: • For printer and drive (34-pin)...C165:\$22

• For Mod I bus (40-pin)...C167:\$24 • For Mod 3 & 4 bus (50-pin)...C169:\$28

Keyboard to E/I (40-pin, 8")...C161:\$21 If this is confusing, send for our Cable Flyer. Our cables are made with high quality gold plated connectors to ensure utmost reliability.



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power line drops too low to properly drive the computer.

These are expensive, usually \$500 or more, but you're guaranteed that you'll always have enough power to run your computer, even if the main power supply totally cuts off. In the last case, you'll usually have 15-30 minutes of operational time before you'll have to shut down your computer and stop work.

If you can reliably read your disks with such wide power supply fluctuations, you shouldn't have any trouble using them in a normal, steady power line situation.

Q■ I own a Model III and am having difficulty with the USR function in Disk Basic. Each time my program reaches the USR statement, I get one of several weird reactions, from crazy error messages to exit to TRSDOS. I have ensured that the Assembly-language program is correctly loaded, the DEFUSR statement points to the correct starting address, and high memory is protected.

I've tried rebooting, using my original TRSDOS distribution disk, and using every conceivable combination of syntax variations (blanks, punctuation, and so on) in the USR statement, and it still doesn't work. Is something wrong with Basic, or am I doing something wrong? (D.M.W., Lake Charles, LA)

A■ I think you're doing something wrong, but I'm not sure what. The correct procedure for using machine language and Basic is to load the machine-language program into memory from DOS, load Basic, set the number of disk file buffers, set memory size, then load the Basic program. The correct syntax is: DEF USR1=&HXXXX, where XXXX is the hexadecimal (hex) execution address of the routine (for example, &H7D00).

One other word of caution: You can't use the last 2 bytes at the top of memory (&HFFEF and &HFFFF); these are reserved for use by Basic.

The only other possibility is that your machine-language routine is at fault; it's either loading into a different area than you think or it has bugs.

Does anyone else have any suggestions?

Q■ When uploading files from my Model 100 to my Model I, I either lose the first three or four characters of the document, or get garbage in their place. The remainder of the document transfers correctly.

I have used three software programs: Microconnections Smart80D, Omniterm, and LDOS's LCOMM utility—all with the same results. When I tried uploading from my Model 100 to a friend's LNW, however, the entire document was transmitted without error.

At a local user's group I was advised to send nulls. I also tried another cable without success. As per the manual, I'm using a Radio Shack null modem and extender cable. My equipment consists of a 48K Model I with three disk drives and an LNW interface. I've set both computers to 300 baud, even parity, 1 stop bit, and 7-bit word length.

Although this is a minor annoyance, I would like to correct it if possible. Also, how does one insert a null or nulls within a Text document, or after a TELCOM prompt? (William Sones, Cerritos, CA)

A■ I use Omniterm on my Model I under MULTIDOS to transfer documents back and forth to my Model 100, and I've never had a problem with garbage characters appearing (except when the RS-232 connection on my Radio Shack Expansion Interface needed cleaning, or the RS-232 board warped away from its contacts).

Since you've experienced the same problem with three different communications programs (and I assume with more than just LDOS), I think the problem might lie with the LNW interface.

Have you tried sending keyboard data to the Model I before sending the document? If the problem appears every time you start an upload, the problem is probably hardware oriented and you need to discuss it with the LNW people.

If you really want to send nulls, go into Text and create a short, 5-byte (all the same) file called Null. Now use a

short Basic program to locate those 5 bytes in memory:

```
10 FOR I=32767 TO 62000:A=PEEK(I):
PRINT I;IFA>32767 THEN PRINTCHR$(I):
NEXT:ELSE PRINT:NEXT
```

When you see them appear, use the Basic command POKE to replace the three middle characters with CHR\$(0).

Now you can use the Paste buffer to transfer the blank characters from the Null file to your text file, and delete the leading and trailing special characters used to define the null characters.

Q■ In your February 1984 column (p. 17), Stephen Milliken asked about his inability to use dual disks for backing up or transferring data. This is the same problem I had about a year ago.

I wrote a letter to you people in which I expressed the negative feelings I was (at the time) getting from your magazine and the advertisers. One said that the equipment I purchased will not work correctly because Tandy uses bad ICs and other junk not worth mentioning.

The real problem was that the supplier didn't do a complete job in his directions to the installer of his kit. Two grounding problems existed.

What I did was run a ground wire from the chassis of each drive to the third (ground) post of the system (the ground, or safety, wire of the 110V ac supply). Next I took the advertiser's disk drives' power supply and mounted four metal mounting posts (available at any hardware store) to the power supply. The printed circuit board has four spots for doing this (one is a PCB ground).

I then bolted these posts to a piece of flat sheet metal, and put a ground plane under the power supply. I also ran a wire from the ground plane to the system ground mentioned previously. All this properly grounded the power supply, which the drive supplier's directions never said was necessary.

The TRS-80 now works fine. (Griffith Jones, Bath, ME)

A■ Thanks for the information. I'm sure the owners of non-

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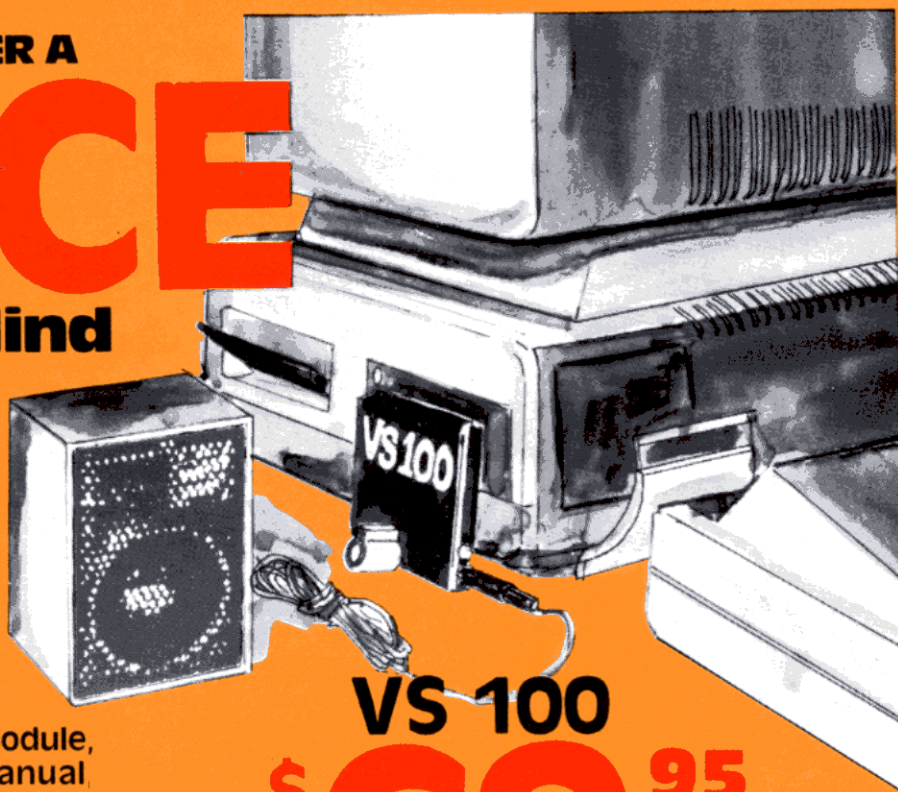
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Tandy drives will check their systems for a properly installed and grounded power supply if they're having erratic drive operation.

Q■ The solution you gave J.S. Bellefontaine in the February 1984 Feedback Loop (p. 22) might not be adequate for his problem. You suggested using TAPEDISK to make the desired back-ups.

Since TAPEDISK is merely two utilities, a tape file loader and a memory dump routine linked together, using it causes two nasty problems. First, you must know the start, end, and execution addresses of the program for a proper disk memory dump. Second, if the program loads into the address space of TAPEDISK or TRSDOS, the results could be disastrous.

In the first case, if you wrote the program yourself, you won't have a problem. However, if you want to use a commercial program or the code from a high-level language like Fortran or Pascal, finding the proper addresses is difficult at best.

What you need is a program that reads the tape file byte-by-byte into a buffer, converts it to a disk core image file format, and saves it to disk.

When I was writing a disassembler, I noticed the need for such a program, so I wrote one called T2D2T, short for tape-to-disk-to-tape. It performs the operations I mentioned above, and it also goes from disk to tape. It's not an LMOFFSET, which also adds a loading routine to the program to let you use the target program with DOS intact, but it will easily transfer System tapes to disk files and vice versa.

It also preserves any strange results, like messages that appear on the video while the program is loading. If Mr. Bellefontaine or anyone else would like a copy, he can send me (Joe Sewell, 6776 Sheridan Road, Melbourne, FL 32901) a disk or tape and I will put a copy of the program onto it for him. Remember, the program is for TRSDOS 2.3. (Joe Sewell, Melbourne, FL)

A■ Thanks for the offer; it's appreciated.

Q■ I have a 48K, single-drive (35-track Vista 80) Model I. I want to expand by adding another

disk drive, but I can't get satisfactory answers concerning compatibility with other makes of disk drives or with drives of greater track capacity.

First, can I mix drives of different track capacities (i.e., 35 and 40)? If so, will this present any problems should I decide to upgrade to double density in the future? What about a single-sided disk drive with a double-sided disk drive? Does it make any difference if the second drive is a Vista? (Lt. Malcolm E. Baird, USN, Cape Canaveral, FL)

A■ First, you can mix and match most 5¼-inch drives in any order; the restrictions are primarily software derived. TRSDOS 2.3 can only address single-sided, 35-track disk drives, so getting higher track count drives or double-sided drives is a waste of money. If you want to upgrade your system using better drives, you have to get a new DOS capable of using them (most of the other DOSes can).

Selecting the new drives becomes a matter of convenience. If you have a 35-track and 40-track drive, backing up from the 35 to the 40 is easy. However, the reverse won't work because the first drive lacks the necessary five extra tracks, so you'll have to make the 40-track back-up as if you had only one drive. The situation becomes even more drastic with one 35-track and one 80-track drive.

You can use 40-track disks in the 35-track drive, but you can't access the upper five tracks, so trying to read any data on those tracks (put there by the 40-track drive) results in data error messages from the disk drive. The 35-/40-track drives can't read 80-track disks without having lots of problems, although 80-track drives can read 35-/40-track disks (the drive thinks the 35-/40-track disk is an 80-track disk with every odd-numbered track identical to the previous even-numbered track).

Writing to the 35-/40-track disk with the 80-track drive will make the disk useless in the 35-/40-track drive, since half the directory track will have information from the 80-track drive. This will confuse the 35-/40-track drive since it'll pick up both the old information and the new.

Double-sided drives lead to similar but more complex problems because

most DOSes logically treat double-sided drives as single-sided drives with twice as many sectors per track (each side has half the sectors). In that situation, backing up becomes a real chore. Also, some DOSes restrict the use of double-sided drives to two.

My suggestion is to get two new drives of the same type, and sell the older 35-track drive or keep it as an emergency back-up unit in case of drive failure.

Almost all disk drives now sold are capable of double-density operation. However, you must make sure your DOS will support the double-density mode when you add that modification to your Model I. (Don't get the Tandy board; it isn't compatible with most of the double-density DOSes, and isn't compatible with most of Tandy's software.) In many cases, going to double density adds greater disk capacity without losing access to any programs.

The source of the disk drives shouldn't make any difference, and you don't have to stick with any one supplier. (By the way, are you sure the Vista drive is only 35-track? It might be a 40-track drive that TRSDOS is using as a 35-track unit. If you can borrow another DOS, try formatting a data disk to 40 tracks and see if you can use the full count.)■

Terry Kepner is a free-lance writer and programmer. He's been writing about microcomputers since 1979.

Frequently Needed Numbers

Radio Shack, National Parts Division, 900 E. Northside Drive, Fort Worth, TX 76102, 817-870-5662. M/C and Visa accepted—each order includes \$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), *Microsoft 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), *TRS-DOS 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).

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

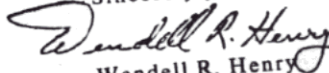
To Alpha Products, 79-04 Jamaica Ave., Woodhaven, NY 11421
Gentlemen:

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

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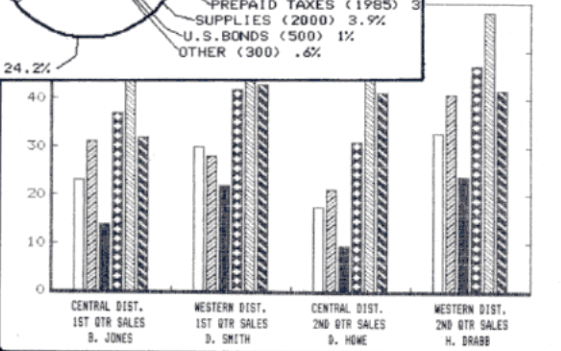
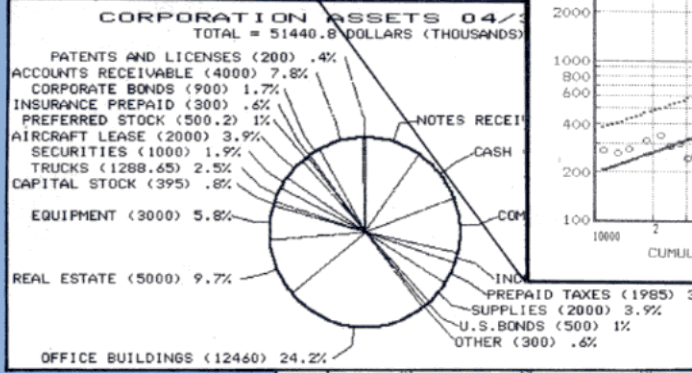
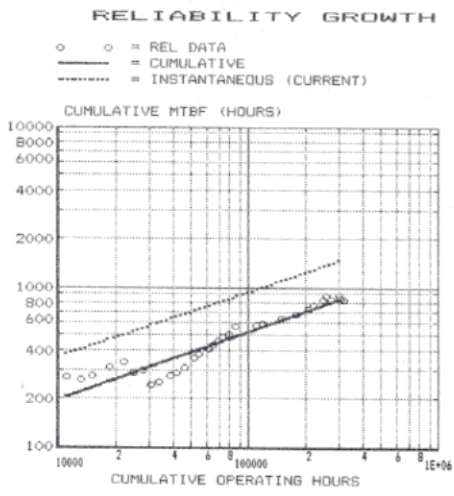
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January	NYCI	DITA	DIT	DDJ	SAP	500	Advances	Declines	Up Vol	Dr Vol	
1231	77.08	963.99	398.10	114.42	135.76	1040	593	24.338	11.356		
102	78.26	972.78	421.43	115.12	136.24	1062	495	17.275	8.405		
105	79.00	992.55	453.77	117.81	137.89	1084	433	41.159	14.669		
106	79.14	1004.69	482.99	117.16	138.12	1049	640	38.443	23.709		
107	77.29	980.89	391.19	115.19	135.68	216	1555	3.940	85.944		
100	76.20	965.79	385.24	114.09	132.04	578	1028	11.759	37.779		
109	76.44	968.69	384.82	112.89	131.48	909	620	28.933	15.739		
112	76.52	968.77	388.34	112.85	131.52	928	633	23.813	19.192		
113	76.35	965.10	387.18	112.49	131.24	578	993	12.407	24.532		
114	76.55	966.47	389.55	112.38	131.47	914	612	23.382	13.773		
115	76.99	969.97	396.10	112.60	131.72	789	691	21.567	13.526		
116	77.33	973.29	401.98	113.22	134.77	880	642	23.22	14.425		
119	77.10	970.99	403.55	114.35	134.37	740	750	14.112	15.338		
120	75.81	950.68	394.89	113.80	131.53	371	1172	5.859			
121	75.39	946.25	392.46	113.80	131.36	547	954	15.787			
122	74.76	940.44	392.03	113.00	130.26	48	7824	11.057			
123	74.72	940.19	391.61	111.74	130.23	683	780	14.604			
124	74.45	938.91	389.19	111.47	129.84	504	890	11.094			
127	75.19	949.48	394.64	111.72	131.12	943	559	20.753			
128	74.79	942.52	395.43	112.49	130.34	624	788	17.433			
129	74.69	948.09	398.04	112.74	130.21	774	710	19.433			
130	74.27	947.27	402.22	112.82	129.55	727	776	16.777			

WORKSHEET			
NYSE Vol	104 NYCI	A-D	ADL
1231	41.21	77.65	447
102	28.87	77.49	557
105	38.91	77.76	873
106	67.40	78.99	407
107	92.89	77.87	133
100	55.35	77.59	450
109	50.19	77.38	289
112	48.76	77.23	295
113	46.99	77.07	415



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MicroTrends

According to a report in the May/June issue of *Electronic Learning*, over 50 percent of the nation's public schools owned or bought microcomputers during the 1982-83 school year.

The big three in education are the same as those at the end of the 1981-82 school year, with Apple, Radio Shack, and Commodore retaining their respective 1-2-3 positions.

Radio Shack's second-place status is strong with 21 percent of the classroom market, while Apple leads with 54 percent, and Commodore follows with 13 percent. The remainder of the pack includes Atari and Texas Instruments with 3 percent each, IBM with 2 percent, Franklin at 1 percent, and miscellaneous systems accounting for 3 percent of the market.

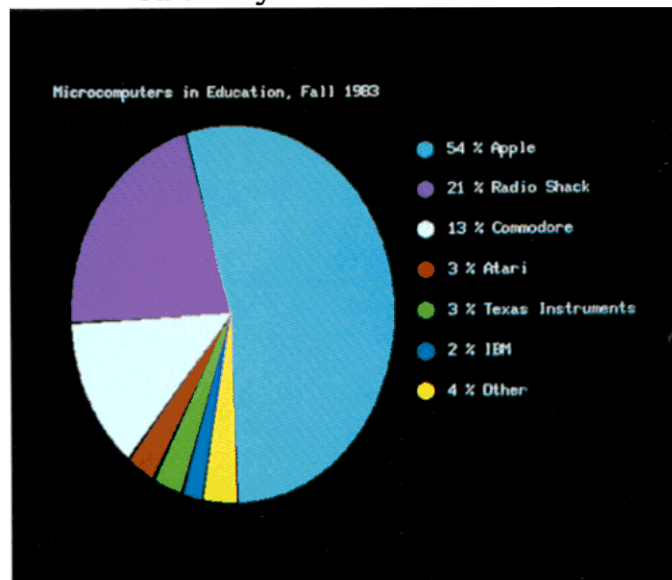
The survey doesn't mention which of Tandy's machines predominates in schools, but last spring Ed Juge, Tandy's director of marketing, said, "We'd make money on the Model 4 if we sold it only to schools."

Along with the Model 4, the Color Computer 2 enjoys a large user base in America's schools. This base grows as Tandy and other software manufacturers increase their educational software offerings.

The solution to the Soviet boycott of this year's Summer Olympics was easy for Michael Katz, president and chief executive officer of Epyx Computer Software of Sunnyvale, CA. If the Russians aren't coming to the Olympics, Katz figured, he'd send the Olympics to the Russians.

Katz sent complimentary samples of their new C-64, IBM, Apple, and Atari game called Summer Games to

edited by Bradford N. Dixon



Microcomputer brands in public-school classrooms.

Russian ambassadors Anatoliy Dobrynin and Oleg Troynanowsky. Epyx also offered to supply additional copies of the game at no charge if the ambassadors liked it.

The Olympics events featured in Summer Games include diving, swimming, pole vaulting, skeet shooting, and others. Players can compete on the national team of any one of 18 countries, including the U.S.S.R. Perhaps in an updated version for the 1988 Olympics, Epyx will include a race-for-Olympics-tickets competition.

In most product marketing schemes, companies renew the life cycle of their money makers by repackaging the product and adding "new and improved" to the label. But in software marketing, updated versions of popular products usually sport a new version number.

Ashton-Tate Inc. of Culver City, CA, has upgraded their venerable dBase II data base manager to dBase III, which was scheduled to debut in June. Ashton-Tate released dBase II for Tandy's Model 2000 last spring,

but they haven't yet mentioned a 2000 version of dBase III.

The new dBase III comes "not a moment too soon" according to Ashton-Tate's president and chief executive officer, David C. Cole. "There are over 100 [dBase II] competitors now. We have easily over half the market, and we intend to keep it," he said.

dBase III includes a tutorial program called dBase Assistant and offers greatly increased record-keeping capacity. dBase II can store 65,000 records, but dBase III stores as many as 2 billion records.

The "new and improved" marketing strategy for dBase III includes

cutting dBase II's \$695 price to \$495 while dBase III will now retail for \$695.

Model 2000 owners looking to get the most out of their machine in a data base application can only hope Ashton-Tate considers them before announcing new and improved dBase IV.

Last November, Electric Mail and Micro Systems (EMMS) of Norwalk, CT, surveyed 13 electronic mail systems to determine which gives consumers the best service.

EMMS compared the electronic mail services on the basis of standard use comprising 35 messages in a typical month. The news is bad for CompuServe and The Source subscribers. Canada's CNCP EOS in Toronto, Ontario, had the best overall rating of all the electronic mail services (at a cost of \$55.80 per month), while Tymeshare of Cupertino, CA, had the lowest monthly cost of U.S.-based electronic services (\$59.43).

ITT Dialcom (\$68.57 per month), GTE Telemail (\$70.10/month), and MCI Mail (\$74 a month) finished

somewhere in the middle of the list. In the loser's bracket were The Source, rated 11th in the survey at a monthly charge of \$102.12, and CompuServe, ranked 12th at \$138.33/month. The worst electronic mail service in terms of price was Western Union's Easylink, which showed a monthly cost of \$139.70 according to the survey.

Hot Items

Software piracy will always be a harsh reality for commercial software companies. Radio Shack is as aware of the problem as any other software developer and recently took steps to protect its products by incorporating the Prolok copy protection system in some of their products.

Vault Corp. of Westlake Village, CA, markets Prolok. The system involves a master "fingerprinted" floppy disk that you use in conjunction with your software. While you can make program back-ups, the programs won't run unless the fingerprinted disk is present.

Tandy currently plans to sell some of its educational software with the Prolok protection on it, but the extent of Prolok's use depends on licensing agreements with Tandy. The Prolok system will eventually be available on Tandy's Model 2000 software as well.

The biggest user complaint against Tandy's Model 2000 is its incompatibility with the IBM PC.

Tandy's heard the gripes and they're trying to make 2000 owners with PC access a bit happier. By the time this issue hits the newsstands, Tandy should have released a utility that formats disks in IBM's 40-track format and lets the user write information to them.

The Tandy 2000 has always been able to read many IBM-formatted disks, but this utility brings the machine one step closer toward complete compatibility with the PC.

Tandyland

During September, October, and November, Radio Shack will sponsor five TRS-80 trade shows and seminars in different cities across the U.S. The shows are scheduled to run in Hous-

ton, Atlanta, Los Angeles, New York, and Chicago.

Although Radio Shack will supply the hardware for the shows and seminars, the company's involvement will be minimal. The whole idea is to highlight the support industry for the wide range of Radio Shack's computers and peripherals. Tandy's Director of Marketing Ed Juge said, "We're doing this to show people the kind of support our machines have out there by companies other than ourselves."

This approach is something new to Tandy and is yet another example of the company's move away from limiting third-party involvement in their computers. In light of the disappearance of many software companies supporting TRS-80s, the Radio Shack community can only hope this trend continues.

When was the last time you saw the Tandy 2000 commercial featuring Bill Bixby? It's been a while. This spring's shortage of Intel's 80186 chips ham-

pered Tandy's ad push for the Model 2000. But now the shortage is easing and you'll soon see a new 2000 campaign on the tube.

80 Micro asked Tandy if they would air the same ad, but Ed Juge, director of marketing, noted that a new campaign is in the making. He also indicated that Tandy would be giving the 10-month-old MS-DOS micro some heavy television exposure.

Perhaps Tandy will follow other computer companies' example and add more color and clamor to its fall television advertising. Given the amount of time and money computer companies devote to television ads, it'll be interesting to see how Tandy stacks up.

Tandy's in-house TRS-80 publication, *Microcomputer News*, stopped publication with its June issue. According to Ed Juge, director of marketing, one reason Tandy had for discontinuing the monthly was the expense involved in maintaining the publica-

A New Image?

In the past, Tandy has been satisfied with consumer response from their national advertisements. But with their recent slow-down in computer sales, perhaps Tandy should consider another approach.

Last spring, Radio Shack hired adman Gregory T. Lincoln as media director of the company's in-house advertising agency. In that capacity, Lincoln's responsible for planning and buying national media advertising in magazines and on television and radio.

In an interview with *80 Micro*, Lincoln commented on Radio Shack's future advertising plans. Lincoln noted that, for the time being at least, Radio Shack's ad campaigns "will stay pretty much the same" with regard to the dollar amount spent and the distribution of funds among the various media. According to Lincoln, Radio Shack doesn't intend to beef up its television advertising in spite of the barrage of ads aired by Apple, IBM, and Commodore.

When asked if he thought all the

noise on TV actually sways potential computer buyers, Lincoln stated, "I don't believe any potential buyer makes a decision on one ad he sees on TV or in a magazine." The role of Radio Shack's advertising in magazines and on TV, Lincoln continued, "is to provide information about a product and to try to persuade a potential buyer to go to a store and check it out."

Lincoln mentioned that Radio Shack is considering a slight change in the thrust of their ad campaign for the 1984-85 fall and winter seasons, but declined to be more specific. Lincoln also claimed that Radio Shack's ad budget won't change even while other computer manufacturers outspend them 5- or 10-to-1.

Although Radio Shack seems content with their current position in the computer market, they aren't getting much attention for their efforts in the press or on the air. In an era when flash and glitter are the norm, Radio Shack might do better to alter their advertising strategy a little. It might not hurt as much as they think it will.

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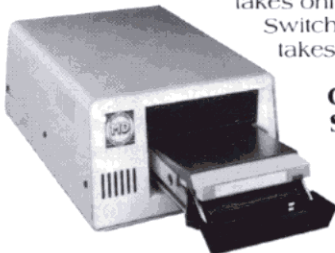


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tion's 100,000-reader circulation.

"It [*Microcomputer News*] was just getting too big for us to handle anymore," Juge said. "We were beginning to compete with other, larger magazines and didn't want to incur that kind of expense." Juge went on to say that all current subscribers would have the option of choosing one of the other TRS-80 magazines for the remainder of each subscriber's term.

Tandy has relocated most of the staff from *Microcomputer News* to Juge's marketing department. The expanded marketing staff is working to strengthen Tandy's image in print and in public by working closely with TRS-80 magazines and on a variety of other special public relations projects.

Tandy gained the attention of *Business Week* magazine this spring in a May 21 article prompted by Radio Shack's April sales decline of 4 percent from April 1983. It was the first month Radio Shack showed a year-to-year decline since February 1978, when the CB radio boom went bust.

These days, Tandy faces a brand-name recognition problem. People don't know quite what to make of a store that sells stereos and stuffed-animal radios in front and computers in back.

In fact, Tandy's computer sales have cooled despite its past role as a microcomputer pioneer, to the point where they could use another new product to buoy the company. John

V. Roach, Tandy's chief executive officer, told *Business Week*, "While the sales pace has been trending down, we believe our computer business will continue to grow at very acceptable rates."

Roach and others in the Tandy Towers are betting on newly installed telephone centers as the company's hot new product. And although the tone is upbeat in Fort Worth, market analyst Douglas A. Cayne of the Gartner Group thinks, "They [Tandy] will be successful in telephones, but there is no way telephones will make a mark in the company before fiscal 1986."

New Threads

It won't be long before you can walk into your local Radio Shack Computer Center and see a full line of telephones as well as computers.

John V. Roach, Tandy Corp.'s chief executive officer, cited the advantage of "synergy in both customers and equipment with Radio Shack Computer Centers" as part of the reasoning behind adding telephone centers to the computer centers. He also mentioned economy of operation and expected profits. Thank goodness Tandy decided not to get into video games.

Update

Fortunately for Olivetti, their engineers decided to go with a time-proven

Olivetti's engineers decided to go with a time-proven design when they introduced their portable computer.

and popular design when they introduced their portable computer last May. The result is a Model 100 clone that's the same size and weight, has the same firmware, the same retail price, and the same limitations as the Tandy totable.

In fact, the only way to describe the machine is through its few differences from the Model 100. First, the entire screen tilts to make the LCD more visible instead of using the 100's LCD dial.

Second, the keyboard is different. It's been described as a cross between an IBM and a Model III keyboard. The function keys are the same and it includes all ASCII characters from the keyboard.

The last difference is the color. The Olivetti M10 is gray—a bit darker than Radio Shack's old Mercedes silver.

If imitation is the sincerest form of flattery, Olivetti has given Tandy quite a compliment.

Al Jackson, public relations representative at the Dallas, TX-based Portable Computer Support Group, cited "developmental delays" as the reason for the scarcity of their Model 100 portable disk drive.

As of June 5, 1984, PCSG hadn't shipped any of the long-awaited battery-powered devices, and Jackson didn't expect shipment until the third week in June. He also stated that the first shipment had sold out, and the second wouldn't occur until late August.

Percom Data, also of Dallas, TX, manufactures the \$799, 3½-inch portable disk drive that is the only competition for Holmes Engineering's Bullet wafer storage system. The Murray, UT, firm's retail price for the Bullet is only \$369.99. However, rumor has it that Holmes might not be content with the success of their rapid-access wafer system, and might introduce a portable disk system by the end of the summer. ■



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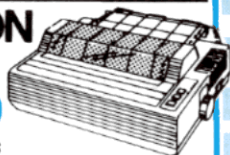
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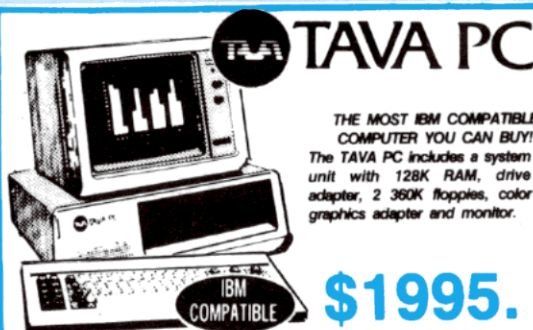
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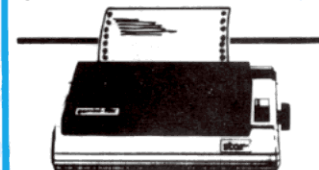
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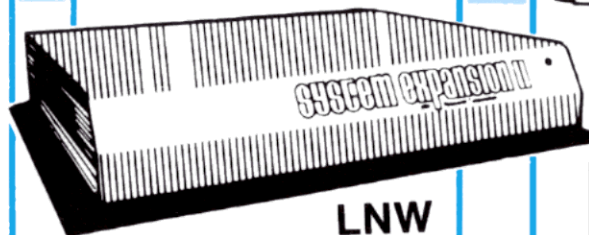
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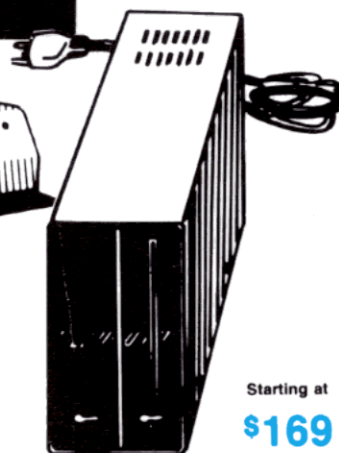


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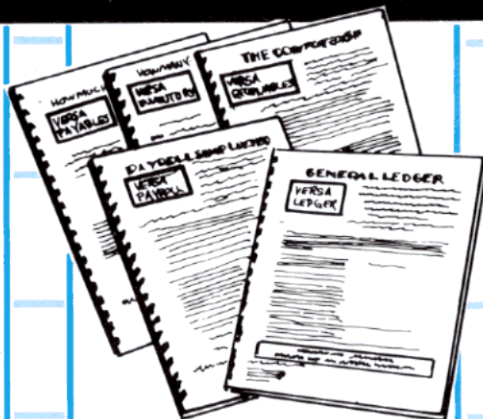
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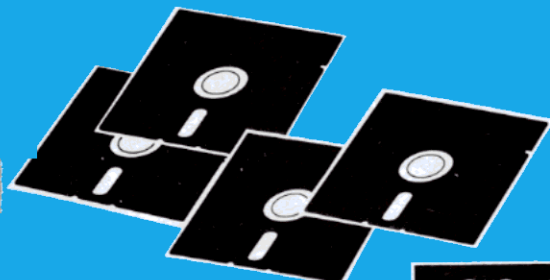
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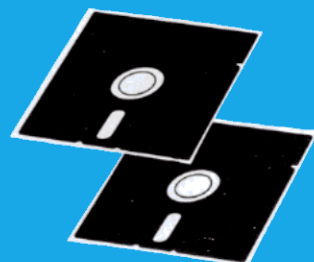
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Don't Swap Now

I'd like to share a trick that saves a lot of work when I back up TRSDOS 1.3 data disks on my Model III with two drives.

Radio Shack's TRSDOS manual never explains the procedure for backing up data disks without an operating system. If I use `BACKUP :0 :0` or `BACKUP :1 :1`, I get prompts to swap disks repeatedly, even though one of the drives is idle.

Recently I discovered a shortcut. I put any system disk in drive zero, the destination disk in drive 1, and type in the command `BACKUP :0 :1`. When the computer asks for the source disk master password, I cheat: I remove the system disk from drive zero and insert the source disk instead. Only then do I answer the password question. It works. The procedure even ends gracefully with an "insert system disk" message blinking on the screen.

T.P. Eggarter
Chantadata Inc.
Ramirez Mitchell 358
5700 San Luis, Argentina

Random Thoughts

Model 100 users: Instead of using the seconds portion of `TIME$` as the random number generator (p. 175 of the Model 100 manual), use `PEEK(63791)`, which is a timer that rapidly decreases from 125 to zero.

The line:

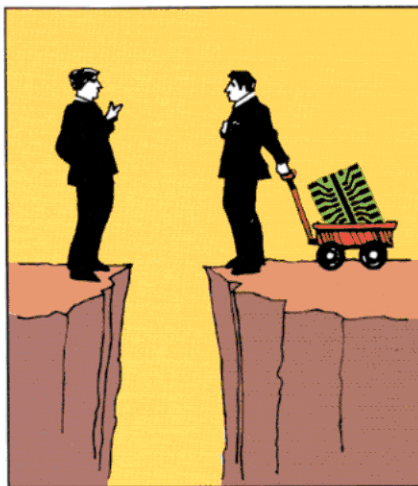
```
FOR I=1 TO PEEK(63791): DUMMY =  
RND(1): NEXT I
```

at the beginning of your programs will give you more random numbers.

Chris Miller
1328 Geiser St.
Larchwood, IA 51241

Due Process

My thanks to Delmer Hinrichs for sharing his word processor program (March 1984, p. 100). However, I couldn't get it to run until I changed



line 90 from `"IF T$ <> "" ..."` to `"IF T$ = ..."`. The program still seems to work, but I'm having trouble getting it to exit the insert function in the edit mode. Also, I have to check carefully to make sure that what I type on the screen actually gets picked up by the memory.

Larry D. Hollan
156 Lee Ave.
Vidalia, LA 71373

Line 90 is correct as listed; it assures that all texts have a title specifying whether they're text or address files. If this title (in variable T\$) is null, you'll have problems with the program.

You sometimes have to press the enter key twice to leave the insert function in the edit mode.

As for losing characters, if they get to the screen, they're in memory. However, a fast touch-typist can get ahead of the program, and Basic's occasional garbage collection pause can cause the loss of some characters.

Delmer Hinrichs
2116 S.E. 377th Ave.
Washougal, WA 98671

True/False Test

For Boolean operations in Basic, here's a simple way to perform the exclusive Or function: Implement `C = A XOR B` as `C = A <> B`. It returns the logical variable C as true (with the

value - 1) if A and B are not both true or both false.

Roxton Baker
Box 8272
APO San Francisco 96555

My Back Pages

I stumbled across an easy way to get Scripsit to print a single page of a multi-page text. Turn off the printer's power switch, then start the page-by-page printing process (`<break> P,P`). Repeat this until you're up to the page you want to print (six times for page 7, and so on). Then turn on the printer and press the enter key, and Scripsit prints the page you need.

I've used this method with regular Model I Scripsit, and with the Acorn SuperScripsit patch. I've used Diablo and Epson protocol printers. This trick should work with any operating system, though.

Steven Lenkowsky
284 Highland Ave.
S. Norwalk, CT 06854

Help Wanted

I'm looking for a patch for cassette Scripsit 3.1 so I can run it on my Exatron Stringy Floppy. Discovery Bay Software's Patchword program works only with version 1.0.

John Boren
2950 N. Sheffield
Chicago, IL 60657

I'd like to know what to POKE (and where) to make cassette Scripsit initialize in upper-/lowercase mode.

Winfield Smith
5825 S. Blackstone Ave.
Chicago, IL 60637

Can anyone tell me who makes 100-character plastic daisy print wheels that are compatible with the Radio Shack DWP-210 printer (catalog number 26-1257)?

Paul Ferris
Route 1 Ranch Lake
Pound, WI 54161

The second correction is in line 7380. The apostrophe at the end of the line is missing. Leave 21 spaces between the apostrophes.

Kevin Collins
16 B. D. Atwater Road
Chadds Ford, PA 19317

*R. Lee Stockman
10748 100th St.
Alto, MI 49302*

```
3310 DEFM ' <SHIFT ↑> + LETTER =  
SENDS PRINTER CODE'
```

*David Fischer
141-20 72nd Ave.
Flushing, NY 11367*

Roger Alford
P.O. Box 2014
Ann Arbor, MI 48106

Eds.

Load 80 users: I'd like to point out a mistake on the July cassette instruction sheet. The list of cassette programs includes four Model 4 pro-

I found that transferring the programs from cassette to Model 4 mode caused data errors. The Model 4 programs are on the Load 80 disk only. We're sorry for any problems or inconvenience the mixup might have caused.

Keith Johnson
Load 80 Technical Editor

Iowa City TRS-80 User's Group
P.O. Box 1494
Iowa City, IA 52240
BBS: 319-338-2750
Contact: Keith Davis

Great River Microcomputer User
Group
1226 Daniel Court
Quincy, IL 62301
Contact: L. Moeller

IFBBS
Idaho Falls, ID
208-523-7400
Contact: Mark Pelot

Also, a peculiarity in the solution to the spherical triangle in my program *Navigate* ("North by Northwest," April 1984, p. 186) produces an inaccuracy in the bearing under

Smith Harris
Route 4 Box 59
Gray, GA 31032

I've discovered a bug in my Munchies program ("Sneak a PEEK. Invoke a POKE." March

```

230 IF MPS + MA > V1 AND MPS + MA < V2
THEN POKE MPS, Q: MPS = MPS + MA:
Q = PEEK(MPS): POKEMPS, MC: GOTO 40
EI SE 40

```

*Tad Kershner
10579 Rainbow Ridge
Grass Valley, CA 95945*



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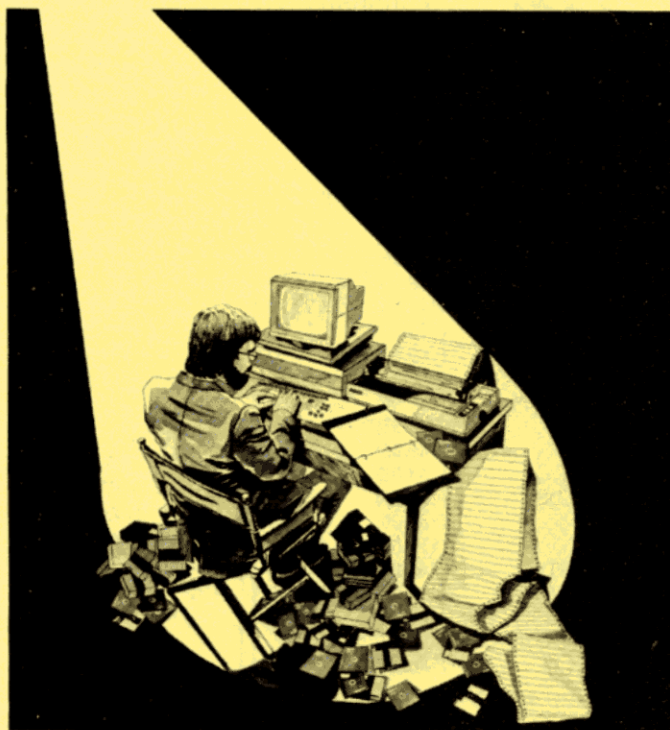
A. Copelle, Northbrook, Illinois.

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Learning the Language: An Assembly Tutor

by Hardin Brothers

edited by Susan Gubernat

Radio Shack's Assembly Language Tutor (ALT) is designed to help newcomers through the difficult first steps of Assembly-language programming. This two-part package—a 200-page instructional manual and a special editor/assembler/monitor for trying and modifying the suggested programs and exercises—while thorough and well-written, doesn't substitute for the real assembler you'll eventually need in order to program in Assembly language.

The ALT Manual: Step-by-Step Learning

The manual's author is William Barden Jr., who has justly earned a reputation as one of the best writers of introductory Z80 Assembly-language texts (*TRS-80 Assembly Language Programming* and *More TRS-80 Assembly Language Programming*, both published by Radio Shack). While covering much the same ground as these earlier books did, his ALT manual is organized more as a formal course than are the others.

In general, the ALT manual is clear enough so that, with conscientious study, most people using it should be able to learn the fundamentals of Z80 Assembly-language programming. Barden's writing style is easy to read, and he presents complex concepts, like Z80 addressing and using subroutine calls, clearly and simply.

He divides the manual into 27 lessons. The first three are purely introductory; they convey some general information about how Assembly language works as well as explaining how to use the ALT software and the Z80 registers and how to translate between

decimal, binary, and hexadecimal numbers.

The second section of the manual presents most of the Z80 instruction set. Lesson 4 covers the techniques of loading data into the Z80 registers; Lesson 5 explains how to store data in the computer's memory. Lessons 6 and 7 present the Z80's addition and subtraction instructions.

The next two lessons, numbers 8 and 9, explain the various types of jumps and loops. Lesson 9 also presents the first practical program in the manual, a short algorithm for calculating integer square roots. Lessons 10–12 present some miscellaneous instructions: logical operations, techniques for multiple-precision arithmetic, and block moves.

After completing the first 12 lessons, you should understand enough about Assembly language to begin writing some useful, albeit simple, programs. Lessons 13–16, therefore, are concerned with data tables stored in memory: setting up a table, finding information in one, sorting a table, and scanning through a table to find a

particular entry with the Z80's comparison instructions.

Lessons 17–22 return to explaining Z80 instructions: subroutine calls, stack manipulations, rotations and shifts, bit operations, binary coded decimal operations, and the handful of Z80 instructions that the ALT assembler doesn't support. In many of these lessons, ALT emphasizes arithmetic programs and multiplying and dividing larger and larger numbers.

The next three lessons, 23–25, explain how to use Assembly-language routines as part of Basic programs. Lesson 26 shows how to use two ROM sub-

routines and the final lesson, 27, provides some hints about writing and organizing longer programs. The manual concludes with several appendices that list the ALT software commands, number conversions, the complete Z80 instruction set, and ASCII codes.

The ALT Software

The ALT program was written expressly to present the information in the manual. It combines, in a single program, a very simple editor/assembler, a monitor/interpreter, and a memory trace utility. Also included on the disk is a copy of the programs included in each lesson. You can simply load the example programs instead of typing them in while you read through the manual, though you'll learn faster if you do the typing yourself.

The first page of the manual states that the minimum system requirement necessary to use ALT is a 16K RAM, one-drive Model I or III. This statement is, quite simply, false. The ALT assembler requires that you have at least 32K RAM, and some of the sample programs require 48K. Further,



the Model I version of ALT is distributed with the assembler program on a system disk and the sample lessons on a separate data disk. You cannot use the disk versions of the sample lessons on a Model I computer unless you have two disk drives.

I have to rate the ALT software as merely fair. Squeezing three different functions onto a single screen at once (see Fig. 1) gives short shrift to all three. The memory trace function, near the bottom of the screen, is similar to a Debug display, but shows only 32 bytes at a time—often an insufficient number. The register display at the top of the screen has the advantage of showing the A register in both hexadecimal and binary representation, but fails to show the alternate, or prime, registers.

The greatest weakness of the display, however, is that it sets aside only five lines to display the Assembly-language program. Because each instruction performs a single, very small part of a program, most programmers need to see as much of the program as possible to understand what is happening. Often, the 16-line display of a Model I or III (or even the 24 lines of a Model 4) seems too small. Trying to understand a program five lines at a time is like studying a street map one block at a time: it may be possible, but it's terribly inconvenient.

To be fair, having the program, register values, and memory trace all available simultaneously can be beneficial when you run a program. If you

set the monitor to a slow execution speed, you can see in detail how each instruction affects the registers and memory. But when you're writing a program, you'll probably want to see many more than the allotted five lines.

A related problem with the program display portion of the screen is that there is no room for line-by-line comments. Most Assembly-language programmers comment every line, or almost every line, of code that they write; without comments, later debugging can be almost impossible. The ability to comment code clearly and succinctly is one of the skills needed for Assembly-language programming, and one that's impossible to learn with the ALT software.

The ALT editor/assembler commands are a subset of those available with Radio Shack's Series 1 Editor/Assembler. The assembler can save source files to disk, but not the resulting object (CMD) files. You can use this assembler to create and test programs, but you won't be able to run those programs from DOS Ready.

The assembler lets you insert and delete lines, but not edit lines that already exist. To change a line of a program, you must first delete it and then insert the corrected version. You also cannot scroll an entire listing with a single command. Instead, the editor lets you scroll five lines at a time by pressing the P key repeatedly. However, since only five lines are displayed at any one time, it is unlikely that you'd ever need to scroll the entire program at once.

The monitor/interpreter is very protective of itself and system memo-

ry. When you run an assembled program, the interpreter actually reads each instruction and then simulates its effects. If the instruction would make the program overwrite the ALT software, change the screen display, or modify the program you've written, the interpreter stops operation with an error message. It also won't allow your program to access any ROM routine, though some of those routines are discussed in the manual.

The monitor lets you set up to four break points and set execution speed from several instructions per second to one instruction every three seconds. It also lets you single-step through a program by performing one command each time you press a key.

The memory trace function of ALT displays 32 bytes of memory in either hexadecimal or ASCII mode. You can scroll a block of memory by repeatedly entering <Z><+><RET> or <Z><-><RET>. You can also use the monitor to change the value in any Z80 register or register pair.

One major problem with the ALT software is that the file formats it creates are incompatible with all other editor/assemblers on the market, including Radio Shack's Series I. If you use ALT to learn Assembly language, you won't be able to transfer any programs you write with it to another assembler later on. Instead, you'll have to type in the programs again when you decide to get a real editor/assembler.

Final Evaluation

For less than the cost of this package, you can buy an assembler and

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```
PC  AH AB  S Z H P NC B C D E H L IX  IY  SP
B4AE FF 11111111 1 1 1 1 1 1 FF FF FF FF FF FFFF FFFF FED8
*****
STATUS  LOCN  CONTENTS      LINE  LABEL  OPCODE  OPERAND  COMMENT
      B4AE      21 03 B0      00100  ; ADC FOR MULTIPLE-PRECISION 4-BYT
      B4AE      21 03 B0      00110 MPADDS  LD      HL,0B03H
      B4B1      DD 21 07 B0      00120      LD      IX,0B07H
      B4B5      06 04          00130      LD      B,4
      B4B7      B7          00140      OR      A
*****
LOCN 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
B4B0 B0 DD 21 07 B0 06 04 B7 7E DD 8E 00 77 2B DD 2B
B4C0 10 F6 ED 4B 06 B0 ED 6B 02 B0 B7 ED 4A ED 63 02
*****
MODE=EDIT SPEED=9000 FREE MEMORY=18898 BP @ FFFF,FFFF,FFFF,FFFF
COMMAND=
```

Figure 1. A typical ALT screen display: The top two lines show the current condition of the Z80 registers. Lines 5-9 show five assembled instructions. Lines 12 and 13 display the current contents of memory locations 0B4B0 hex to 0B4CF hex. The last two lines show the current state of the interpreter.

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monitor package, along with a good introductory text. You wouldn't have the sample programs included on the ALT disks, but you'd have software that could fulfill your needs for several years. Radio Shack's Assembly Language Tutor would be worth the expense if you shared both package and cost among several people. But for an individual, it seems overpriced. Once you finish the 27 lessons, you'll still need to buy a real assembler. Why not do so from the start? ■

microMERLIN Transforms TRS-80s Into 16-Bit Systems

by R. Walter Steur

When you use microMERLIN—a well-designed and neatly constructed 16-bit system—as an intelligent peripheral to your Model I, III, or 4 and their compatibles, you can explore the beckoning world of 16-bit software at a reasonable cost and still maintain your TRS-80 base.

The Hardware

microMERLIN's 8088 chip runs at 5 MHz; the unit comes equipped with 128K RAM and a 4K ROM monitor expandable to 8K. One RS-232C input/output (I/O) port and a Centronics parallel printer port are standard. The unit fits nicely on top of Models III and 4 (see the Photo) or under the

Model I's expansion interface. (You can place it on top of your LNW Model I or II and under the monitor.) The Model 4, used for this review, makes the best use of microMERLIN's capabilities.

Installation is simple: You plug microMERLIN's cable onto the Model I (or LNW I/II) expansion bus, or Model III/4 I/O bus, plug in the power cable, and it's ready to go—without trace-cutting, soldering, prying out chips, or plugging in modification boards. (The Model I requires a double-density disk controller adapter.) Your system can now operate in either 8- or 16-bit mode.

microMERLIN, supplied with your choice of either CP/M-86 or MS-DOS, uses the TRS-80 as its keyboard, monitor, and mass storage facility. microMERLIN supports the Model 4's 80-character by 24-line display and reverse video capabilities. In addition, if your Model 4 has 128K RAM, the current release of CP/M-86 for microMERLIN can use the upper 64K as a RAM disk. But microMERLIN doesn't support the Model 4's sound capability and function keys, nor does it support any 80-character by 24-line video boards for the TRS-80 Models I and III. Beyond the 64-character limit, characters are either truncated or wrapped around, depending on the environment, that is, the DOS and the applications program. Both DOSes let you connect an external terminal to

microMERLIN's RS-232C port so you can have the larger display.

Under CP/M-86, microMERLIN configures the TRS-80 to emulate the Lear Seigler ADM-3A terminal codes, so you can use software such as WordStar, Supercalc, dBase II, and others that permit configuration to a specific terminal. (On a Model I or III you may still have to patch the program for the 64-character by 16-line screen display.) Under MS-DOS, microMERLIN uses the ANSI standard for cursor control and simulates the IBM PC's 10 function keys. With either DOS you can input the full ASCII character set from the keyboard and display all ASCII characters available from the TRS-80 character-generator ROMs, as well as the standard TRS-80 graphics.

By the way, the factory setting for microMERLIN's UART (universal asynchronous receiver/transmitter) is for use with an external terminal. The manual shows how you can easily reconfigure it for a modem connection by changing a couple of jumpers on the main board.

DOS Implementations

CP/M-86 was the first DOS available, and therefore the first configured for microMERLIN. (Micro Products Engineering [MPE] provided CP/M-86 version 1.1, release 1.6, for this review; IBM ROM interrupt calls aren't simulated in this release.)

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Photo. microMERLIN sitting atop the Model 4. Along with the microMERLIN manual, MPE supplies documentation for either CP/M-86 or MS-DOS.

The conventional Digital Research utilities are present, including ASM86 (the CP/M assembler), DDT86 (the debugger), ED (the text editor), and a special 64-character by 16-line display version of ASM86 for Models I and III. MPE developed a number of special utilities for this application. Beyond those summarized in Table 1, there are even utilities to reboot CP/M and boot the system back to your TRS-80 DOS!

CP/M-86, on a single bootable 5¼-inch disk, supports single-sided, double-density, 40-track, 5¼-inch drives only. As in CP/M-80, the system holds directory information in memory and doesn't automatically recognize disk changes. You must "log in" each new disk before it's read from or written to. CP/M is reasonably fast. For example, boot time is roughly three seconds; the system load is under two seconds—about the same as it is for TRSDOS 6.1 and DOS-PLUS IV.

In contrast, many of the utilities required with CP/M are built into MS-DOS, making for a larger system using more RAM. MPE provided MS-DOS 2.11, release 1.5, on a single-sided, 5¼-inch disk with a separate system booter disk, for this review. The system booter disk contains the Z80 I/O processor code needed to load the MS-DOS system programs on the second disk. (There is insufficient room to place the booter code on the tracks where the IBM PC expects to find the system programs. Displacing the system programs would thus compromise the compatibility of the media.)

The manual warns that the MS-DOS system booter disk is your only copy. Yet the standard back-up utility won't back it up. According to MPE, the code isn't copy-protected or proprietary, though its nonstandard format requires backing up with Super-Utility Plus or a commercial copy program. (Copycat worked successfully.)

MPE's implementation of MS-DOS 2.11 has added code to address the IBM ROM interrupt conventions, so any program using them as part of its input/output programming should run on the microMERLIN—so long as the TRS-80 configuration supports the hardware it addresses. This release of MS-DOS supports four single-sided, double-density, 40-track, 5¼-inch

drives and simulates IBM PC function keys through a multiple-key technique. Like CP/M-86, MS-DOS 2.11 doesn't recognize disk changes automatically, so each time you change a disk you must log it in.

Most of the utilities the MS-DOS implementation supports are similar to their CP/M counterparts. MPE has changed the standard Format utility to call a special Z80 program, MPFOR-MAT.Z80, to format disks under Z80 control and then return control to the microMERLIN. You don't need separate utilities for changing the default printer and console, warm booting, or booting the host TRS-80 DOS since the code has been incorporated into the MS-DOS system programs. The distribution disk includes the usual MS-DOS utilities, such as a text editor and debugger; there is no assembler.

You'll notice how slow the MS-DOS input/output can be when you display or scroll text on the screen. The initial boot time is the same as that for the CP/M-86, but loading MS-DOS takes 10 seconds, as compared with under two seconds for the CP/M-86. (The input/output problem is apparently inherent in the design of the system itself, and, as a result, some programmers bypass MS-

DOS I/O to address the hardware directly.)

MS-DOS requires both the time and the date to initialize the system. The MPE implementation ties the system clock to the front panel lights so that the LED marked "Master" is turned off and then on at one-second intervals.

Documentation

The microMERLIN manual provides all the information you'll need to use the microMERLIN with the least amount of fuss. After an introduction covering the terminology and features of the system, a section describes procedures for setting up microMERLIN, connecting peripherals, and booting and backing up master disks. A short section describing the interaction between the TRS-80 and microMERLIN precedes a software section devoted to the ROM operating system (ROS), system-specific utilities and commands for CP/M-86 and MS-DOS, and compatibility guidelines. A short chapter details future expansion possibilities.

The manual's last section is technical. In addition to hardware data, it includes such information as I/O protocols, accessing host devices, ROS function calls, and examples of their use, and even IBM ROM calls. An appendix lists software tested for compatibility. Despite a few typos, MPE has produced a readable and understandable manual that should satisfy the needs of both novice and advanced programmer.

Besides microMERLIN's own manual, the package includes the standard system documentation for either CP/M-86 or MS-DOS (see the Photo).

Customer Support

Support for the microMERLIN appears to be good. A newsletter sent to registered owners about every three months covers software bugs, tips on program use and compatibility, and DOS updates and upgrades. You get free updates if you return the original DOS disk to MPE. The company is forming microWIZARD, a user's group for microMERLIN users. My own experiences with phone requests for help were very satisfying: MPE provided information and explanations courteously, quickly, and clearly.

Utility	Description
NEWDISK	Controls disk-formatting on the TRS-80
COPYDISK	Sector by sector back-up utility
MPSYSGEN	Copies CP/M system onto new disk
SETBAUD	Controls RS-232 baud rate
MEMDISK	Allows top 64K of 128K RAM Model 4 to be used as a pseudo disk drive
COMLDR.COM	Reads a program from the CP/M disk, copies it to the TRS-80, and executes it on the Z80 CPU (used with programs like MEM-DISK.COM)
UPRINT	Sets microMERLIN parallel printer port as the default
UCONS	Makes the external terminal the default console

Table 1. MPE's special utilities developed for the CP/M-86 implementation on microMERLIN.

Compatibility

While not touting microMERLIN as a PC clone, MPE is working hard to make the system as compatible as possible with the IBM PC. For evaluation purposes, MPE furnished this reviewer with demonstration disks of Digital's Personal Basic and MicroPro's WordStar 3.2, both for use with CP/M-86. I encountered no problems running either program; WordStar ran enjoyably fast.

For use with MS-DOS, MPE supplied Ashton-Tate's dBase II and Microsoft's Multiplan. While both ran on the microMERLIN, the slow MS-DOS input/output was apparent in the video displays of both programs.

Expansion

You can expand the microMERLIN system through both hardware and software. microMERLIN incorporates an expansion bus (not to be confused with the TRS-80 I/O bus). There is ample room in the case for three full- or half-size expansion cards. The back panel of the case has blanked-off openings intended for the following connections: a DIN-type monitor connection, disk-drive cable connector, a second RS-232C connector, and one spare. In other words, MPE has made all the necessary preparations to let you expand microMERLIN to function as a free-standing computer!

Memory expansion cards are already available. Socketed to handle up to 256K, a memory card with 64K RAM in place is priced at \$275; each additional 64K of RAM (8 chips) is \$99. If you want to use microMERLIN with another TRS-80 or LNW model later on, MPE offers a \$99 re-hosting kit that includes the correct cable assembly and required software. microMERLIN's main board already has the circuitry and socket for the Intel 8087 math coprocessor chip—a significant advantage for scientific programming, well worth the \$325 for the 8087 chip and the assembler support software for either MS-DOS or CP/M-86.

MPE plans to make available a monochrome video (not a high-resolution) card functionally compatible with the IBM PC video card for under \$200. The new video card will let you run programs like Lotus 1-2-3 and WordStar 3.4.

Besides hardware expansion possibilities, both current and projected, MPE provides some interesting software expansion options. For one thing, you can buy a second DOS for \$249. Further, the microUTIL program (\$99 each version) transfers files between TRS-80 and MS-DOS or CP/M-86 formats. This approach is effective primarily for high-level language (for example, Basic) programs and text. In addition, MPE plans to make the following available: The microDISK utility will let the TRS-80, as master, use microMERLIN RAM as a MEMDISK. (The microPRINT program will be the print spooler version of microDISK.) MPE further plans hard disk support for microMERLIN.

Future Plans

At press time, MPE planned new releases of the two DOSes. These revised implementations will both incorporate support for four double-sided, 5¼-inch disk drives, 8-inch disk drives, and a 64-character by 16-line scrolling capability. The CP/M-86 version is slated to include the simulated IBM ROM interrupt calls as does the current release of MS-DOS 2.11. It will also provide the time/date utility that is standard in Digital's distribution disk.

MPE plans even more extensive improvements of the MS-DOS version: MS-DOS calls will be bypassed to improve system speed; a MEMDISK utility will let you use the upper 64K of a 128K model as a solid-state disk drive. The new release will implement the special MS-DOS editing keys and will provide access to the TRS-80 RS-232C port from the microMERLIN. ■

The ALDS Package: Your Right of Assembly

by Gary A. Shade

I waited three years for a top-notch Assembly-language development system to become available for the Model III. Now there's one that works on both the Models III and 4: Radio Shack's Assembly Language Development System (ALDS). If you've used Microsoft's M80, you'll appreciate many of ALDS' similar features. ALDS goes even further in many of the high-level extensions it permits.

The package provides advanced Assembly-language development features such as macro support, conditional assembly, and relocatable modules. ALDS comes complete with a full-screen text editor for creating source programs, an assembler that assembles the source program and produces either absolute or relocatable Z80 machine code, a linker to link relocatable modules into an absolute file, a communications program for file transfer, and a debug program.

The Editor

The ALDS text editor is easy to master. It lets you enter source code, move text, copy blocks of text, and edit existing text. You enter the editor by typing <ALEDIT filespec:d>, automatically invoking the editor and loading the file you specify into the text buffer. One note of caution: As the Model 4 powers up with lowercase enabled, you have to enter the filespec in uppercase. This is true whether you load a file from within the editor, or specify the file when you invoke the editor. The program doesn't convert the filespec to uppercase before attempting to load it from disk.

The commands cited in Table 2, along with many others, demonstrate the ALDS text editor's sophistication and superiority over line-oriented editors.

The Assembler

The ALDS assembler (ALASM) assembles source code that the editor

Continued on p. 164

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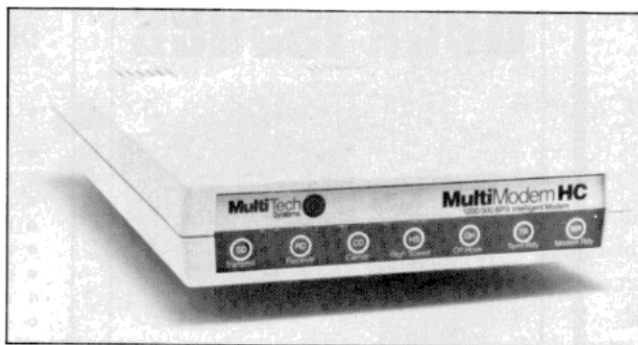
The cyclic buffer ensures continuous data capture and can expand to use all available memory. FullVu 100 includes a cassette and manual for \$39.95.

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MultiModem's many features include time on CompuServe and NewsNet.

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Contact MultiTech Systems Inc. at 82 Second Ave. S.E., New Brighton, MN 55112, 612-631-3550.

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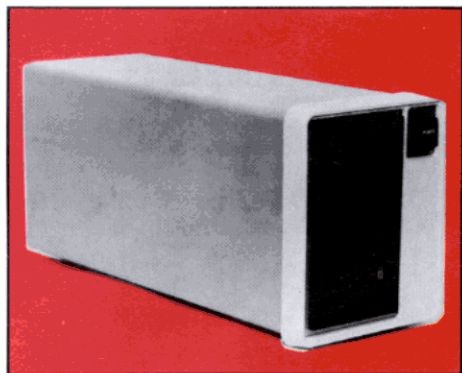
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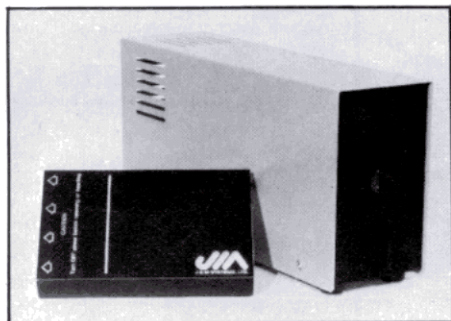


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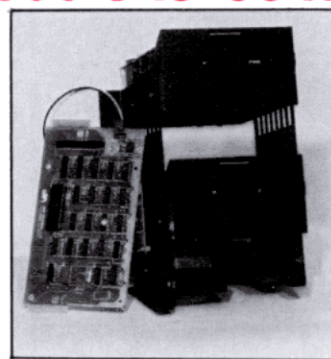
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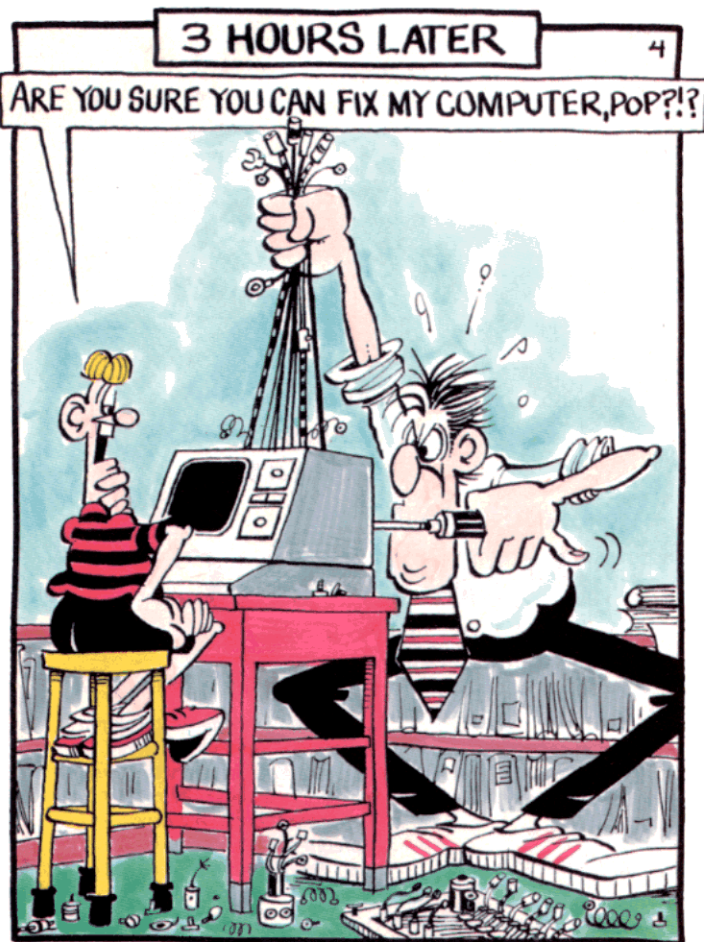
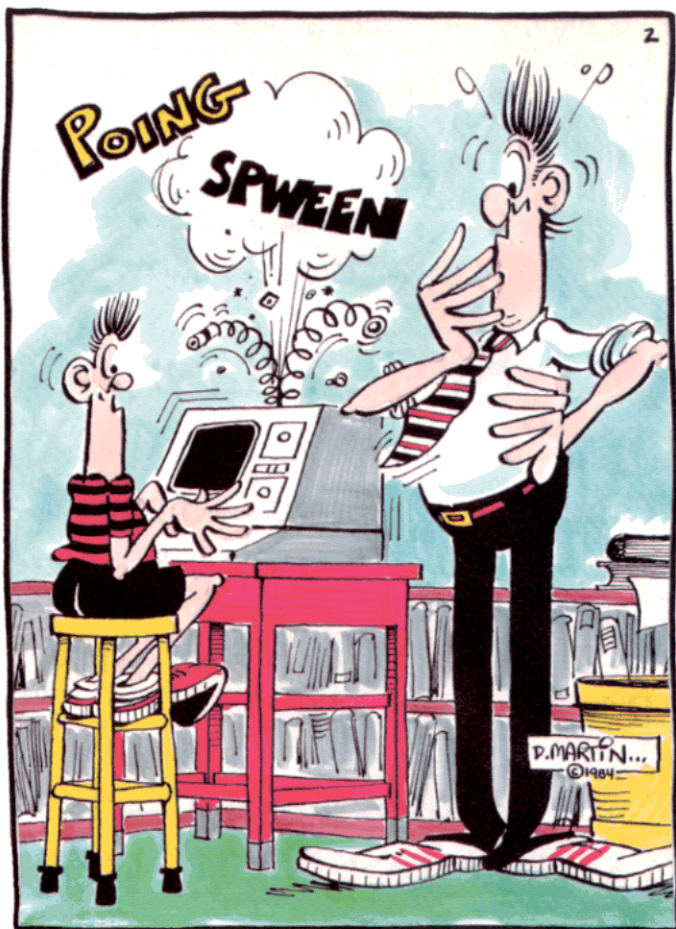
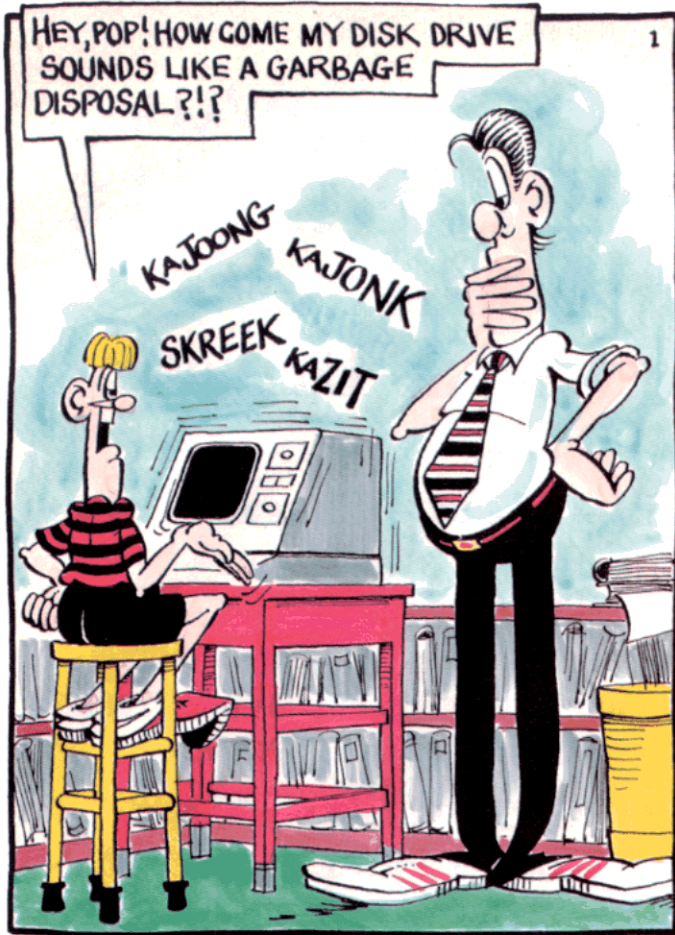
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DRIVE WAYS

by Vincent E. Meyer

A professional technician tells you how to cope with disk drive disaster.



Illustration by Don Martin

A TRS-80 computer is a lot like a Volkswagen Beetle: It's easy to keep one running and, with a little tender loving care, it will last forever. Like your car, your TRS-80 needs preventive maintenance at regular intervals. When it breaks down, you have the same two options: a costly trip to the repair shop or your own labor.

As a professional technician, I have a lot of experience with maintenance and repairs. Most computer problems are the result of faulty disk drives. The following advice will help you keep your drives alive, even if you have a limited technical background.

The procedures in this article apply to disk drives by Tandon, who made the early Radio Shack drives, as well as to the stock drives that Tandy's Texas Peripherals makes for the newer machines (see the sidebar [p. 55] for addresses of all manufacturers mentioned in this article).

In any case, a disk drive is a disk drive. If you installed your own and they're manufactured by Shugart (early Model I), Micro Peripherals Inc. (MPI), Percom, TEAC, Siemens, or whatever, the adjustments you have to make are about the same. All drives have the same basic components, and they all fail for pretty much the same reasons.

I'll describe only preventive maintenance and repairs for the most common disk drive problems—dirty heads, incorrect motor speed, and improperly positioned head mechanisms (for head alignment). These cover about 90 percent of the difficulties you'll encounter. (I won't include certain seemingly simple adjustments that are tricky, nor will I discuss adjustments that you need to make only rarely.)

You can repair all these problems by making simple drive adjustments. I'll show you how to take your computer apart, make the necessary adjustments, and put your computer back together.

I recommend that you clean your drives twice a year if you use your computer about four times a week (base your maintenance schedule on frequency of use), whether or not you encounter problems with them. You should also run the diagnostic tests as part of routine maintenance; it's better to locate a potential trouble spot early. Similarly, if you *are* having problems, you should thoroughly clean the drive heads before running diagnostics. Often, dirt is the source of your troubles.

Necessities

You need to use the correct tools to work on your TRS-80. Most of these are inexpensive and they're usually handy for more than computer repair (see the Table for a complete parts list).

One of the required tools is some type of diagnostic software. You need a way to test the basic functions of the disk drives so you can pinpoint trouble spots. Some available software products include J & M Systems' Disk Drive Analysis System, Floppy Doctor by Micro Data Supplies, and Prosoft's RPM. RPM diagnoses speed errors only, the most common drive problems. Tandy also has test programs that their technicians use in-house.

Many standard drive tests and adjustments require an oscilloscope and a special alignment disk, unless you have the J & M Systems diagnostics program. This system uses a new kind of computer-readable alignment disk that does all

the oscilloscope tests without requiring an oscilloscope.

An alignment disk is unformatted. It has five tracks written in special locations, with special patterns, and by a special drive. Two concentric tracks cross in track 16; the alignment disk uses track 16 as the basis for judging your disk's alignment.

Dysan is a major source of alignment disks, although you can also buy them from Radio Shack's National Parts Division, and Tandon. I recommend that each computer user's group buy one alignment disk for its members. Each disk costs about \$40, and each member needs the disk only two nights a year.

Disk System Savvy

Although it's not necessary to understand how a disk system works in order to fix it, you should have a little background information. A disk system has two main components: the disk controller, which is the interface between the drives and the computer, and the disk drives themselves.

The disk controller is the system's brain. It turns the drives on and off, positions the head, selects which side of the disk to read, decodes the raw data read from the disks, and packages the data you want to write on the disk. Most of the time, the controller isn't responsible for disk input/output errors (I'll discuss some exceptions later).

The disk drives consist of a special speed-controlled motor to turn the disks

at a precise speed, a sensor for the index hole so the controller knows when the disk is at the beginning of a track, a sensor to determine when the head rests over track zero, a write-protect tab sensor, the read/write head, and the motor that positions the head on the correct track.

With this background, you're ready to take your computer apart. To make the process easier, I've included several photographs to show you where everything is.

Getting Inside

If you're going to work on your disk drives, you have to get at them. Bear in mind that if you open your computer's case before your warranty is up, you void that warranty.

First, unplug your machine. Model I, Color Computer, and other external drive owners must locate four screws, two on each side of the drive casing near the bottom. Remove the screws, put them somewhere safe, then remove the drive cover.

Models III and 4 users have to do more work to get at their drives. You'll have to remove the computer case top and cover, and the screws on the drives. First, shine your flashlight through the vent slots at the top of the case and look inside. The drives are on the right; a shield covers them in the newer computers. On the left side, about 4 inches in, is the neck of the picture tube: It's pretty close to the metal circuit board shield.

Alcohol
Alignment disk and software
Allen wrench set
Bath towel
Blank disks
Cotton swabs
Small flashlight
Flat-head screw driver, 1/4-inch wide blade, at least 4 inches long
Small hand mirror
Oil (Chem-oil or Marvel oil; not WD-40)
Oscilloscope (optional with the J & M Systems diagnostic package)
Paper
Pencil

Table. Necessary tools for disk-drive maintenance.

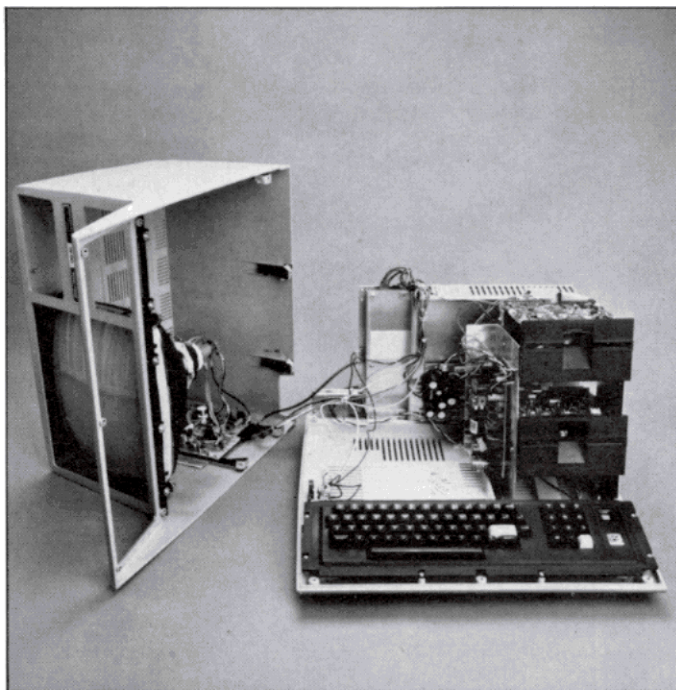


Photo 1. Model III with its computer case removed and lying on its side.

This means that when you take the cover off, you have to pull it carefully straight up.

Now take it all apart. Don't be nervous—you can't hurt anything except the picture tube. If your machine has a black screw in its center back, remove it and turn the computer up on its back. You should see a total of 10 screws: three along the front, two about 6 inches back along each side, and five around the back. Take them all out and put them in a safe place. Gently put the machine back on its feet.

With a hand on each side of the machine, gently pull the computer case straight up. You might have to move it slightly forward or backward to clear the internal wires. Sometimes the case top gets hung up on the ribbon cable from the keyboard (the cable that plugs in on the side of the card cage and might be held in place by a metal clamp or bracket). If it does, reach under the right side near the back, feel around for it, and unhook it. Place the case top on its side next to the machine (see Photo 1); set it on a towel so it won't get scratched.

Take a few minutes to look around inside and get comfortable with the guts of the machine (see Photo 2 for an overhead view). If you've unplugged it, you can't hurt anything and nothing can hurt you.

The disk drives are located on the right. Each one has three loose wires for power, a ribbon cable for data and con-

trol signals, and (on some machines) a ground wire.

The power supply is on the side of the disk drive mounting brackets. Avoid touching it when the machine is on—it bites. Safety inside a computer doesn't require technical training, just common sense and a knowledge of where not to put your hands.

Some of the non-Radio Shack add-on kits use screws or double-sided tape to mount the power supply on the bottom of the machine. These are called switching power supplies. Others have a linear power supply that uses power transformers. The transformers are on the side of the drives, hung off the back of the drives' mounting brackets, or under drive zero.

Your next step is to remove the disk drives (see Photo 3). If your computer has metal brackets with slots for the drive mounting screws, you might want to take a pencil and mark the screw locations on each bracket. Then, when you put the machine back together, the drives will line up with the holes on the front of the computer.

While holding the top disk drive up so it doesn't crash down on the bottom drive, remove the screws that hold in the top drive. You should see two on each side of the bracket. Unplug the ribbon cable by pulling off the connector. Then unplug the power connector by pulling straight down; you might have to wiggle the connector because it's usually tight. If your machine has one, pull off the

ground wire. Put the drive somewhere safe.

Now it's time to remove drive zero. If your machine has the heavy plastic Radio Shack mounting brackets, you might find a screw behind the power supply left of the drives. It's easy enough to find out: Remove the three exposed screws and see if the drive is loose. If it's still attached, you have to take out the hidden screw.

To get at this screw, you don't have to completely remove the power supply. If you take out the top right corner screw and the two bottom screws, the power supply will swing back far enough to let you remove the hidden screw.

This screw isn't absolutely necessary—even Radio Shack technicians leave it out so they don't have to get at it next time. Unless you're a purist, discard the screw. You'll find that the three screws remaining in the bottom drive and the screws in the top drive are more than enough to support drive zero.

Finally, remove the wires on this drive as you did on drive 1. Congratulations—you now have your TRS-80 completely apart. Set drive zero in another safe place where you won't confuse it with drive 1.

Now take a break. Walk away from the computer. The next few steps involve taking the drive apart for cleaning and it's easier to make stupid, costly mistakes if you're tired.

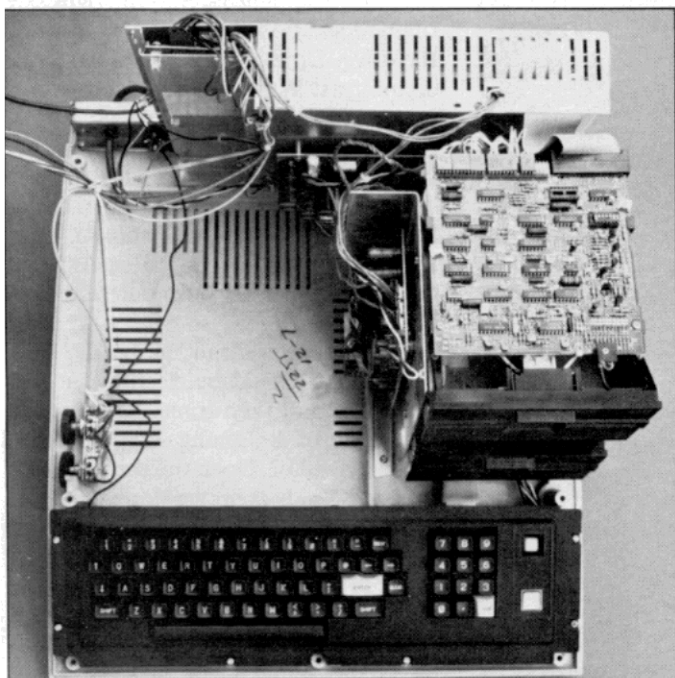


Photo 2. Overhead shot of a Model III's insides.

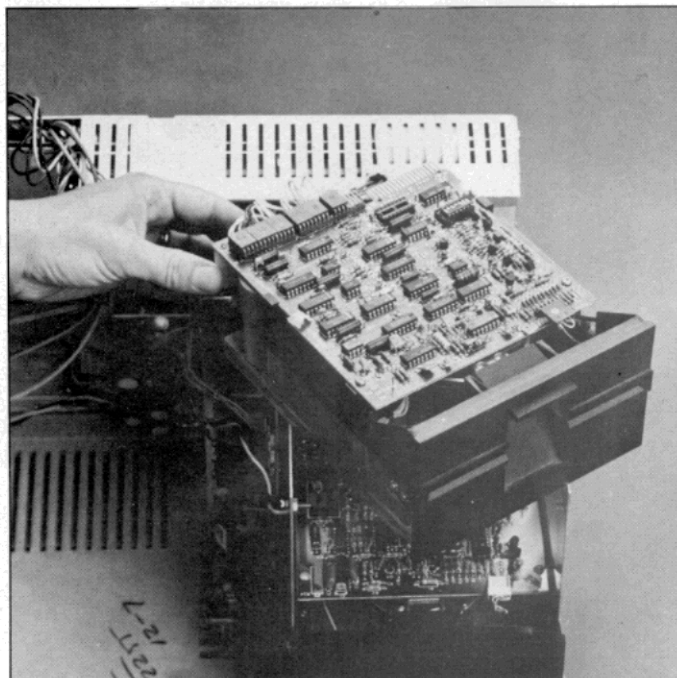


Photo 3. Removing a Tandon top disk drive. Hold the top disk drive up so it doesn't fall down on the bottom drive, and remove the screws that hold the top drive in place.

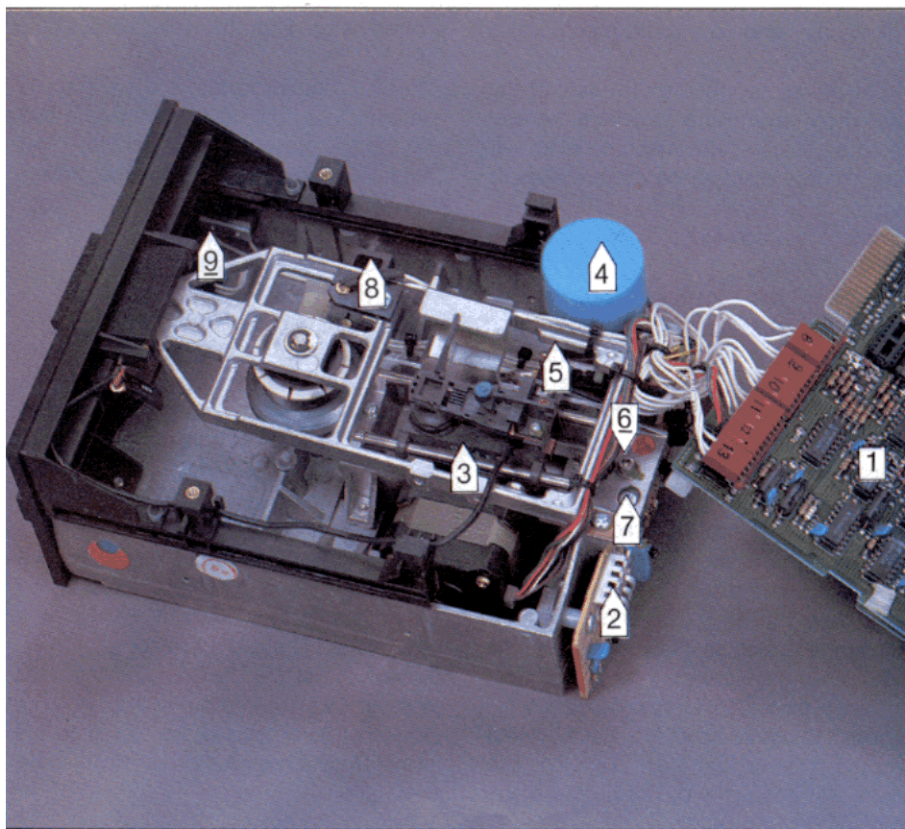


Photo 4. Tandon drive with top board hinged out of the way. (1) Main logic printed circuit (PC) board or top board. (2) Motor speed control PC board or servo board. (3) Head carriage assembly. (4) Drive motor. (5) Track-zero switch. (6) Head alignment screw (one of three). (7) Head alignment adjustment cam screw. (8) Index detector assembly. (9) Write-protect switch.

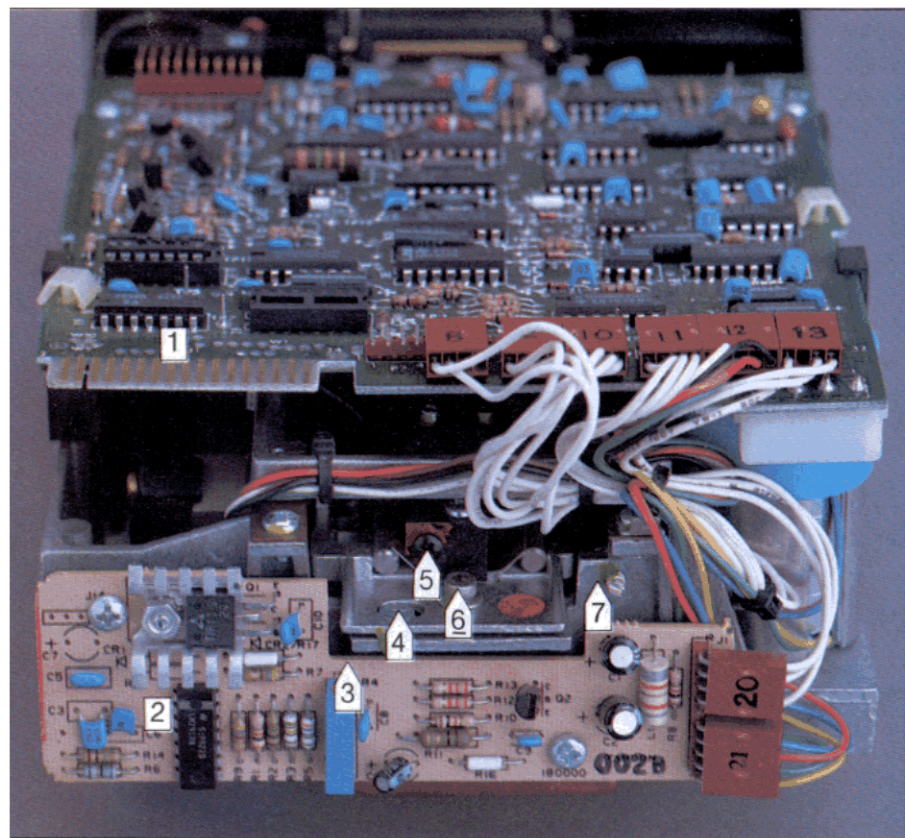


Photo 5. Rear view of a Tandon drive. (1) Main logic PC board. (2) Motor speed control PC board. (3) Motor speed adjustment. (4) Head alignment adjustment cam screw. (5) Track zero stop screw. (6) Head alignment screw. (7) Track zero switch adjustment screw.

Cleaning Up

Your first task is to clean the drive heads. The only way to do this properly is to get in there with something and clean them. Head-cleaning disks don't make it for a good cleaning.

Which reminds me, *don't* use a head-cleaning disk more than once a month or when you're having dirt-related read/write problems. Overusing the head-cleaning disks causes almost as many disk head failures as not cleaning a machine at all. Most drives that come through my shop with bad disk heads have owners who overuse cleaning disks. Rebuilding a drive with a defective head is expensive (about \$100 plus labor, shipping, and so on) and usually avoidable.

Look at drive zero. It consists of a chassis with the head, motors, guides, and so on, and a logic board on the top. Some drives, including Tandon's, also have a motor speed control board mounted on the back or underneath the chassis.

You're going to remove the top logic board so you can clean the head and oil the guide rails. If your drive has screws, remove them. If you have Radio Shack drives with little white plastic buttons instead of screws, gently push the center plug out of the button from the bottom with a screw driver or knife and remove the pin. Pull out the buttons and put all the pieces aside.

Before you can remove the board, you have to unplug the head connector—the wire plugged into the right side of the logic board toward the front of the drive. Double-sided drives have two connectors: Write down which is which so you remember where they go.

You don't need to remove all the wires plugged into the back of the board. Gently hinge the logic board back out of the way (see Photo 4). Take a few minutes to compare Photos 5 and 6 with the drive to figure out where everything is.

Now you can clean the heads. Disk drive heads should be clean enough to eat off of and then some. Saturate the cotton tip of a cleaning stick or cotton swab in alcohol. Open the drive door to keep the heads apart on double-headed drives and the pad off the head in single-headed drives.

Scrub the bottom head with the cleaning stick or swab (see Photo 7). Start at the center (the stripe in the middle is the actual read/write area) and work your way out. Some of the oxide that sticks to a head is stubborn, so don't be afraid to scrub hard. Nothing

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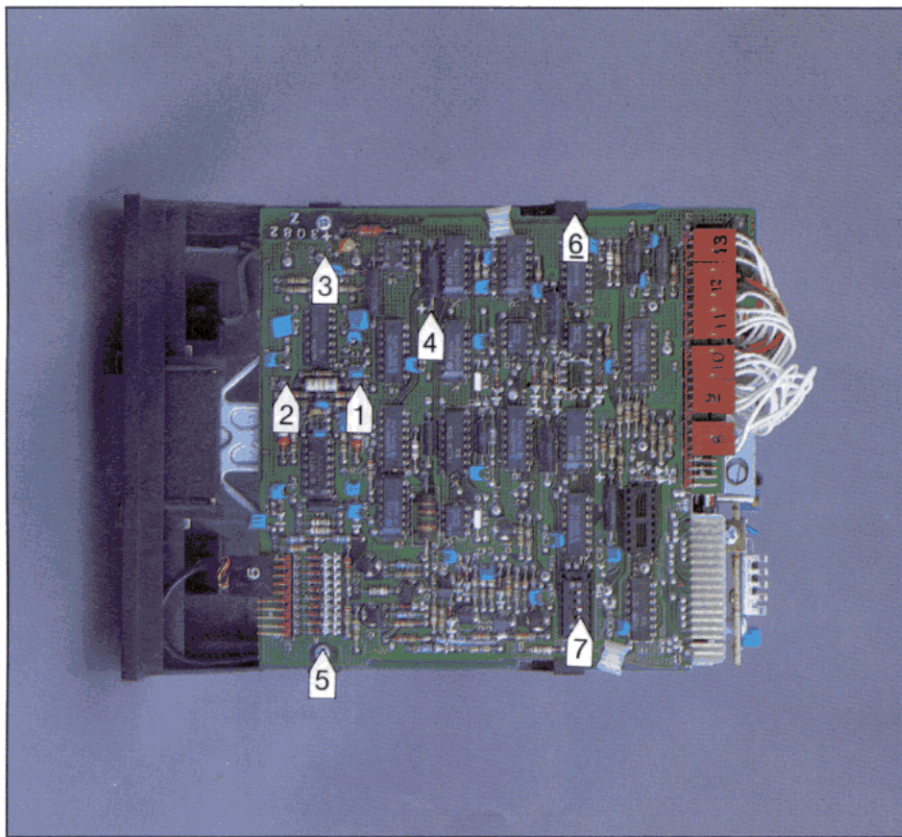


Photo 6. Top view of a Tandon drive. (1, 2) Head preamplifier test points for alignment. (3) Ground test point. (4) Index detector test point. (5) Top board mounting screw. (6) Slide board back so notches line up with plastic clips to remove board. (7) DIP shunt for drive select.

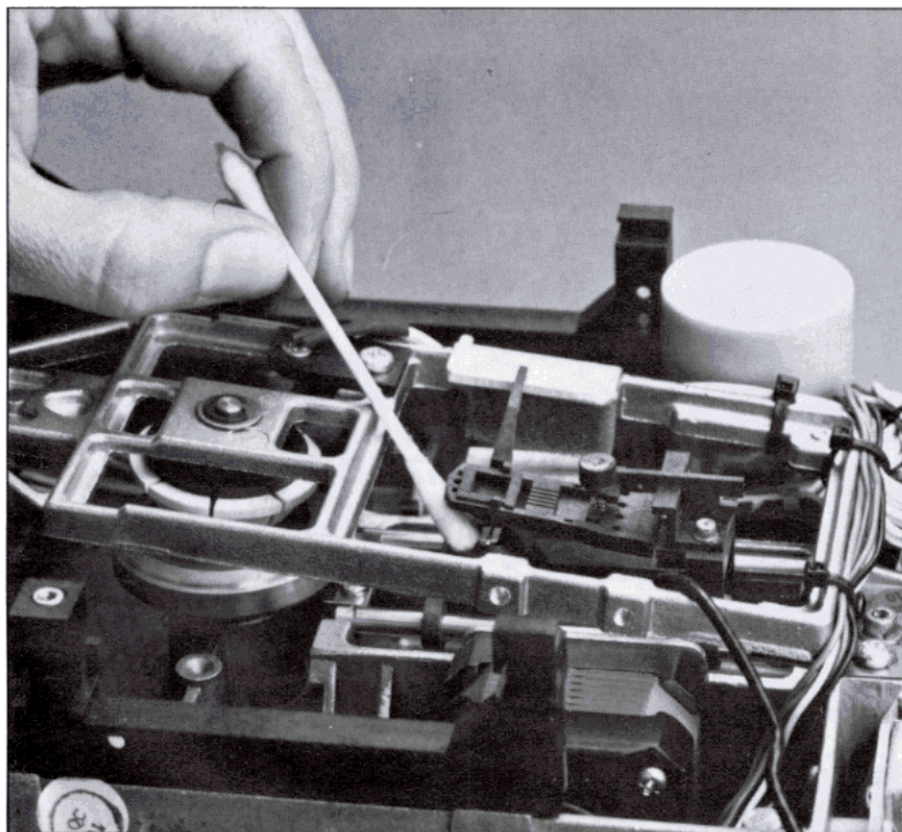


Photo 7. Cleaning a Tandon drive head. Saturate the cotton tip of a cleaning stick or cotton swab in alcohol. Open the drive door to keep the heads apart on double-headed drives and the pad off the head in single-headed drives.

should touch the heads except the alcohol and cotton swab.

If you have double-headed drives, gently clean the top head using a fresh swab and alcohol. Leave the drive door open so the heads don't touch.

If you have single-headed drives, gently clean the felt pad with the swab; remember that not much holds it in place. Inspect the pad. If it looks badly worn, you should consider replacing it. If it has any residue on it, gently scrape it off with your fingernail. The drive will probably work until you get a new pad unless it's very badly worn or has a hard build-up that won't come off.

If you're thinking that you'd like to clean and check your drive heads twice a year, order a couple of spare pads and put them in next time. However, if this one trek through your TRS-80 is one too many, jot down that drive zero needs a pad and tell your service technician next time you take your machine to the shop.

If you have a new pad and want to install it now, peel off the old pad. Carefully peel the new pad off the paper it comes on and stick it into the old pad's indentation. Tandon sells the pad alone or the entire top arm assembly (the plastic arm that holds the pad).

You can replace the pad either way, but I don't recommend replacing the top arm assembly unless it's absolutely necessary. Getting the arm, spring, and hardware together without losing the little spring is tricky. Also, positioning the top arm requires a delicate touch, an oscilloscope, and a lot of patience.

Wet another swab with alcohol and wash both rails. The rails are actually what engineers call linear bearings: The head slides on them and they should have very little friction. Be sure to clean off the dirt, dust, fuzz, and nicotine. (By the way, cigarette smoking kills your disk drives. If you can't quit, don't smoke near the machine.)

Other Drive Maintenance

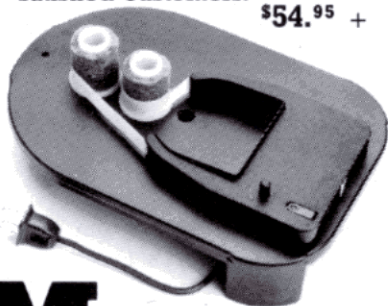
After you clean the rails, locate the clamp on the shaft between the stepper motor and the head. A loose clamp is the most common cause of TRS-80 head alignment problems. Find the proper size Allen wrench and make sure the clamp is reasonably tight.

Now get out the oil. Tandon doesn't recommend oiling the disk drives; unfortunately, using them dry seems to cause excessive noise and wear. On drives I've treated, the head carriages last longer with a little lubrication. (See Photos 8 and 9 for top and side views of the head carriage assembly. I removed

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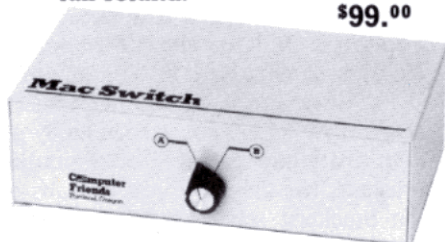
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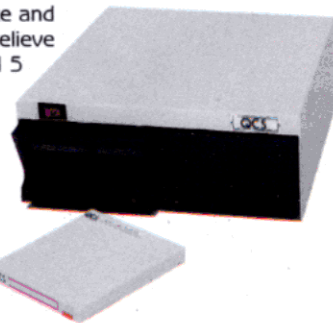
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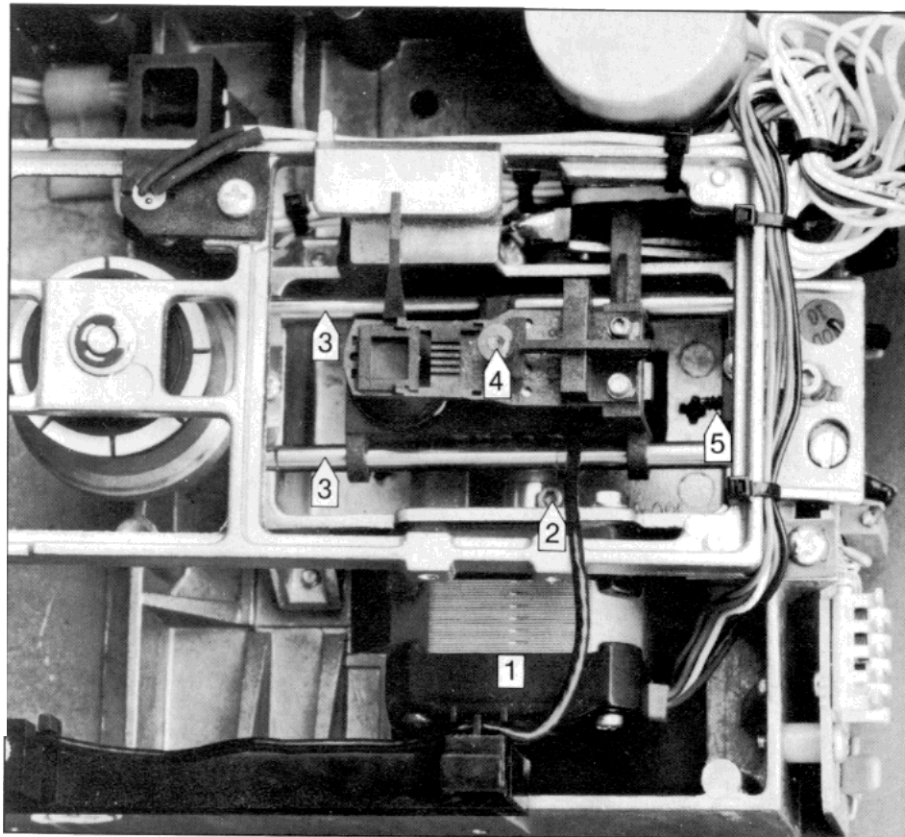


Photo 8. Top view of a Tandon head carriage. (1) Stepper motor. (2) Head positioner clamp screw. (3) Head rails. (4) Head pressure adjustment screw. (5) Track zero stop screw.

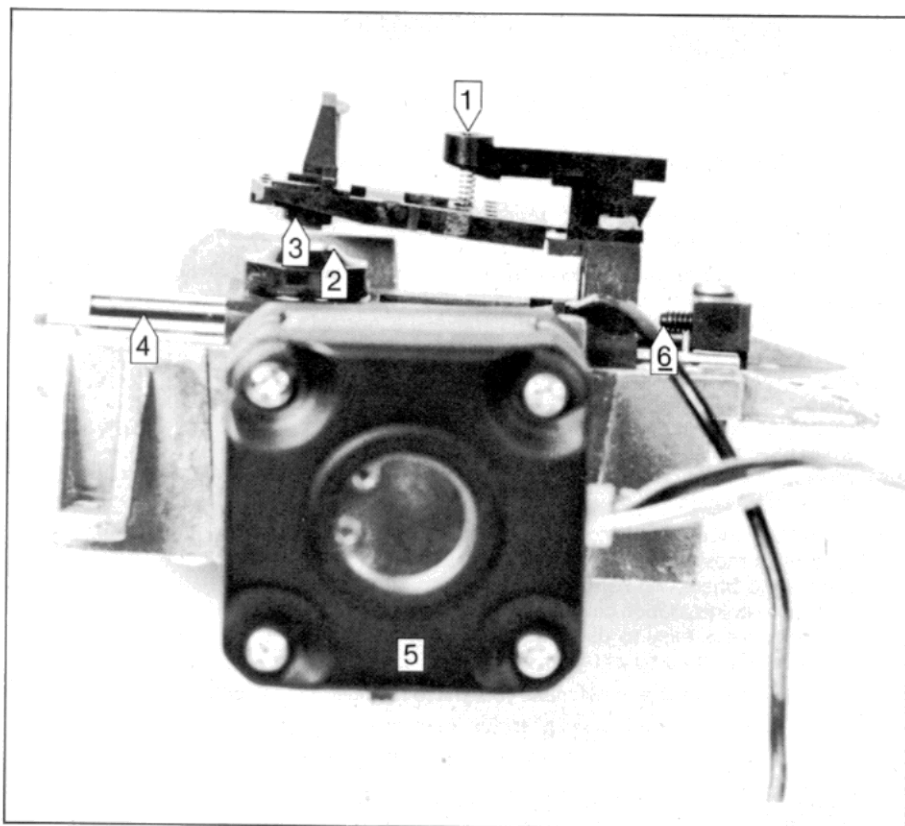


Photo 9. Side view of a Tandon head carriage. (1) Head pressure adjustment screw. (2) Head—clean here. (3) Head load pad—clean here. (4) Head rails—clean and oil here. (5) Stepper motor. (6) Track zero stop screw.

the carriage assembly from the drive for photographic purposes. *Do not remove the carriage assembly from your drives.*)

The oil you use should be thin, light, and oil-based (rather than silicone-based), and shouldn't thicken or dry excessively with age. I use Chemtronics' Chem-oil, which is available at most good electronics wholesalers who sell to TV repair shops. Also, your local TV or computer repairman can get some for you. Chem-oil comes in a spray can, but you might find it easier to use a liquid. Marvel's Mystery Oil works well, too.

The secret to oiling a disk drive is to get the oil only where you want it and to use just enough to coat the rails. You want to leave a thin film of oil on the moving parts, but not so much that it drips or sags.

The best way is to put a little oil on a cotton swab or cleaning stick and swab the left and right head carriage guide rails. If you're using Siemens drives, lightly oil the feed screw that positions the head carriage.

Together Again

Now you're ready to put drive zero back together. Put the logic board back onto the drive chassis. Line up the little notches on the sides of the board with the plastic holders, then slide the board forward so the screw holes line up.

If your drive had screws, replace them finger tight. If it had plastic buttons, reinsert the buttons and press the pins through the holes. Gently reconnect the head or heads. On double-headed drives, be careful that the proper plug is on the proper connector.

Now connect the power connector to drive zero. The notched connector plugs in only one way. Be firm, but don't force it.

Look at where the ribbon cable connects. If the board edge connector looks a bit tarnished, clean it with alcohol and a cotton swab. Reconnect the ribbon cable by pushing it back into place.

Put drive zero back into the brackets where drive 1 goes so you can easily get at it. If you have Radio Shack mounting brackets, the drive will rest on tabs on the brackets; screws aren't necessary. Everybody else should put the screws on each side with a couple of turns to hold the drive in place. You'll probably have to take it out again to make adjustments, so don't bother to tighten the screws too much.

This is the moment of truth: Plug in and turn on your computer. The light should come on and the drive should step back to track zero. Put your diag-

nostic disk in drive zero and boot it up. If the head steps back to track zero with a loud thunk, the track zero stop is set too far in. Find the right size screw driver or Allen wrench, back the screw off about half a turn, and try it again.

If the drive fails to boot, the head alignment is probably off. Connect drive 1 in place of drive zero if your system uses a keyed cable. A keyed cable has teeth missing in the connector so that only one drive is selected at a time. If your drives have them, switch the drive select DIP shunts to select drive 1 as drive zero. If this drive boots, clean and oil it as you did for the other drive and use it as drive zero. I'll help you align the other drive later and you can use it as drive 1.

Chances are that you didn't do anything bad to the drive. Sometimes the alignment shifts when you tighten the screws. Right now you want a drive that boots properly as drive zero so you can load the diagnostics.

Testing

For testing purposes, you have to plug in your computer. The first diagnostic test you should run is for drive speed. (Editor's note: See "Timing Your Drives," p. 72.)

If you use commercial software, consult your diagnostic program's documentation for instructions. Insert a blank disk for the speed check to avoid a glitch on your master disk.

Your drives should rotate at 300 rpm, plus or minus 1 rpm. TRS-80 drives have a habit of drifting off speed over time. About 90 percent of TRS-80 disk drive problems involve speed or dirt.

If the diagnostic program indicates that your drive speed is correct, you're all set. If not, the speed adjustment for Tandon drives is the blue 24-turn potentiometer on the motor speed board.

If your computer uses Tandon drives and the plastic Radio Shack brackets, you'll find the speed board on a bracket underneath the drive and the adjustment is difficult. Hold the drive with one hand, remove the screws with the other, and gently remove the drive while it's running so you can get at the speed control. Adjust the potentiometer with a small screw driver or your fingernail until the program indicates that the speed is 300 rpm.

Fortunately, other types of disk drives make life easier. Texas Peripherals' (Radio Shack's own) drives have a different circuit board with the motor

control on the top board. The speed potentiometer is on the left facing front. Micro Peripherals Inc. drives also have the control on the top board. It's usually located on the left side of the board, is blue or brown and about 1/2 inch square, and has a screw on one edge. Again, adjust for 300 rpm.

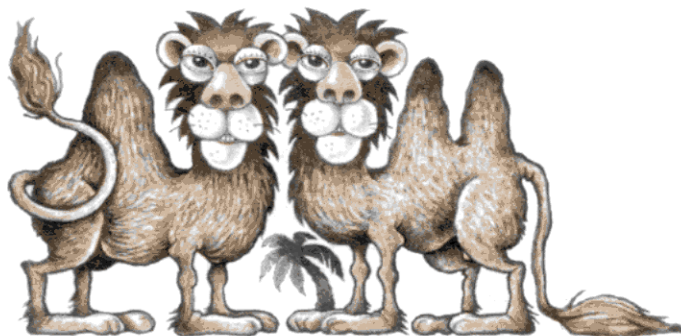
One way to check speed if you don't have a test program is to look at the strobe disk on the large pulley at the bottom of the drive. This disk has lines on it that are spaces, so as the flickering light of a bulb hits them, they appear to stand still. You might want to use a small mirror to see better. Don't waste time trying to check the speed on a strobe disk in daylight; natural light doesn't flicker like artificial light.

The disk's outside band is for American, 60 cycle-per-second (cps) power, and the inside band is for European, 50 cps power. When you've correctly adjusted the speed, the lines appear to stand still. If they seem to drift slowly one way or another, adjust the speed until they stand still. Test programs are easier to use.

Now for a really hard test. With your fingers, grab the large pulley on the underside of the drive and hold it. If the

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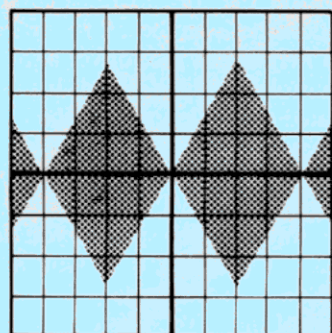
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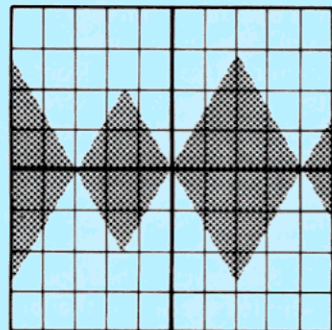


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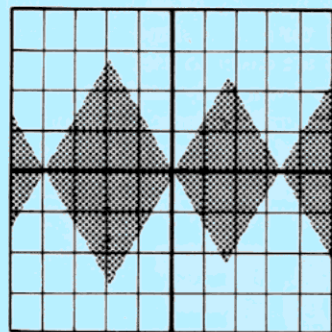
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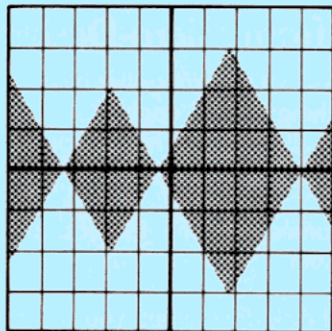
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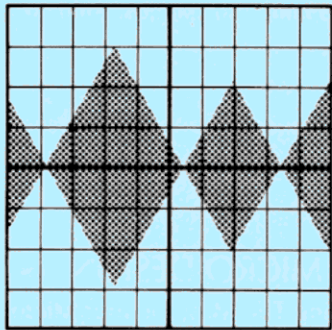
Acceptable reading



Acceptable reading



Unacceptable reading



Unacceptable reading

Figure. Oscilloscope double-lobe configuration.

belt doesn't fall off and the motor still runs, the belt is worn out and you should replace it soon. It will act up when it starts to slip on its own. If the motor stalls, the belt is OK.

If you had to pull the drive out, put it back in again. If you're using J & M Systems' package, run the quick-test option to check the rest of the drive for alignment. Ignore the index test of the quick test (it has a bug). Don't let the hysteresis test bother you if it comes up bad; many drives can't pass this test (more on this later). Next, you're going to test head alignment.

Select the radial alignment test and look at the screen. As long as the sectors the drive reads are centered, the alignment is fine. Again, check your program's documentation for instructions. If the sectors aren't centered, you have to adjust the head alignment to center them.

Oscilloscope Directions

If you're using an oscilloscope and an analog alignment disk, connect the channel 1 input to the read preamplifier test point (see Photo 6). Most drives have two test points because the read preamplifier is balanced to cut down on common mode noise.

To find the two test points for your drive, look for them near the head connector and near each other. They look like they're connected to the same kind of components. If you still can't find them, consult the drive manufacturer or the technician where you bought the drives.

It helps to connect the oscilloscope external sync input to the index detector test point (see Photo 6), but it's not necessary. Set the oscilloscope's vertical amplifier for alternate current (ac) coupling and 50 millivolts/division, and the horizontal sweep to 50 milliseconds/division.

Insert the alignment disk in the drive, and use your test program to position the head over track 16. In some programs that use hexadecimal (hex) locators, like Floppy Doctor, this is track 10 hex. If you're using Floppy Doctor, answer all the questions, then select test T. Tell the program to seek track 10H.

Now look at the screen on the oscilloscope. You should see a double-lobe pattern that most disk drive repair manuals call a cat's eye pattern. Both lobes should be the same size, or within 10 percent of each other in height (see the Fig.).

If they are too large or small, adjust the vertical amplifier control on the oscilloscope a notch either way until the

picture is easy to see. The vertical amplifier gain is like a volume control on a radio; it makes the signal to the oscilloscope stronger or weaker, so it appears larger or smaller.

If the pattern looks OK, this drive is all set and ready to put back in place. If the pattern doesn't look good, it's time for the second most common disk drive adjustment: head alignment.

Alignment Advice

Aligning heads on a disk drive is fairly easy. If the alignment is already close (if it isn't, the machine won't boot the test program), you can touch up the alignment yourself. If you feel that head alignment is beyond you, your local computer technician will do it for you. Remember: Radio Shack Service Centers will not work on a drive that doesn't have a computer or case around it.

To align the heads on a Tandon or Texas Peripherals disk drive, loosen the two screws underneath the drive and the one on the top at the back of the drive. Use a medium-size, flat-blade screw driver on the adjustment screw, and turn it a fraction of a turn while watching the screen or oscilloscope. This screw is actually a cam that moves the head carriage slightly as you turn it.

If the alignment gets worse, turn the screw the other way. This requires only a light touch; don't force it.

If you can't align the drive over the range of the adjustment cam, the job becomes more complicated. You have to loosen the stepper motor clamp and move the head positioner on the motor shaft. This is a job that requires a skilled technician. Tighten the screws back up a bit and call in the cavalry.

When you finally get the two lobes the same size (those of you with oscilloscopes) or all the smile faces centered on the scale (those of you with J & M Systems' program), tighten the screw on the back of the drive finger tight. If the alignment has shifted a little, gently apply the screw driver to the adjustment screw again. Tighten the hold-down screw a little more, and tighten the two screws underneath the drive finger tight.

If you're using the J & M Systems' test package, run the hysteresis test. This tells you how accurately your drive can repeatedly find the same spot on the disk (or how sloppy the head carriage positioning is), and also works in the oil. Usually Tandon and Texas Peripherals drives fail this test on the quick test, but pass after the oil works in. As long as the two rows of smile faces line up closely on the screen, the drive is OK.

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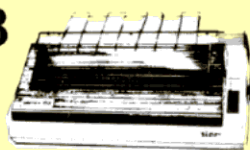
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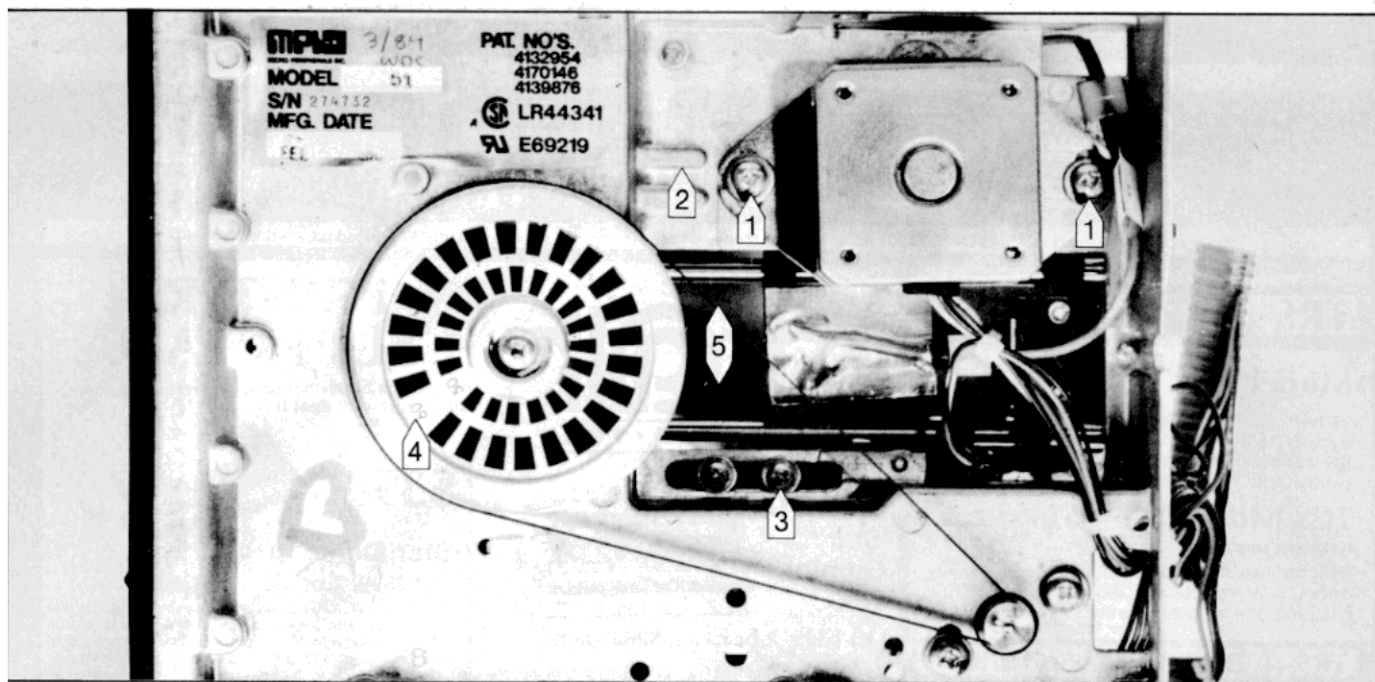


Photo 10. Bottom view of a Micro Peripherals Inc. drive. (1) Head stepper motor mounting screws. (2) Notches for screw driver to align head. (3) Track zero detector adjustment. (4) Strobe disk. (5) Head rails.

Shack's Color Computer), Micro Peripherals Inc., or Siemens drives, you align the heads by turning the stepper motor that positions them (see Photo 10). Find the screws that hold the stepper motor in place and loosen them slightly. While watching the screen or oscilloscope, gently turn the stepper motor slightly. Some drives have a notch in the motor and in the drive body in which you can wedge a screw driver.

If the alignment gets worse, turn the stepper motor the other way. The object is to get the head in the right place so the two lobes on the oscilloscope are the same size (or the smiles are centered). When you've achieved that, tighten the screws and you're done.

Whichever drive you finish first that works is your drive zero. Put it in the drive zero slot and put back the screws that hold it in place.

If you have loose sheet metal shields on the sides of your drive mounting brackets (Radio Shack drives), be sure all the holes in the shield line up with the holes in the bracket before you tighten the screws; otherwise, you'll have to loosen them up later.

Repeat all of the above for the second drive.

The Finish

Now that you have both drives cleaned, lubed, aligned, and adjusted for speed, you need a test drive. Note that you shouldn't put the cover back on yet. You first want to make sure everything works properly.

Load your favorite DOS disk and format a blank disk in one of the drives. It should be a new disk or one in good condition.

The idea here is to see if the drives can read and write properly. Nothing will drive you crazy faster than trying to get the bugs out of a drive that has nothing wrong with it. You want any errors to be drive or controller problems, not disk errors.

If the drive won't format all the way through, try the other drive. If that drive won't format either, you might have a disk controller problem.

You want to read/write test the drives before you put the machine back together. If you have Floppy Doctor, use the worst-case pattern test. If you have the Radio Shack diagnostic, use the DSKDG3/CMD program. Whichever test you use, be sure that the disk in your computer is the blank disk you just formatted, not your diagnostic disk. I lose more diagnostic disks that way; it's an easy mistake to make.

Test both drives following the directions that come with your program. If you get a lot of errors on the higher numbered tracks, make a note of it and I'll get to that problem in a minute. If your drives get only a couple of errors each, they're probably OK.

Here's a trick that might cut down on the number of soft errors on a drive: Turn up the pressure with which the pad pushes against the head. To adjust this, you have to remove the drive again, hinge the board out of the way, and

tighten the little screw above the spring about one turn (see Photo 9). Put everything back together and retest the drive. If this doesn't clear up most of the errors on the drive, it's time to call for help.

Again, if both drives have lots of errors, you might have a disk controller problem. The only easy way to test the disk controller is to swap in another one and see if the problem goes away. If you have your heart set on doing it yourself, borrow a disk controller from a friend or swap your controller into his machine. Your best bet is to take the computer into the shop. Why take unnecessary chances?

If everything works, you can put it all back together again. Put all the screws in the two drives except the hidden screw behind the power supply and tighten them reasonably tightly. Be sure that all the power, ground, and ribbon cable connectors are connected where they belong, and that all the wires are neat.

If you marked the brackets where the drives were, make sure they line up with your marks so they'll align with the openings in the front of the computer case. Tuck the keyboard connecting cable out of the way so the case doesn't hang up on it.

Pick up the case top and align it over the top of the computer chassis. Carefully lower it onto the chassis, making sure that the picture tube neck doesn't tangle in the wires or bump the printed circuit board shield. Also be careful to

slide it over the disk drives and to avoid the keyboard cable. If the keyboard cable gets in the way, slide your hand under the case and unhook it. Set the case on top of the chassis, then make sure that no wires are pinched between the two. If they are, lift the top an inch and tuck them in.

Gently turn the case on its back and put the three short screws in the front, the two long ones in the side holes near the front, and the five other screws in the holes around the back. Flip your

machine back down on its feet; if you had a black screw, put it in the hole in the back of the machine. Now you're finished.

Assistance

If you had problems or need more help, you can call me at Wildwood Data Systems during normal business hours.

Parts are a problem. You can order Radio Shack drive parts through their National Parts Division. Allow 6-8 weeks for delivery. Tandon parts take

just as long to get, and the minimum order is \$50.

If you don't need that many parts, you can order most Tandon and Radio Shack drive parts through your local dealer or from Wildwood Data Systems, Box 114, Plank Road, Berlin, NY 12022. ■

Vincent E. Meyer is a computer technician. You can reach him at his company, Wildwood Data Systems, Box 114, Plank Road, Berlin, NY 12022.

Disk Drive Manufacturers

Dysan Corp.
5201 Patrick Henry Drive
Santa Clara, CA 95050

J & M Systems
137 Utah NE
Albuquerque, NM 87108

Micro Data Supplies
22295 Euclid Ave.
Euclid, OH 44117

Micro Peripherals Inc.
9754 Deering Ave.
Chatsworth, CA 91311

Percom Data Corp.
11220 Pagemill Road
Dallas, TX 75243

Prosoft
Dept. C, Box 560
N. Hollywood, CA 91603

Radio Shack National Parts
900 E. Northside Drive
Fort Worth, TX 76102

Shugart Assoc.
475 Oakmead Pkwy.
Sunnyvale, CA 94086

Siemens Communications Systems Inc.
Data Communications Division
186 Wood Ave. S.
Isenlin, NJ 08830

Tandon
9333 Oso Ave.
Chatsworth, CA 91311

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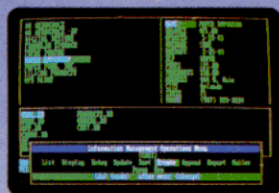
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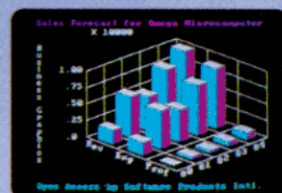
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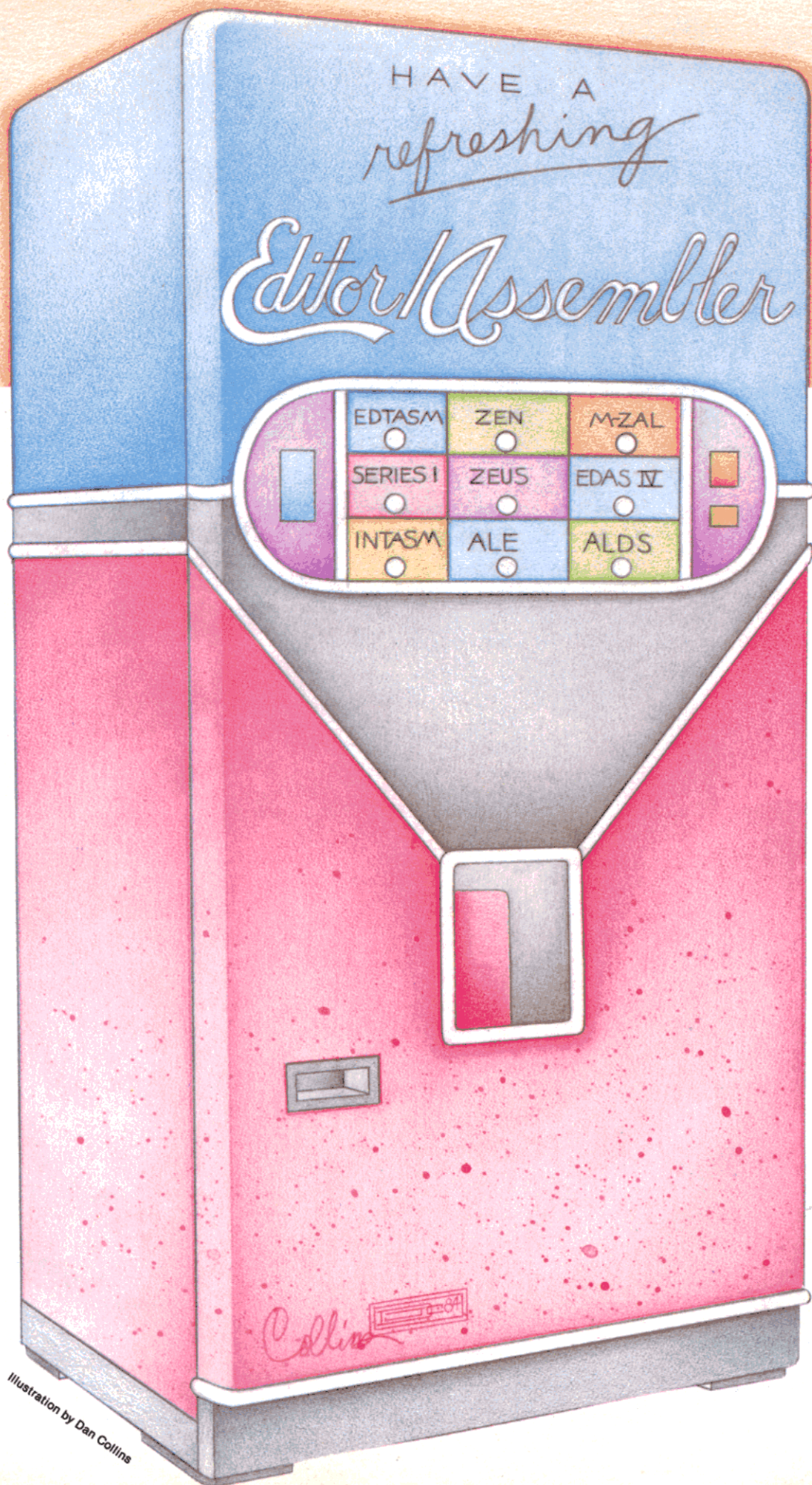
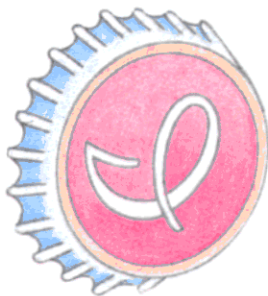


Illustration by Dan Collins

Making Your Selection: Choosing the Right Editor/Assembler

by Hardin Brothers

Confused by the variety of TRS-80-compatible editor/assemblers on the market? Hardin Brothers calls the roll and tells you what different editor/assemblers will and won't do for you.



I've studied, compared, and tested nine of the most popular TRS-80-compatible editor/assembler packages on the market (see Table 1 [p. 60] for a complete list). I found a wealth of special features and a complete lack of agreement among program developers about what makes up an ideal package. In addition, some of the software includes auxiliary programs that enhance their abilities (see Table 2 [p. 62]). I wish the best features of all these packages could be combined into a single system.

My programming style and yours undoubtedly differ. What I want and what you want from an editor/assembler will vary. If you use one program constantly, you might be so used to working with it that you see no reason to change.

My purpose is not to praise or blame any software manufacturer or program user by saying that his system is bad; rather, I explain my evaluations of these systems so you'll know what is available and what isn't. See Tables 3 (p. 64) and 4 (p. 66) for a comparison and summaries of pseudo-ops.

Defining an Ideal

Before examining the individual packages, I'll define the features that my ideal editor/assembler would have.

First, the editor portion of the program should be full-screen-oriented instead of line-oriented. It should function like a word processor, letting you scroll forward or backward through the source code, changing anything, anywhere, at any time. Backward scroll that merely prints the lines in reverse order at the bottom of the screen is no substitute for a full-featured editor (I doubt anyone can make sense of source code in reverse order).

The editor should support global search with and without replacement, should suppress line numbers (who needs line numbers while writing source code?), and should show the difference between tabs and spaces when asked. If the source code

is larger than memory, the program should use virtual memory, and support scrolling either forward or backward from a disk file.

The assembler must support the full Z80 instruction set. It should allow labels and symbols with various nonalphanumeric characters (@, \$, #, and so on) and with lengths of more than eight characters.

It should support conditional assembly and macro instructions. It must be able to include other source code from disk into the program being assembled, and search a library of standard subroutines for those named in the program.

If the assembler supports the undocumented Z80 instructions, so much the better; however, I seldom use such codes because there's no guarantee that they'll work on any given computer. Certainly, the assembler should be able to handle source codes larger than memory and to link various programs together. Also, it should be able to assemble either into memory or onto disk.

Finally, the assembler should handle a full range of arithmetic and logical operations, and understand decimal, hexadecimal (hex), and binary numbers.

Second to a disk system, a printer is the Assembly-language programmer's greatest ally. The ideal editor/assembler should print source code, assembled code, complete symbol tables, and complete cross-reference lists. It should

**Apparat's EDTASM
is essentially
the old Radio
Shack tape
package, upgraded
to work on
disk with a
few enhancements.**

leave top and bottom margins on each page if desired, and indent so you can store code in a notebook. It should also be able to print headers on each page, along with the current date.

Besides the ability to combine files at assembly time, the program should have some facility for linking various preassembled modules together, resolving external symbols, and producing code that will run from any given location in memory. The linker that performs this function should also be able to search through a library of preassembled subroutines and pick out the correct ones to add to the program.

Once you assemble the code and load it into memory, you must debug it (again and again). To aid the debugging process, a full-functioned monitor pro-

gram should be part of the total package. The monitor must support single-stepping through a program, display a disassembly of selected portions of memory, set multiple breakpoints, and let you make memory modifications either in ASCII or hex.

Finally, the program should be able to do all the above in such a way that the programmer can concentrate on programming instead of file handling. Every function of the package should be available without returning to the DOS level and without giving the system specific save and load commands.

Unless you override it, the system should be able to develop appropriate file names itself, using the same general name with different extensions for source code, assembled code, linked programs, subroutine libraries, cross-reference lists, and so on.

Though none of the editor/assemblers I've used meets all these criteria, some come much closer than others. Some include features I never thought about. All seem to work without bugs, though I couldn't use some long enough to guarantee that they are bug-free.

EDTASM—Apparat

This is the most primitive of the packages, and probably the most popular as well. Almost every other Model I/III editor/assembler supports EDTASM disk files normally or as an option.

The line-oriented editor uses commands similar to those in Basic.

Table 1. Model III/4 editor/assemblers. (All programs that run on the Model III also run on the Model 4 in Model III mode.)

EDTASM

(Included as part of NEWDOS80 2.0 for the Model I/III.)

Apparat Inc.
4401 S. Tamarac Parkway
Denver, CO 80237

Series I Editor/Assembler

(\$34.95; Model I and III versions included in one package.)

Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102

Instant Assembler (INTASM) 2.1

(\$49.95; available for the Model I/III. Model 4 version available soon.)

Mumford Micro Systems
P.O. Box 400
Summerland, CA 93067

Zen 4.3

(\$39.95; one package supports Model I/III/4.)

The Alternate Source
704 N. Pennsylvania
Lansing, MI 48906

Zeus

(\$79.95; runs on Models I and III.)

Cosmopolitan Electronics Corp.
5700 Plymouth Road
Ann Arbor, MI 48105

ALE 1.5

(\$49.95; runs on Models I and III.)

The Alternate Source
704 N. Pennsylvania
Lansing, MI 48906

M-ZAL release 3

(\$99.95; available for Models I, III, and 4. Model 4 version not reviewed.)

Computer Applications Unlimited
P.O. Box 214
Rye, NY 10580

EDAS IV and Pro-Create

(\$100; EDAS IV runs on Models I and III with LDOS. Pro-Create runs on Model 4 with TRSDOS 6.X.)

Misosys
P.O. Box 4848
Alexandria, VA 22303

Assembly Language Development System (ALDS)

(\$149; Model III/TRSDOS 1.3 and Model 4/TRSDOS 6.X versions included in one package.)

Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102

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Screens

Visicalc menu

Main Menu

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2.	10. Utilities
3. Letters	11.
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5. Business	13.
6.	14. NICE development
7.	15.
8. Visicalc	16. Entertainment

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Format utility

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Ref => _____

=> _____

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Visicalc ^(tn) interface

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4	Parking	08/20/83	\$15.00
5	Shopping	08/20/83	\$73.20
6		Total:	\$116.06
7			
8			
9			

The information kept in the database can be processed by Visicalc.

Special built-in interface allows data transfer from Database to Visicalc.

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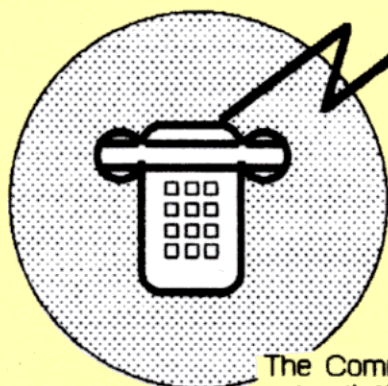


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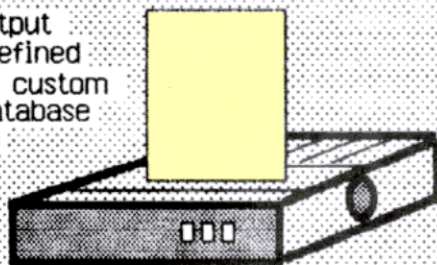
Communications



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EDTASM edits and assembles only source code that fits into memory along with the symbol table. It doesn't support conditional assembly or macro instructions. This program is essentially the old Radio Shack tape EDTASM upgraded to work on disk with a few enhancements. You must have the tape EDTASM instruction manual in order to use the program, but that manual is no longer available.

The program is distributed as a "free" extra, along with a reasonable disassembler and an excellent Debug utility, with NEWDOS80. It's a good package for the beginner, but too limited for a more experienced user.

Series I Editor/Assembler— Tandy/Radio Shack

Tandy's package is about equal to Apparat's EDTASM with three enhancements: It reports the amount of memory remaining at any time instead of just at the end of each assembly, it inserts an unlimited number of lines between any two existing lines of source code, and it automatically adds the extensions /SRC and /CMD to source and object files.

The best part of this package (as well as the original tape EDTASM) is the section of documentation that describes the complete Z80 instruction set in the clearest, most useful form around (add page tabs to help find each group of instructions). Like EDTASM, this is a

The docs for
Tandy's Series I
describe the
complete Z80
instruction set in
the clearest, most
useful form around.

usable editor/assembler for a novice, but would limit a serious programmer.

While most of the more complete programs can read an EDTASM source file, only a few can read a Series I file. If you start with this package, you might have a difficult time transferring your programs to a more complete package later.

Instant Assembler— Mumford Micro Systems

I have mixed feelings about the Instant Assembler. It's unique in the way it handles source code: Each line is partially preassembled as you enter it (either from the keyboard or from a disk file). Instant Assembler's approach, while necessitating a line-oriented editor, has several advantages.

First of all, the code takes up much less room in memory and on disk. Also, all typing and many coding errors are flagged during entry instead of during assembly; this usually limits assembly errors to undefined symbols and out-of-range branching. Finally, assembly is extremely fast—this program deserves its name.

The package also contains a useful debugger. You can assemble a program to memory, use the debugger to check the code, and return to the editor to make changes without exiting to the DOS level and without disk access. Also included is a linking program that can take several source code modules and assemble them together, resolve global symbols, and create a /CMD program from the combination.

However, Instant Assembler has several limitations that range from irritating to unacceptable. For example, the most common error message is "BAD" with no explanation. That was annoying while I was trying to learn how to use the program.

More importantly, Instant Assembler doesn't support many of my programming habits or techniques. The only arithmetic the assembler allows is adding or subtracting a decimal value between -31 and +287. You cannot, for example, use LD BC,END-START or LD HL,VIDEO+4*64+12.

The assembler doesn't allow multiple ORGs in a program. The entire program must be contiguous in memory.

Table 2. Auxiliary programs available with editor/assemblers.

An editor/assembler, by itself, is not enough to create machine-language programs. At the least, you will also need a monitor program (Debug is one possibility, but there are others). A disassembler can also be helpful, for studying others' programs as well as debugging your own. Some editor/assemblers have auxiliary programs; others do not.

EDTASM

This assembler is only available on NEW-DOS80 2.0 disks. Other useful programs also supplied with the DOS are a disassembler, a file relocation program (LMOFFSET), and a file/memory zap utility (Superzap), as well as one of the best Debug utilities available.

Series I Editor/Assembler

No additional programs are included.

Instant Assembler (INTASM)

INTASM comes with two versions of a useful monitor, Micromind. One version is integrated with the assembler; the other is a stand-alone program. Also included is a linking loader that can load independently assembled modules, resolve external symbols, and then dump the total program to disk or tape.

Zen

The disk version of Zen includes an installation program that modifies Zen for your DOS, a Basic program that subdivides large disassembler outputs into subunits small enough to fit into memory for reassembly, a Basic program that expands macro instructions, and an integrated monitor-debugger.

Zeus

Zeus is supplied with a DOS configuration program that also sets the default forms parameters used by the assembler for printer output and an integrated decimal and hex calculator.

ALE

ALE is supplied with several utilities that you can optionally integrate into the editor at any time: a utility for editing files larger than memory, another for printing such files, a utility that converts files to ALE format, a four-function calculator, two versions of a linker that link modules for assembly instead of preassembled modules, a utility to change keyboard defaults, and the source code (two sides of a separate disk) for a monitor/debugger/disassembler.

M-ZAL

Besides the separate editor, assembler, and linker programs, M-ZAL also includes a monitor/debugger, a disassembler, and a utility to convert source files between various disk formats. Also included are linkable object files containing hex and decimal conversion routines, a file of useful macro instructions, and a source file of useful ROM routine equates.

EDAS

The EDAS package includes two utilities: XREF/CMD, which provides a full cross-reference listing of symbol use, and TTD/CMD, a utility that converts tape EDTASM source files to EDAS disk format.

ALDS

ALDS includes separate editor, assembler, and linker programs, as well as a debugger (similar to but more powerful than Model 4 Debug) and a file transfer program that allows sending files (source, object, or data) between any two TRS-80s through the RS-232 port.

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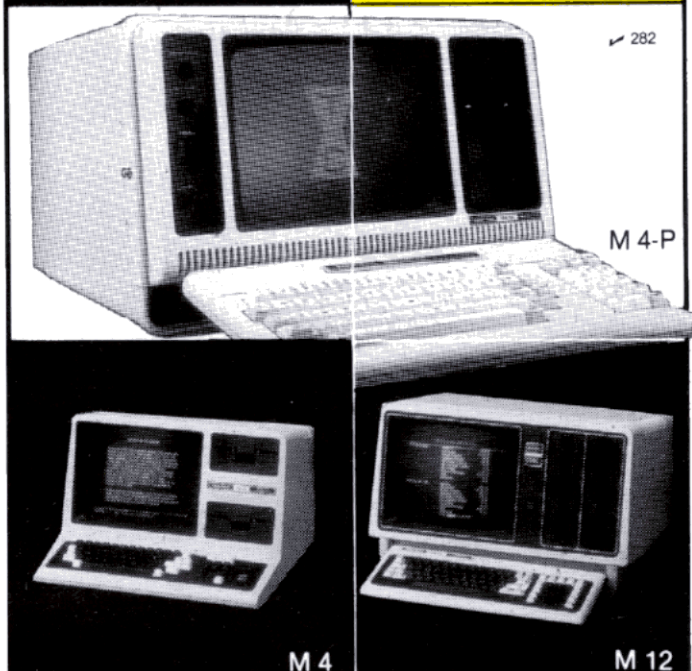
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Instant Assembler
has its quirks;
if you can
learn to work
around them,
the package is
powerful.

All Instant Assembler listings contain both source and object code unless you use the debugger to reset a value inside the program. With that value reset, you can only list the source code without object code.

You cannot use \$ or any other symbol to indicate the address of the present instruction. Also, the DEFM pseudo-op accepts only strings up to 43 characters in length. DEFS always fills a section of memory with 00H.

You can use labels only to refer to 16-bit values, and the EQU pseudo-op won't accept a label as part of its operand (or anything except a 16-bit value or absolute address).

For my personal work habits, Instant Assembler has too many quirks to be useful. If you can learn to work around its limitations, the package, including its preassembler and debugger, is powerful.

Zen—The Alternate Source

Laurie Shields wrote Zen 4.3 in England, and The Alternate Source is distributing it in the United States. Several years ago, I read that Zen was the best tape-based editor/assembler available for the Model I. The disk version I received works equally well with the Models I, III, and 4 (in Model III or 4 mode). The Model I/III version supports both disk and cassette operations.

Included in the Zen package, and in memory at the same time, are an assembler, simple editor, monitor program, and simple debugger. The assembler operates on source code stored in memory or on disk, and sends the object code to memory, disk, or tape. The assembler links source files, does conditional assembly, and stores files on disk in EDTASM format or without line numbers.

Zen has a unique way of handling macro expansion. First, you need to

store macros on a file separate from the rest of the source code. After you write the source code, a Basic program processes both the source file and the

macro file, then writes a new source file with expanded macros to disk. It's not elegant and it certainly isn't fast, but it does work.

Table 3. Pseudo-op comparisons.

Pseudo-op	EDTASM	Series I	INTASM	Zen	Zeus	ALE	M-ZAL	EDAS	ALDS
...									X
COMM				X			X	X	
End	X	X		X	X	X	X	X	X
EXEC				X					
LITORG									X
Load				X					
LORG								X	X
MOD								X	
NOEND									X
NOLOAD									X
OBJ									X
Offset				X					
ORG	X	X		X	X	X	X	X	X
Patch									X
Prefix								X	
PSECT									X
RESLOC									X
SETLOC									X
ADISP									X
ERR					X			X	
Get					X		X	X	X
List Off	X	X		X	X	X	X	X	X
List On	X	X		X	X	X	X	X	X
Pause							X		X
Quit									X
RADIX									X
REF									X
Search								X	
Stop									X
Bytes							X	X	X
Date									X
DEFB (single)	X	X	X				X		
DEFB (multiple)				X	X	X		X	X
DEFC						X			
DEFE									X
DEFL	X	X			X		X	X	X
DEFM	X	X	X	X	X	X	X	X	X
DEFR									X
DEFS	X	X	X	X	X	X	X	X	X
DEFT									X
DEFW (single)	X	X	X	X			X		
DEFW (multiple)					X	X		X	X
EQU	X	X	X	X	X	X	X	X	X
EXTERN							X		X

Pseudo-op	EDTASM	Series I	INTASM	Zen	Zeus	ALE	M-ZAL	EDAS	ALDS
Fill & NOFILL									X
Global							X		X
Time									X
Words							X		X
+ -	X	X	X	X	X	X	X	X	X
*/				X	X	X		X	X
%					X	X		X	X
.OR.				X	X	X		X	X
.AND.	X	X		X	X	X	X	X	X
.XOR.					X	X		X	X
.NOT.								X	X
.SHL/R	X	X		X	X	X	X	X	X
EQ								X	X
NE								X	
ALDS math									X
Else								X	X
ENDIF				X	X	X	X	X	X
If				X	X	X	X	X	X
IFDEF								X	X
IFEQ				X		X		X	†
IFGT								X	
IFLT								X	
IFM									X
IFNDEF								X	X
IFNE								X	
IFNOT							X		X
IFNZ									X
IFP									X
IFREF								X	
IFZ									X
Macro				X			X	X	X
ENDM				X			X	X	X
EDAS's %, %&								X	
Footer						X			
Page					X	X	X	X	X
Space							X	X	
SUBTTL					X	X		X	X
Title					X	X	X	X	X
Version									X
ALDS print commands									X
Index commands									X
Link directives									X

† ALDS extended math can simulate all conditionals it doesn't directly support.

Zen's editor is line-oriented and while it's more powerful than EDTASM's it's a little clumsy. However, the Zen package encourages use of Scripsit as a source

code editor. Once you run Zen's installation program, you can write source code with Scripsit and run Zen, which picks up the source code you've left in memory.

Zen is a good choice for someone who wants to move up from EDTASM or Series I without spending too much money.

All in all, this is an impressive package for \$39.95. Since a monitor and debugger accompany its editor and assembler, Zen is a good choice for someone who wants to move up from EDTASM or Series I without spending too much money.

Zeus—Cosmopolitan Electronics

Zeus does some things well and others poorly. The assembler portion of this package seems fast, but the line-oriented editor is somewhat clumsy to use.

Like the Instant Assembler, Zeus processes each line of source code through a syntax check routine before entering it in the source code table. If you've made a mistake, the program enters an edit mode and doesn't let you leave until you correct the line to Zeus's satisfaction (you can't abort this edit mode without fixing the line or pushing the reset button).

Zeus has a handy calculator mode that performs both arithmetic and logical functions, and always reports the result in both decimal and hex. Another useful feature is the assembler's ability to accept relatively complex expressions and almost any keyboard character as part of a label.

However, I dislike Zeus's manual. Some parts of it are thorough and complete; others seem much too abbreviated. For example, the manual explains which device control blocks (DCBs) the program uses for keyboard input and printer output and which ROM calls it uses during disk file transfers, but completely neglects to define the maximum length of a label, explain whether source code fields are fixed in length, and discuss whether the assembler supports the undocumented Z80 opcodes.

Continued on p. 68.

Table 4. Summary of pseudo-ops and assembler commands.

One measure of an editor/assembler's power is the diversity of pseudo-ops and other commands the assembler supports. Each command shown in Table 3 is briefly defined below. Occasionally, two assemblers use the same command or pseudo-op with a slight difference in spelling (e.g., *ENDIF* and *ENIF*). Such slight differences don't appear below.

The first set of commands affects the way the program is saved on disk and how it executes when run.

- **...** turns a block comment function on and off. Everything between the asterisks is considered a comment (avoids repetitious semicolons).
- *COMM* inserts a nonloading comment block at the beginning of a disk file (often used to add hidden copyright notices).
- *End* terminates assembly and can be used for all supporting assemblers except Zen to set execution address.
- *EXEC* sets the beginning execution address of a program in Zen (most others use an argument following the *End* pseudo-op).
- *LITORG* resets the location counter and stores all program literals at the current address.
- *Load* causes the object code to be assembled directly into memory (instead of to disk).
- *LORG* establishes a load origin (as opposed to an execution origin) for the object code.
- *MOD* specially modifies label names in source modules, and so creates pseudo-local labels in EDAS.
- *NOEND* used in place of a normal end causes a program (such as an overlay) to be assembled without an execution address.
- *NOLOAD* assembles the code in memory-image form (like a boot sector) instead of load-module form.
- *OBJ* specifies the name of the object file to use (instead of specifying it with the assembly command).
- *Offset* tells the assembler to add the operand value to all absolute calls and JPs (similar to, but more awkward than, *LORG*).
- *ORG* establishes the program's origin address (first byte in memory).
- *Patch* fills the remaining bytes on the last disk sector with *OFFHs* to create a patch area.
- *Prefix* specifies an additional, third label in macro substitution strings, allowing the creation of several thousand local labels for macros.
- *PSECT* used by ALDS like *ORG* if followed by an address; if not followed by an address, *PSECT* defines the beginning of a

block of relocatable, linkable code. (ALDS uses *ORG* to reset the location counter inside a block of source code.)

- *RESLOC* resets the assembler's location counter following a *SETLOC*.
- *SETLOC* temporarily changes the assembler's location counter to the specified absolute address, so selected sections of code can be made to run at an address other than where they load.

The second set of pseudo-ops is included in the source code in order to issue direct commands to the assembler while it is in the process of assembling.

- *ADISP* causes the assembler to pause and display a message or prompt for an input (for example, the value for a label).
- *ERR* generates an assembly error to force assembly to halt (usually used in a conditional block).
- *Get or Include* forces the assembler to temporarily stop assembling the main code and include the source code from another file. When it finishes assembling the second file, it returns to the first.
- *List Off* suppresses output of the object listing (to screen and/or printer) while a section of code is being assembled.
- *List On* reverses the effect of *List Off* and re-enables output of the object code listing.
- *Pause* causes assembly to pause at current location until pressing the enter key resumes assembly or pressing the clear key returns control to the DOS.
- *Quit* causes control to stop and to return to DOS Ready. This is useful for stopping test assemblies part way through the second pass.
- *RADIX* changes the default number base (for example, from decimal to hex). Numbers with base suffixes are still evaluated normally.
- *REF* is like *Include*, but uses only the symbol definitions from another file, not the actual code (useful for *EQU* tables, and so on).
- *Search* causes the assembler to search a special library file to resolve undefined references in the code.
- *Stop* stops assembly listing and returns control to the DOS.

The third group of pseudo-ops forces the assembler to include specific values in either the object code or the symbol table during assembly.

- *Bytes* or *DC* sets a given number of bytes (usually less than 256) all equal to a given value.
- *Date* stores the current date (found from DOS) as an ASCII string in the program.

● *DEFB* or *DB* (single value) inserts a single byte with a specified value at the current location in the object code.

● *DEFB* or *DB* (multiple values) inserts a series of bytes of specified values at the current location in the object code. Zen, EDAS, and ALDS can also use this command to define ASCII strings. ALDS uses it to perform the same function as *Bytes*.

● *DEFC* or *DC* is similar to *DEFM*, except that bit 7 of the last character is set, providing an easy method for finding the end of a string.

● *DEFE* stores an ASCII string in encrypted form. ALDS's encryption technique is to store the string length in the first byte, then XOR each ASCII value with 55H.

● *DEFL* or *DL* temporarily assigns a value to a label. You can redefine the label with new *DEFLs* as often as you wish.

● *DEFM*, *DM*, or *ASCII* inserts an ASCII string at the current location in the object code.

● *DEFR* converts a decimal number into a Roman numeral, which is stored in ASCII form in the object code.

● *DEFS*, *DS*, or *Block* reserves a specific number of bytes of memory for later use by the program. Most assemblers simply advance the location counter the specified number of bytes; *INTASM* fills the space with 00H bytes.

● *DEFT* is similar to *DEFM*, but the string length is stored in the first byte, followed by the ASCII string.

● *DEFW* or *DW* (single value) inserts a 16-bit or 2-byte word into the object code at the present location.

● *DEFW* or *DW* (multiple values) inserts a series of 2-byte words into the object code at the present location.

● *EQU* sets a label equal to a specified value. Most assemblers allow either 8-bit or 16-bit values; *INTASM* only allows 16-bit values.

● *EXT*, *EXTRN*, or *Extern* defines a set of labels as external to the present source file, which means they will be defined in another source module.

● *FILL* and *NOFILL* turn a fill option on and off. When used with *DEFS*, the option can fill a reserved area with a given byte instead of just reserving space.

● *Global* or *Entry* defines a set of labels as global or public, which means that other source modules can use them. All other labels in the module are private (can only be used in their own module).

● *Time* stores the present system time in ASCII format in the object code at the present location.

● *Words* sets a given number of 2-byte words equal to a given 2-byte value.

The next set of assembler pseudo-ops is the math, logic, and relational operators. These are used in expressions that the assembler evaluates, either before entering the values in the object code or before branching into or past a conditional assembly block.

- + and - are addition or subtraction of two values. INTASM's arithmetic is limited to the range of +287 to -31; all other assemblers can handle multiple label arithmetic and addition or subtraction of any value.

- * and / are multiplication and division of two values.

- % is modulo arithmetic. Returns remainder (but not quotient) of a division.

- !, ., or .OR. is logical, bit-by-bit or of two values.

- & or .AND. is logical, bit-by-bit and of two values.

- # or .XOR. is logical exclusive or of two values.

- .NOT. is logical 1's complement of a value.

- < performs a logical bit-by-bit shift of a value to the left or right a specified number of positions. ALDS uses .SHR. and .SHL.

- EQ returns TRUE (0FFFF hex) if its two terms are equal. Otherwise, it returns FALSE (0000 hex).

- NE returns TRUE if its two terms are unequal.

- ALDS has a large number of other math and relational operators not found in other editor/assemblers:

- .HIGH. or .MSB. returns the high order byte of a value.

- .LOW. or .LSB. returns the low order byte of a value.

- .BIT. returns a value with the specified bit set (1 shifted n bits to the left).

- ** or A exponentiation.

- .RR. and .RL. logical left and right rotate.

- .ABS. absolute value.

- .GT. or > greater than (true or false).

- .GE. greater than or equal.

- .LT. or < less than.

- .LE. less than or equal.

- .RES. result ignoring overflow.

- .SGN. sign.

- .UGT. unsigned greater than.

- .UGE. unsigned greater than or equal.

- .ULT. unsigned less than.

- .ULE. unsigned less than or equal.

The next group of commands is for conditional assembly—part of the source code will

be assembled only if a certain condition is true. Conditional assembly is particularly useful if you need to produce several different versions of the same program (for example, Model I and Model III versions).

- Else begins alternate code to be assembled when a conditional If statement is false.

- ENDIF marks the end of a conditional block of source code.

- If assembles source code between If and ENDIF only if the value of the operand is true (not zero).

- IFDEF assembles conditional block if a given label has been previously defined in the program.

- IFEQ assembles conditional block only if two values or labels are equal. EDAS can use this test (as well as IFGT, IFLT, IFNE) with strings inside a macro statement.

- IFGT assembles block if the first label is greater than the second.

- IFLT assembles if first expression is less than the second.

- IFM assembles if expression is negative (minus).

- IFNDEF assembles if a label has not been previously defined.

- IFNE assembles if two expressions are not equal.

- IFNOT or IFF assembles if an expression is false (the exact opposite of If).

- IFNZ assembles if an operand is not zero.

- IFP assembles if an operand is positive.

- IFREF assembles if a label has been referenced, but not defined, earlier in the program.

- IFZ assembles if an operand is zero.

Some pseudo-ops establish macro definitions within a source code.

- Macro establishes the beginning of a macro definition.

- ENDM marks the end of a macro definition.

- % returns the length of a macro and %& concatenates macro labels in EDAS.

You can include the next set of pseudo-ops in source code to affect the printed listing of an assembly.

- Footer defines text to be placed at the bottom of each printed page.

- Page forces a form feed during printer output.

- Space prints a specified number of blank lines. Can also force a form feed if less than a specified number of lines remain on a page.

- SUBTTL defines a subtitle to be printed at the top of each page.

- Title defines a title to be printed at the top of each page.

- Version prints the current time at the top of each page.

- ALDS includes several unique printer pseudo-ops:

- All prints all source lines.

- MAC prints source lines generated by macros.

- NOMAC does not print macro expansions.

- CON prints all conditional lines, whether they produce code or not.

- NOCON only prints conditional lines if they produce code.

- LST outputs the listing (to video, disk, or printer) regardless of what is on assembler command line.

- NOLST does not output listing, regardless of what is on the command line.

- Short prints only the first 6 bytes of object code generated by each line (e.g., DEFN lines).

- Long prints all object code generated, even if it requires several lines.

Some other assemblers can perform similar print functions if you give the appropriate command at assembly time. ALDS is the only one that lets you enter such commands in the source file.

Two types of pseudo-ops are unique to ALDS.

- ALDS uses index commands to automatically calculate offsets for IX or IY to specified data fields:

- Index begins an index section of data.

- ENDI ends an index section.

- Using associates either IX or IY with an index section.

- Drop drops the association defined by Using.

- APUSH saves the current Using status on an assembler stack.

- APOP restores the Using status saved by APUSH.

- ALDS also has the ability to pass directives to the linker module directly from the program source code.

- EXTERN brings in external symbols from another object module.

- GLINK brings in global symbols.

- Global creates a global symbol file.

- Link links an external program section with the current module.

- PSECT begins a program section and determines mode (either relocatable or absolute).

- Public declares symbol definitions to be public.

M-ZAL can perform similar functions, but only if the commands are passed directly to the linker program.

The assembler portion of Zeus seems fast, but the line-oriented editor is somewhat clumsy to use.

Continued from p. 65.

Zeus supports simple conditional assembly but not macros. Its \$79.95 price is a bit steep, especially compared to the prices of the more powerful editor/assemblers.

ALE—The Alternate Source

The editor portion of ALE is the best I found. It's a large subset of The Alternate Source's EDM word processor/file editor, and it's the first package I've mentioned that supports full-screen editing. It's complex, powerful, and somewhat difficult to learn to use, but you can do almost anything with it, including storing a complex series of commands that you can repeat with a single keystroke.

ALE also has the most powerful printer and file output options of all the packages I reviewed. It's the only assembler I examined that lets you write a source code file larger than the memory buffer: It uses a paging system similar to virtual memory, although it doesn't allow reverse scrolling from the output buffer.

ALE is also capable of merging two input files to produce a single output file. After working with ALE's editor for awhile, I became proficient at using its multitude of editing commands and options.

Unfortunately, the ALE assembler isn't as strong as the editor. It can assemble either from memory or from disk, or link together separately written source modules. It supports two conditional pseudo-ops (If and IFEQ), as well as a standard list of arithmetic and logical operators. Unfortunately, ALE doesn't support assembly macros.

ALE can configure itself to work with any popular Model I/III DOS, and can read and write source files compatible with EDTASM (Apparat's or Radio Shack's), M-ZAL, EDAS, EDIT-80, and its own condensed format.

The ALE package comes with the source code for a machine-language monitor, C-ALL, on a separate disk. C-ALL has no documentation, so you must figure out how to use it by examining the source code, which is very clearly written.

If you don't need the power of macros, ALE is a terrific value for \$49.95. However, plan to spend a few hours learning to use the editor.

M-ZAL—Computer Applications Unlimited

M-ZAL is a full-featured assembler that comes as several separate but interrelated modules. You write source code with the editor, and save the code to disk. Then you must return to DOS Ready to run the assembler, the linker program, or the file converter.

M-ZAL's editor is screen-oriented

ALE's editor is complex, powerful, and somewhat difficult to use, but you can do almost anything with it.

and similar to a word processor. It isn't as powerful as ALE's editor, but it allows the luxury of full-screen editing, and includes the ability to copy or move any block of lines to any position in the source file. It's a great improvement over the editors available with most assemblers.

M-ZAL's assembler is also very powerful; it supports both conditional statements and assembly macros. When you run the assembler, all input and output options appear in a full-page display. You can change them by moving the cursor to the appropriate spot and pressing the X key or the space bar (a lot easier than remembering several assembler command options).

The assembler creates relocatable modules that you can link together with the linker program into a single, coherent program. You can also use the linker to relocate previously written programs. The M-ZAL package includes a full-function monitor/de-

bugger and a disassembler, as well as a program that converts source files to several different assembler formats.

M-ZAL is an excellent package with only a few minor drawbacks (for example, it supports only four math operators). I haven't seen Model 4 M-ZAL, but I gather that it's also an excellent editor/assembler (it's available with DOSPLUS 4.0).

EDAS and Pro-Create—Misosys

EDAS and Pro-Create are essentially the same program. EDAS runs on the Model I/III under LDOS (or under DOSPLUS 3.5 with patches included with the DOS); Pro-Create runs on the Model 4 with TRSDOS 6.X. You can purchase EDAS and Pro-Create alone or with a version of the C language supplied by Misosys.

EDAS has earned a reputation as the most powerful assembler available for the TRS-80. It supports a multitude of pseudo-ops, conditional assembly, and macros in several forms. It can search a library of routines to resolve references in source files (you must have Misosys's PaDS utility to create the library files), assemble code from memory or disk, and output code and text in several different forms.

Although its assembler is more powerful in many ways, EDAS lacks M-ZAL's ability to link assembled modules. However, the editor and assembler are normally both resident in memory at the same time, so using EDAS for major projects is usually faster than using M-ZAL.

EDAS's editor is line-oriented. It compensates for this limitation by supporting block copy and move functions, as well as global search-and-replace. However, I know EDAS users who write source code with a word processor because of the editor's limitations.

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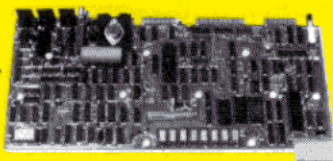
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medium-level
language.

Used to its full capacity, EDAS moves Assembly language from a low-level to a medium-level language, complete with string operators (for comparing parameters passed to macros), 10 different conditional statements, and 14 math/logic operators.

EDAS's editor and inability to create relocatable modules might limit its usefulness for some, but otherwise it is one of the best editor/assemblers available.

Assembly Language Development System— Tandy/Radio Shack

Except for one major flaw, ALDS is the best editor/assembler I've seen. It is distributed in two forms: one for the Model III/4 (the package I reviewed) and the other for the Models I, II, 12, and 16.

Like M-ZAL, ALDS is a modular package. It includes a powerful editor, a separate assembler, a linker, a monitor/debugger, and a communications package for transferring programs among all the TRS-80 Z80 computers.

ALDS's unusual editor is not quite screen- or line-oriented. You can scroll the text up or down, just as you would with a word processor, but when you come to a line that you want to edit you must enter a line-editing mode. However, the editor is both powerful and easy to use.

The ALDS assembler supports 50 pseudo-ops and directives; 30 math, logic, and relation operators; conditional assembly; and macros. It also supports 10 classes of extended mnemonics—commands like LD (IX+10), HL and MOVI 4000H,5000H,10H—that are actually self-contained macros. These extended mnemonics are a superb feature; they shorten my program development time considerably.

However, ALDS suffers from one major weakness. Every other assembler that supports macros can change part of each label in each macro every time you invoke it. For some reason, ALDS cannot; it's difficult, if not impossible, to use complex macros with ALDS, because any label inside a macro causes multiple definition errors during assembly. This flaw is enough to seriously limit ALDS's usefulness for major projects.

In all other respects, ALDS is excellent and it comes with one of Radio Shack's best manuals. If you can keep macros simple (without internal labels), this is by far the best package available.

A Final Recommendation

Which editor/assembler is best? It seems to me that ALE has the best editor, with ALDS and M-ZAL a close

The ALDS assembler
supports 10
classes of extended
mnemonics that
are actually
self-contained
macros.

second and third. EDAS appears to have the strongest assembler (because of its extensive support of macro instructions), again with ALDS and M-ZAL close behind. However, EDAS can't link preassembled modules, while ALDS and M-ZAL can.

However, the assembler you choose depends on your programming style and needs. You can do a lot with EDTASM, even though it's the weakest of the bunch, if you don't need macro instructions or conditional assemblies.

My object in this article has been to provide you with the information to make an intelligent choice, not to dictate which package you should buy. Each editor/assembler has weaknesses and each has advantages. Only you can decide which package best suits your needs. ■

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KEEPING TIME

One of the most common causes of disk I/O errors is improperly timed drives. Disk Timer measures your drive speed and displays it on an easy-to-read chart.

Nothing ties my stomach in knots faster than a CRC error when I'm loading a long file. If you frequently encounter disk input/output problems too, you probably have incorrectly timed drives. In addition to CRC errors, mistimed drives can give you improperly formatted disks, "Record not found during read" errors, and write-to-disk problems.

Because such errors result in major data losses, I wrote Drive Timer, a Model III/4 Assembly-language program that accurately times your drives. Drive Timer measures the rate at which your drives spin and displays that rate on the screen (see the Photo). You can then adjust your drives accordingly.

Program Listing 1 is the Model III version of Drive Timer, and Program Listing 2 is the Model 4 version. Although both versions are essentially the same, the Model 4 listing, which uses the 4's larger display, offers twice the accuracy of the Model III version.

Timing Your Drives

Ideally, a 5¼-inch disk drive should spin at 300 revolutions per minute (rpm), with an acceptable speed variation of 1.5 percent over extended periods. This puts the speed for proper operation at between 295.5 and 304.5 rpm.

To determine the spin rate of your drives, Drive Timer uses the floppy disk controller's (FDC) ability to detect a disk's index hole. (You can see the index hole by manually turning the disk in its

mylar envelope until the hole appears in the envelope's small circle.)

When the index hole lines up with the disk jacket window, an optical sensor in the drive signals the FDC that the index hole is present.

Because a disk should spin at 300 rpm, the FDC should find the index hole 300 times per minute. However,

Drive Timer times only one revolution.

After you load Drive Timer, it waits for the presence of the index hole. Once the hole appears, the program begins counting, continually monitoring the index hole status.

When the index hole reappears, the counting process stops and the program compares the counter value to a table of

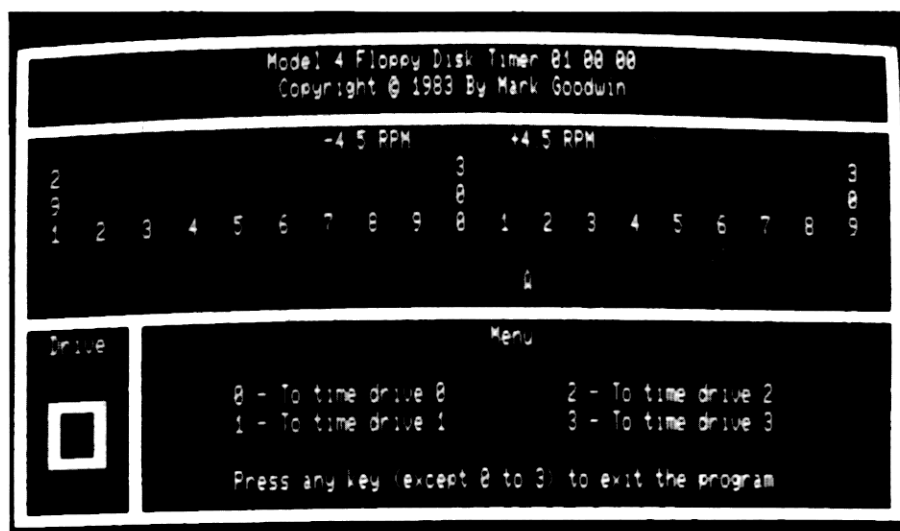


Photo. Sample screen from Drive Timer.

Program Listing 1. Drive Timer program for the Model III.

```
00100 ;
00110 ; Model III Floppy Disk Timer 01.00.00
00120 ; By Mark D. Goodwin
00130 ; Modifications by Frank De Simone
00140 CMD EQU 0F0H
00150 SEL EQU 0F4H
00160 RCLS EQU 01C9H
00170 RDSP EQU 0033H
00180 RDSPLY EQU 021BH
00190 REXIT EQU 402DH
00200 RKBD EQU 002BH
00210 RKEY EQU 0049H
00220 RPAUSE EQU 0060H
00230 COUNT DEFL 12
00240 CURSOR EQU 4020H
00250 VID EQU 3C00H
00310 ORG 5200H
00320 ;
00330 ; Main Program Loop
00340 ;
00350 MAIN CALL RCLS ;Clear the screen.
00360 LD HL,VID ;HL=Video memory pointer.
00370 LD (HL),188 ;Display a character.
```

Listing 1 continued

The Key Box

Models I, III, and 4
32K RAM
Assembly Language
EDTASM
EDAS (Model 4)




```

00380 INC HL ;Bump the video memory pointer.
00390 LD B,62 ;B=Number of characters to be displayed.
00400 LD A,140 ;A=Character to be displayed.
00410 CALL DISGPH ;Display the line.
00420 LD (HL),188 ;Display a character.
00430 INC HL ;Bump the video memory pointer.
00440 LD (HL),191 ;Display a character.
00450 LD HL,VID+77 ;HL=New cursor position.
00460 LD (CURSOR),HL ;Update the cursor position.
00470 LD HL,MESS0 ;HL=Message pointer.
00480 CALL RDSPLY ;Display it.
00490 LD HL,VID+143 ;HL=New cursor position.
00500 LD (CURSOR),HL ;Update the cursor position.
00510 LD HL,MESS1 ;HL=Message pointer.
00520 CALL RDSPLY ;Display it.
00530 LD HL,VID+193 ;HL=Video memory pointer.
00540 LD B,62 ;B=Number of characters to be displayed.
00550 LD A,140 ;A=Character to be displayed.
00560 CALL DISGPH ;Display the line.
00570 LD (HL),191 ;Display a character.
00580 INC HL ;Bump the video memory pointer.
00590 LD (CURSOR),HL ;Update the cursor position.
00600 LD HL,MESS2 ;HL=Message pointer.
00610 CALL RDSPLY ;Display it.
00620 LD HL,VID+641 ;HL=Video memory pointer.
00630 LD B,7 ;B=Number of characters to be displayed.
00640 LD A,140 ;A=Character to be displayed.
00650 CALL DISGPH ;Display the line.
00660 LD (HL),188 ;Display a character.
00670 INC HL ;Bump the video memory pointer.
00680 LD B,54 ;B=Number of characters to be displayed.
00690 CALL DISGPH ;Display the line.
00700 LD (HL),191 ;Display a character.
00710 INC HL ;Bump the video memory pointer.
00720 LD A,4 ;A=Number of lines.
00730 MAIN0 LD (HL),191 ;Display a character.
00740 LD BC,8 ;BC=Offset.
00750 ADD HL,BC ;Figure the new video memory pointer.
00760 LD (HL),191 ;Display a character.
00770 LD BC,55 ;BC=Offset.
00780 ADD HL,BC ;Figure the new video memory pointer.
00790 LD (HL),191 ;Display a character.
00800 INC HL ;Bump the video memory pointer.
00810 DEC A ;Decrement the counter.
00820 JR NZ,MAIN0 ;Loop till four lines done.
00830 LD (HL),143 ;Display a character.
00840 INC HL ;Bump the video memory pointer.
00850 LD B,7 ;B=Number of characters to be displayed.
00860 LD A,140 ;A=Character to be displayed.
00870 CALL DISGPH ;Display the line.
00880 LD (HL),143 ;Display a character.
00890 INC HL ;Bump the video memory pointer.
00900 LD B,54 ;B=Number of characters to be displayed.
00910 CALL DISGPH ;Display the line.
00920 LD (HL),143 ;Display a character.
00930 LD HL,VID+706 ;HL=New cursor position.
00940 LD (CURSOR),HL ;Update the cursor.
00950 LD HL,MESS3 ;HL=Message pointer.
00960 CALL RDSPLY ;Display it.
00970 MAIN1 CALL CLRMEN ;Clear menu portion of the screen.
00980 LD HL,MESS4 ;HL=Message pointer.
00990 CALL DISMES ;Display it.
01000 LD HL,MESS5 ;HL=Message pointer.
01010 CALL DISMES ;Display it.
01020 LD HL,MESS6 ;HL=Message pointer.
01030 CALL DISMES ;Display it.
01040 LD HL,MESS7 ;HL=Message pointer.
01050 CALL DISMES ;Display it.
01060 CALL RKEY ;Get a character from the keyboard.
01070 SUB 30H ;Is it < a 0?
01080 JR C,MAIN6 ;Jump if it is.
01090 CP 4 ;Is it > a 3?
01100 JR NC,MAIN6 ;Jump if it is.
01110 LD (DRIVE),A ;Save the drive number.
01120 LD L,A ;L=Drive number.
01130 LD H,0 ;HL=Drive number.
01140 ADD HL,HL ;HL=Drive number * 2.
01150 ADD HL,HL ;HL=Drive number * 4.
01160 ADD HL,HL ;HL=Drive number * 8.
01170 LD C,L ;C=LSB of drive number * 8.
01180 LD B,H ;BC=Drive number * 8.
01190 ADD HL,BC ;HL=Drive number * 16.
01200 ADD HL,BC ;HL=Drive number * 24.
01210 LD BC,DRIVES ;BC=Graphic numbers table pointer.
01220 ADD HL,BC ;HL=Drive number table pointer.
01230 CALL DISMES ;Display the message.
01240 CALL DISMES ;Display the message.
01250 CALL DISMES ;Display the message.
01260 CALL CLRMEN ;Clear menu portion of the screen.
01270 LD A,(DRIVE) ;A=Drive number.
01280 CALL SELECT ;Select the drive and check status.
01290 JR NC,MAIN4 ;Jump if drive is ready.
01300 JR NZ,MAIN2 ;Jump if no diskette.
01310 LD HL,MESS8 ;HL=Message pointer.
01320 JR MAIN3 ;Jump.
01330 MAIN2 LD HL,MESS9 ;HL=Message pointer.
01340 MAIN3 CALL DISMES ;Display the message.
01350 LD HL,VID+849 ;HL=New cursor position.
01360 LD (CURSOR),HL ;Update the cursor.
01370 LD HL,MESS10 ;HL=Message pointer.
01380 CALL RDSPLY ;Display the message.
01390 CALL RKEY ;Wait till a key is pressed.
01400 JR MAIN1 ;Loop.
01410 MAIN4 LD HL,VID+785 ;HL=New cursor position.

```

Listing 1 continued

expected values. Using the table, Drive Timer converts the counter value to a real-time display of drive speed.

Assembling Drive Timer

Program Listing 1 contains Drive Timer for the Model III. You can assemble it with any editor/assembler. The Model 4 version in Program Listing 2 requires Misosys's EDAS 4.1 editor/assembler for assembly.

Start by typing in the right program for your machine. Be certain to enter the data values accurately—they're essential for proper program operation. After typing in the program, you can make copies of the source and object codes.

Drive Timer checks the index hole's status by setting the FDC to a Type I command status and reading the FDC's status register. A Type I command status occurs during movement of the disk drive read/write head. However, you can force a Type I command status by sending a Reset command to the FDC.

To do this, Drive Timer sends a value of 0D0 hexadecimal (hex) to port 0F0 hex. After the program sends the Reset command, the FDC reads the FDC status register at port 0F0 hex. Bit 1 of the status register indicates if the index hole is present (set) or not (reset).

Using Drive Timer

Both versions of Drive Timer operate in the same manner. Once you correctly load and execute the program, press the key (0-3) that corresponds to the drive number you want to test.

To exit the program and return to DOS, press any key except keys 0-3. Since Drive Timer uses the index hole to time your drives, you must put a disk in the drive before the timing test starts.

Testing a non-existent drive or a drive that doesn't contain a disk results in an error message. Press any key to return to the menu.

A Word on Adjustments

Adjusting disk drive speed requires opening the computer case, which voids your warranty. I strongly suggest that a qualified technician perform any adjustments.

For those who want to do their own repairs, see Vincent Meyer's article, "Drive Ways," on p. 42 of this issue. Alternatively, the Models III and 4 technical reference manuals provide complete instructions for adjusting drive speed. ■

You can reach Mark D. Goodwin at Star Route 79, Box 103, Orland, ME 04472.

```

01428 LD (CURSOR),HL
01430 HL,MESS18
01432 RSPPLY
01434 CALL
01436 OR A
01438 NZ,MAIN1
01440 GETSP
01442 LD A,(CURSOR)
01444 CP C
01446 JR Z,MAIN5
01448 PUSH
01450 LD C,A
01452 LD HL,VID+576
01454 ADD HL,BC
01456 LD HL,32
01458 POP
01460 LD A,C
01462 LD HL,CURSOR
01464 LD HL,VID+576
01466 ADD HL,BC
01468 LD HL,255
01470 JR MAIN5
01472 RCL
01474 JC REXIT
01476 ; Display Graphic Line Routine
01478 LD HL,A
01480 INC
01482 DJNZ DISGPH
01484 RET
01486 ; Clear Menu Portion of the Screen Routine
01488 LD HL,VID+713
01490 LD D,4
01492 PUSH
01494 LD B,54
01496 LD A,32
01498 CALL DISGPH
01500 POP
01502 LD BC,64
01504 ADD HL,BC
01506 DEC D
01508 NZ,CLRME0
01510 RET
01512 ; Update Cursor and Display Message Routine
01514 LD E,(HL)
01516 INC
01518 LD D,(HL)
01520 INC
01522 LD (CURSOR),DE
01524 RSPPLY
01526 ; Select Drive and Get Status Routine
01528 LD C,A
01530 LD B,8
01532 LD HL,DRVTAB
01534 ADD HL,BC
01536 LD A,(HL)
01538 LD (DRVSEL),A
01540 IN A,(CMD)
01542 PUSH AF
01544 LD A,(DRVSEL)
01546 LD (SEL),A
01548 POP
01550 RLCA
01552 LD NC,SELECT1
01554 LD BC,8000H
01556 RPAUSE
01558 JR SELECT8
;Update the cursor.
;HL=Message pointer.
;Display it.
;Scan the keyboard.
;Key pressed?
;Jump if a key was pressed.
;Get the new cursor offset.
;A=Old cursor offset.
;Are the offsets the same?
;Loop if they are.
;Save the new cursor offset.
;BC=Old cursor offset.
;HL=Video line pointer.
;HL=Video memory location.
;Erase the indicator.
;Restore the new cursor offset.
;A=New cursor offset.
;Save it.
;HL=Video line pointer.
;HL=Video memory location.
;Display the indicator.
;Loop.
;Clear the screen.
;Return to DOS.
;Display a character.
;Bump the video memory pointer.
;Loop till done.
;Return.
;HL=Video memory pointer.
;D=Number of lines to clear.
;Save the video memory pointer.
;B=Number of characters to display.
;A=Character to be displayed.
;Display the line.
;Restore the video memory pointer.
;BC=Offset to the next line.
;Update the video memory pointer.
;All lines done?
;Loop if not.
;Return.
;E=LSB of the new cursor position.
;Bump the message pointer.
;D=MSB of the new cursor position.
;Bump the message pointer.
;Update the cursor position.
;Display the message.
;C=Drive number.
;B=Drive number.
;HL=Drive select mask table pointer.
;HL=Drive select mask pointer.
;A=Drive select mask.
;Save it.
;A=Disk status.
;Save the status.
;A=Drive select mask.
;Select the drive.
;Get the status.
;Were the drives already selected?
;Jump if they were.
;BC=Delay counter.
;Delay till drives get up to speed.
;Loop.
;A=Drive select mask.
;Reselect the drive.
;Reset the FDC.
;B=Delay counter.
;Delay till FDC is ready.
;BC=Loop counter.
;Index hole?
;Loop if it is.
;Index hole?
;Loop if not.
;Flag drive ready.
;Return.
;Save the flags.
;Increment the loop counter.
;Is the
; loop complete?
;Jump if it isn't.
;Restore the flags.
;Clean up the stack.
;Flag error.
;Return.
;Clean up the stack.
;A=FDC status.
;Set Zero flag for index hole status.
;Return.
;Disable the interrupts.
;HL=Time counter.
;A=Drive select mask.
;Reselect the drive.
;A=FDC reset command.
;Reset the FDC.
;B=Delay counter.
;Delay till FDC is ready.
;A=FDC status.
;Index hole?
;Loop if it is.
;A=FDC status.
;Index hole?
;Bump the time counter.
;Loop if not.
;A=FDC status.
;Index hole?
;Bump the time counter.
;A=FDC status.
;Index hole.
;Loop if not.
;Enable the interrupts.
;IX=Speed lookup table pointer.
;B=Number of speed values.
;E=LSB of the speed value.
;Bump the table pointer.
;Bump the table pointer.
;Bump the table pointer.
;A=MSB of the speed value.
;Compare it with the speed value.
;Jump if the MSBs don't match.
;A=LSB of the time counter.
;Compare it with the speed value.
;Jump if it's the correct position.
;Loop till the end of the table.
;C=New video memory offset.
;BC=New video memory offset.
;Return.
;Variables, Tables, and Messages
;DRIVE DEFB 8
;CURSOR DEFB 12

```


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Omniterm

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Listing 1 continued

[illegible]

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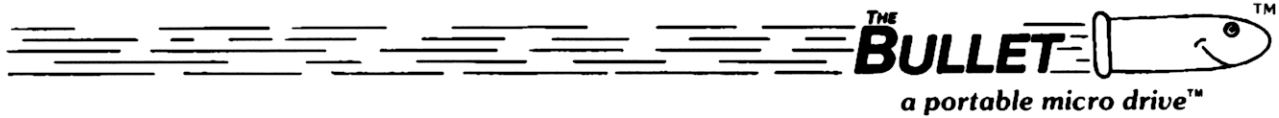
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SPECIFICATIONS:

BULLET: DEM: 5 1/2 x 8 x 2 1/2, WEIGHT: 4 1/2 lbs., 16K RAM
buffer, driver program is ROM based, files transferred at
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	DEFB	191	
03334	DEFM	'	
03340	DEFB	10	
03341	DEFB	8	
03342	DEFB	191	
03343	DEFB	191	
03344	DEFB	,	
03350	DEFM	:	
03351	DEFB	10	
03352	DEFB	8	
03353	DEFB	191	
03354	DEFB	191	
03355	DEFB	10	
03356	DEFB	8	
03357	DEFB	191	
03358	DEFB	191	
03359	DEFB	03	
03360	MESS3	'Drive'	
03361	DEFB	03	
03370	MESS4	VID+737	
03380	DEFM	'Menu'	
03381	DEFB	03	
03390	MESS5	VID+779	
03400	DEFM	'0 - To time drive 0.	
03401	DEFB	03	
03410	MESS6	VID+843	
03420	DEFM	'1 - To time drive 1.	
03421	DEFB	03	
03430	MESS7	VID+907	
03440	DEFM	'Press any key (except 0 to 3) to exit the program.'	
03441	DEFB	03	
03450	MESS8	VID+789	
03460	DEFM	'Drive is not in the system>'	
03461	DEFB	03	
03470	MESS9	VID+788	
03480	DEFM	<'Diskette is not in the drive>'	
03481	DEFB	03	
03490	MESS10	'Press any key to return to the menu.'	
03491	DEFB	03	
03500	DRIVES	VID+770	
03510	DEFB	176	
03511	DEFB	140	
03512	DEFB	140	
03513	DEFB	140	
03514	DEFB	176	
03515	DEFB	3	
03520	DEFM	VID+834	
03530	DEFB	191	
03531	DEFB	176	
03532	DEFB	140	
03533	DEFB	131	
03534	DEFB	191	
03535	DEFB	3	
03540	DEFM	VID+898	
03550	DEFB	131	
03551	DEFB	140	
03552	DEFB	140	
03553	DEFB	140	
03554	DEFB	131	
03555	DEFB	3	
03560	DEFM	VID+770	
03570	DEFB	32	
03571	DEFB	176	
03572	DEFB	168	
03573	DEFB	32	
03574	DEFB	32	
03575	DEFB	3	
03580	DEFM	VID+834	
03590	DEFB	131	
03591	DEFB	32	
03592	DEFB	191	
03593	DEFB	32	
03594	DEFB	32	
03595	DEFB	3	

Program Listing 2. Drive Timer program for the Model 4.

```

00100 ;
00110 ; Model 4 Floppy Disk Timer 01.00.00
00120 ; Copyright (c) 1983 By Mark D. Goodwin
00130 ;
00140 CND EQU 0F0H
00150 SEL EQU 0F4H
00160 @DSP EQU 2
00170 @DSPLY EQU 10
00180 @EXIT EQU 22
00190 @FLAGS EQU 101
00200 @RBD EQU 8
00210 @KEY EQU 1
00220 @PAUSE EQU 16
00230 @VDCCTL EQU 15
00240 COUNT DEFL
00250 SVC MACRO #SVC
00260 LD A,#SVC
00270 RST 28H
00280 ENDM
00290 DATA MACRO #DATA
00300 DW #COUNT
00310 DB COUNT+1
00320 COUNT DEFL
00330 ORG 3000H
00340
00350 ; Main Program Loop
00360
00370 ;
00380 MAIN LD HL,MESS0
00390 SVC @DSPLY
00400 LD HL,GRAPH0
00410 CALL DISGPH
00420 LD C,191
00430 SVC @DSP
00440 LD HL,0116H
00450 CALL POSCUR
00460 LD HL,MESS1
00470 SVC @DSPLY
00480 LD HL,014FH
00490 CALL POSCUR
00500 LD C,191
00510 SVC @DSP
00520 SVC @DSP
00530
HL=MESS0
;DSPLY
;HL=GRAPH0
;DSPLY
;C=Chara
;DSPLY
;HL=New
;Reposit
;HL=MESS1
;DSPLY
;HL=New
;Reposit
;C=Chara
;DSPLY
;DSP

```

Listing 2 continued

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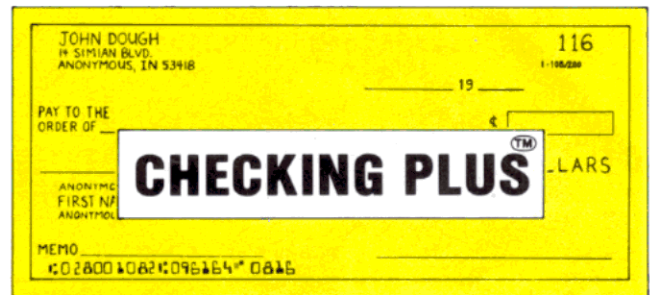
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```

00530 LD CALL
00540 POSCUR
00550 LD HL,MESS2
00560 @DSPLY
00570 LD HL,024FH
00580 POSCUR
00590 C,191
00600 @DSP
00610 HL,GRAPH1
00620 DISGPH
00630 HL,MESS3
00640 @DSPLY
00650 HL,GRAPH2
00660 DISGPH
00670 HL,GRAPH3
00680 DISGPH
00690 B,6
00700 MAIN0
00710 LD CALL
00720 DJNZ
00730 LD
00740 CALL
00750 LD
00760 CALL
00770 LD
00780 SVC
00790 MAIN1
00800 LD
00810 CALL
00820 LD
00830 SVC
00840 LD
00850 CALL
00860 LD
00870 SVC
00880 LD
00890 CALL
00900 LD
00910 SVC
00920 LD
00930 CALL
00940 LD
00950 SVC
00960 @DSPLY
00970 SUB
00980 CP
00990 JP
01000 JP
01010 LD
01020 LD
01030 LD
01040 LD
01050 LD
01060 ADD
01070 ADD
01080 ADD
01090 ADD
01100 ADD
01110 ADD
01120 ADD
01130 PUSH
01140 LD
01150 CALL
01160 POP
01170 SVC
01180 PUSH
01190 LD
01200 CALL
01210 POP
01220 LD
01230 ADD
01240 SVC

;HL=New screen position.
;Reposition the cursor.
;HL=Message pointer.
;Display it.
;HL=New screen position.
;Reposition the cursor.
;C=Character to be displayed.
;Display it.
;HL=Graphics table pointer.
;Display it.
;HL=Message pointer.
;Display it.
;HL=Graphics table pointer.
;Display it.
;HL=Graphics table pointer.
;B=Number of lines to display.
;HL=Graphics table pointer.
;Loop till done.
;HL=Graphics table pointer.
;Display it.
;HL=New screen position.
;Reposition the cursor.
;HL=Message pointer.
;Display it.
;Clear menu portion of the screen.
;HL=New screen position.
;Reposition the cursor.
;HL=Message pointer.
;Display it.
;HL=New screen position.
;Reposition the cursor.
;HL=Message pointer.
;Display it.
;HL=New screen location.
;Reposition the cursor.
;HL=Message pointer.
;Display it.
;HL=New screen position.
;Reposition the cursor.
;HL=Message pointer.
;Display it.
;Get a character from the keyboard
;Is it < a ?
;Jump if it is.
;Is it > a ?
;Jump if it is.
;Save the drive number.
;L=Drive number.
;HL=Drive number.
;C=Drive number.
;BC=Drive number.
;HL=Drive number * 2.
;HL=Drive number * 4.
;HL=Drive number * 8.
;HL=Drive number * 9.
;HL=Drive Number * 18.
;BC=Graphic number table pointer.
;HL=Drive number table pointer.
;Save the table pointer.
;HL=New screen position.
;Reposition the cursor.
;Restore the table pointer.
;Display a message.
;Save the table pointer.
;HL=New screen position.
;Reposition the cursor.
;BC=Offset to the next message.
;Update the table pointer.
;Display a message.

```

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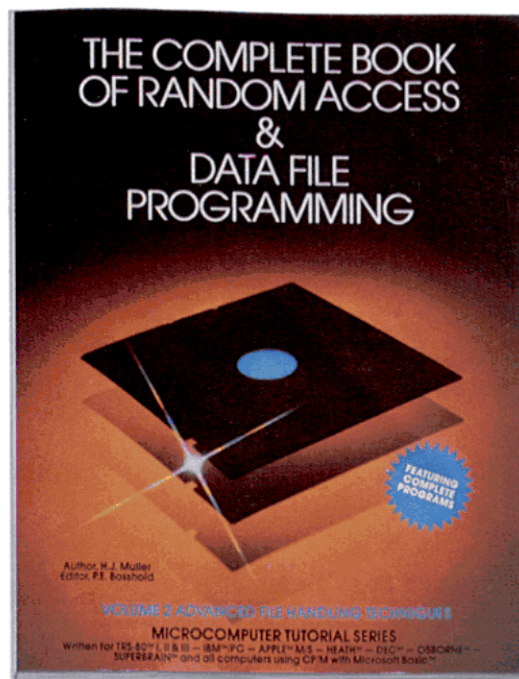
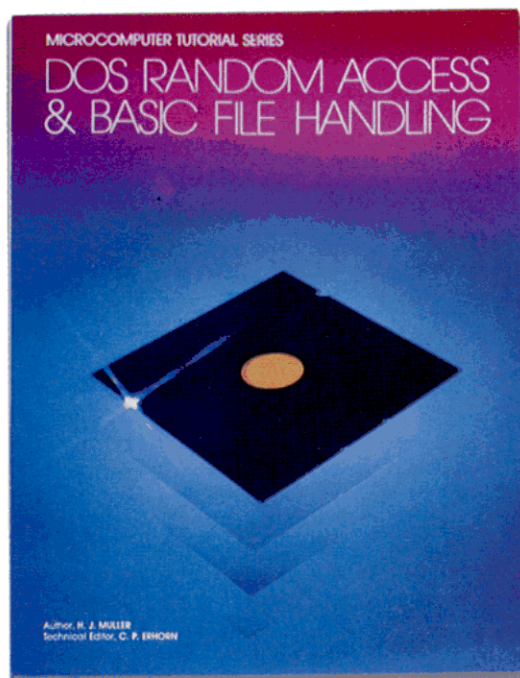
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NAME

DESCRIPTION

- 1 RULE78 Interest Apportionment by Rule of the 78's
- 2 ANNU1 Annuity computation program
- 3 DATE Time between dates
- 4 DAYYEAR Day of year a particular date falls on
- 5 LEASEINT Interest rate on lease
- 6 BREAKEVN Break-even analysis
- 7 DEPRSL Straightline depreciation
- 8 DEPRS Sum of the digits depreciation
- 9 DEPRDB Declining balance depreciation
- 10 DEPRDDB Double declining balance depreciation
- 11 TAXDEP Cash flow vs. depreciation tables
- 12 CHECK2 Prints NEBS checks along with daily register
- 13 CHECKBK1 Checkbook maintenance program
- 14 MORTGAGE/A Mortgage amortization table
- 15 MULTMON Computes time needed for money to double, triple, etc.
- 16 SALVAGE Determines salvage value of an investment
- 17 RRVARIN Rate of return on investment with variable inflows
- 18 RRCONST Rate of return on investment with constant inflows
- 19 EFFECT Effective interest rate of a loan
- 20 FVAL Future value of an investment (compound interest)
- 21 PVAL Present value of a future amount
- 22 LOANPAY Amount of payment on a loan
- 23 REGWITH Equal withdrawals from investment to leave 0 over
- 24 SIMPDISK Simple discount analysis
- 25 DATEVAL Equivalent & nonequivalent dated values for oblig.
- 26 ANNUDEF Present value of deferred annuities
- 27 MARKUP % Markup analysis for items
- 28 SINKFUND Sinking fund amortization program
- 29 BONDVAL Value of a bond
- 30 DEPLET Depletion analysis
- 31 BLACKSH Black Scholes options analysis
- 32 STOCVAL1 Expected return on stock via discounts dividends
- 33 WARVAL Value of a warrant
- 34 BONDVAL2 Value of a bond
- 35 EPSEST Estimate of future earnings per share for company
- 36 BETAALPH Computes alpha and beta variables for stock
- 37 SHARPE1 Portfolio selection model i.e. what stocks to hold
- 38 OPTWRITE Option writing computations
- 39 RTVAL Value of a right
- 40 EXPVAL Expected value analysis
- 41 BAYES Bayesian decisions
- 42 VALPRINF Value of perfect information
- 43 VALADINF Value of additional information
- 44 UTILITY Derives utility function
- 45 SIMPLEX Linear programming solution by simplex method
- 46 TRANS Transportation method for linear programming
- 47 EOQ Economic order quantity inventory model
- 48 QUEUE1 Single server queueing (waiting line) model
- 49 CVP Cost-volume-profit analysis
- 50 CONDPF Conditional profit tables
- 51 OPTLOSS Opportunity loss tables
- 52 FQOQ Fixed quantity economic order quantity model
- 53 FQEOUSH As above but with shortages permitted
- 54 FQEOQPB As above but with quantity price breaks
- 55 QUEUECB Cost-benefit waiting line analysis
- 56 NCFANAL Net cash-flow analysis for simple investment
- 57 PROFIND Profitability index of a project
- 58 CAPI Cap. Asset Pr. Model analysis of project

- 59 WACC Weighted average cost of capital
- 60 COMBAL True rate on loan with compensating bal. required
- 61 DISCBAL True rate on discounted loan
- 62 MERGMAL 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 BUSBJD DOME business bookkeeping system
- 77 TIMECLK 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 PORTVAL Stock market portfolio storage-valuation program

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```

01990 SVC @VDCCTL ;Reposition the cursor.
02000 RET ;Return.
02010 ; Clear Menu Portion of the Screen Routine
02020 ;
02030 ;
02040 CLRMEN LD DE,0B0BH ;DE=Starting screen location.
02050 LD B,6 ;B=Number of lines to clear.
02060 CLRMEN0 PUSH BC ;Save BC.
02070 DE ;Save DE.
02080 EX DE,HL ;HL=New screen location.
02090 CALL POSCUR ;Set the new cursor location.
02100 LD HL,MESS5 ;HL=Message pointer.
02110 SVC @DSPLY ;Display the message.
02120 POP DE ;Restore DE.
02130 INC D ;Bump the line number.
02140 POP BC ;Restore BC.
02150 CLRMEN0 LD B,C ;Loop till all lines done.
02160 RET ;Return.
02170 ; Select Drive and Get Status Routine
02180 ;
02190 ;
02200 SELECT C,A ;C=Drive number.
02210 LD B,0 ;B=Drive number.
02220 LD HL,DRVTAB ;HL=Drive select mask table pointer.
02230 ADD HL,BC ;HL=Drive select mask pointer.
02240 LD A,(HL) ;A=Drive select mask.
02250 LD (DRVSEL),A ;Save it.
02260 SELECT0 IN A,(CMD) ;A=Disk status.
02270 PUSH AF ;Save the status.
02280 LD A,(DRVSEL) ;A=Drive select mask.
02290 OUT (SEL),A ;Select the drive.
02300 POP AF ;Get the status.
02310 RLCA ;Were the drives already selected?
02320 JR NC,SELECT1 ;Jump if they were.
02330 LD BC,0 ;BC=Delay counter.
02340 SVC @PAUSE ;Delay till drives get up to speed.
02350 SELECT0 LD A,(DRVSEL) ;Loop.
02360 LD A,(DRVSEL) ;A=Drive select mask.
02370 OUT (SEL),A ;Reselect the drive.
02380 LD A,0B0H ;A=PDC reset command.
02390 OUT (CMD),A ;Reset the PDC.
02400 LD B,10 ;B=Delay counter.
02410 SELECT2 DJNZ SELECT2 ;Delay till PDC is ready.
02420 LD BC,4800H ;BC=Loop counter.
02430 SELECT3 CALL NZ,SELECT3 ;Index hole?
02440 JR NZ,SELECT3 ;Loop if it is.
02450 SELECT4 CALL SELECT4 ;Index hole?
02460 JR 2,SELECT4 ;Loop if not.
02470 XOR A ;Flag drive ready.
02480 RET ;Return.
02490 SELECT5 PUSH AF ;Save the flags.
02500 DEC BC ;Decrement the loop counter.
02510 LD A,B ;Is the
02520 OR C ; loop complete?
02530 JR NZ,SELECT6 ;Jump if it isn't.
02540 POP AF ;Restore the flags.
02550 POP BC ;Clean up the stack.
02560 SCF ;Flag error.
02570 RET ;Return.
02580 SELECT6 POP AF ;Clean up the stack.
02590 IN A,(CMD) ;A=PDC status.
02600 BIT 1,A ;Set zero flag for index hole status.
02610 RET ;Return.
02620 ; Time the Drive and Figure Cursor Position Routine
02630 ;
02640 ;
02650 GETSP DI ;Disable the interrupts.
02660 SVC ;Get the system flags pointer.
02670 LD A,(IY+12) ;A=Port 0ECH image.
02680 RES 6,A ;Reset bit for 2.02752 MHz clock.
02690 OUT (0ECH),A ;Set the clock for 2.02752 MHz.
02700 LD HL,0 ;HL=Time counter.
02710 LD A,(DRVSEL) ;A=Drive select mask.
02720 OUT (SEL),A ;Reselect the drive.

```

```

02730 LD A,0D0H ;A=PDC reset command.
02740 OUT (CMD),A ;Reset the PDC.
02750 LD B,10 ;B=Delay counter.
02760 GETSP0 DJNZ GETSP0 ;Delay till PDC is ready.
02770 GETSP1 IN A,(CMD) ;Index hole?
02780 BIT 1,A ;Loop if it is.
02790 JP NZ,GETSP1 ;A=PDC status.
02800 IN A,(CMD) ;Index hole?
02810 BIT 1,A ;Loop if not.
02820 JP Z,GETSP2 ;Bump the time counter.
02830 INC HL ;A=PDC status.
02840 IN A,(CMD) ;Index hole?
02850 BIT 1,A ;Loop if it is.
02860 JP NZ,GETSP3 ;Bump the time counter.
02870 INC HL ;A=PDC status.
02880 IN A,(CMD) ;Index hole.
02890 BIT 1,A ;Loop if not.
02900 JP Z,GETSP4 ;A=Port 0ECH image.
02910 LD A,(IY+12) ;Set the clock for the old rate.
02920 OUT (0ECH),A ;Enable the interrupts.
02930 EI ;IX=Speed lookup table pointer.
02940 LD IX,SPTAB ;B=Number of speed values.
02950 LD B,73 ;E=LSB of the speed value.
02960 GETSP5 LD E,(IX) ;Bump the table pointer.
02970 INC IX ;D=MSB of the speed value.
02980 LD D,(IX) ;Bump the table pointer.
02990 INC IX ;Bump the table pointer.
03000 INC IX ;A=MSB of the time counter.
03010 LD A,H ;Compare it with the speed value.
03020 CP D ;Jump if the NSBs don't match.
03030 JR NC,GETSP6 ;A=LSB of the time counter.
03040 LD A,L ;Compare it with the speed value.
03050 CP E ;Jump if it's the correct position.
03060 GETSP6 DJNZ GETSP6 ;Loop till the end of the table.
03070 LD A,(IX-1) ;L=New cursor position.
03080 GETSP7 LD H,9 ;H=Cursor line position.
03090 RET ;Return.
03100 ;
03110 ; Variables, Tables, and Messages
03120 ;
03130 ;
03140 DRIVE DB 0
03150 DRVSEL DB 0
03160 CURSOR DB 0
03170 DRVTAB DB 81H,82H,84H,88H
03180 SPTAB DB 11933
03190 DATA 11924
03200 DATA 11914
03210 DATA 11904
03220 DATA 11895
03230 DATA 11885
03240 DATA 11875
03250 DATA 11866
03260 DATA 11856
03270 DATA 11847
03280 DATA 11837
03290 DATA 11827
03300 DATA 11818
03310 DATA 11808
03320 DATA 11798
03330 DATA 11789
03340 DATA 11779
03350 DATA 11769
03360 DATA 11760
03370 DATA 11750
03380 DATA 11740
03390 DATA 11731
03400 DATA 11721
03410 DATA 11711
03420 DATA 11702
03430 DATA 11692
03440 DATA 11682
03450 DATA 11673
03460 DATA 11663

```



```

03470 DATA 11653
03480 DATA 11644
03490 DATA 11634
03500 DATA 11624
03510 DATA 11615
03520 DATA 11605
03530 DATA 11595
03540 DATA 11586
03550 DATA 11576
03560 DATA 11567
03570 DATA 11557
03580 DATA 11547
03590 DATA 11538
03600 DATA 11528
03610 DATA 11518
03620 DATA 11509
03630 DATA 11499
03640 DATA 11489
03650 DATA 11480
03660 DATA 11470
03670 DATA 11460
03680 DATA 11451
03690 DATA 11441
03700 DATA 11431
03710 DATA 11422
03720 DATA 11412
03730 DATA 11402
03740 DATA 11393
03750 DATA 11383
03760 DATA 11373
03770 DATA 11364
03780 DATA 11354
03790 DATA 11344
03800 DATA 11335
03810 DATA 11325
03820 DATA 11315
03830 DATA 11306
03840 DATA 11296
03850 DATA 11287
03860 DATA 11277
03870 DATA 11267
03880 DATA 11258
03890 DATA 11248

```

```

03900 DATA 11238
03910 MESS0 DB 1CH,1FH,0FH,03
03920 MESS1 DB 'Model 4 Floppy Disk Timer 01.00.00',03
03930 MESS2 DB 'Copyright ',21,239,21,' 1983 By Mark Goodwin',03
03940 MESS3 DB 191, : -4.5 RPM : +4.5 RPM
: ',10,00,191,191
03950 DB ' 2 3
3',10,00,191,191
03960 DB ' 9 0
0',10,00,191,191
03970 DB ' 1 2 3 4 5 6 7 8 9 0 1 2 3 4
5 6 7 8 9',10,00,191,191
03980 DB ' : .....: ',10,00,191,03
03990 MESS4 DB 'Drive',03
04000 MESS5 DC 68,32
04010 DB 03
04020 MESS6 DB 'Menu',03
04030 MESS7 DB '0 - To time drive 0. 2 - To time drive 2.',03
04040 MESS8 DB '1 - To time drive 1. 3 - To time drive 3.',03
04050 MESS9 DB 'Press any key (except 0 to 3) to exit the program.',03
04060 MESS10 DB '<Drive is not in the system>',03
04070 MESS11 DB '<Diskette is not in the drive>',03
04080 MESS12 DB 'Press any key to return to the menu.',03
04090 GRAPH0 DB 3,1,188,78,140,1,188
04100 GRAPH1 DB 3,1,191,78,140,1,191
04110 GRAPH2 DB 3,1,191,78,32,1,191
04120 GRAPH3 DB 5,1,191,9,140,1,188,68,140,1,191
04130 GRAPH4 DB 5,1,191,9,32,1,191,68,32,1,191
04140 GRAPH5 DB 5,1,143,9,140,1,143,68,140,1,143
04150 DRIVES DB 188,140,140,140,188,03
04160 DB 191,32,32,32,191,03
04170 DB 143,140,140,140,143,03
04180 DB 32,140,188,32,32,03
04190 DB 32,32,191,32,32,03
04200 DB 140,140,143,140,140,03
04210 DB 140,140,140,140,188,03
04220 DB 176,140,140,140,143,03
04230 DB 143,140,140,140,140,03
04240 DB 140,140,140,140,188,03
04250 DB 32,140,140,140,191,03
04260 DB 140,140,140,140,143,03
04270 END MAIN

```

End

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Stockvalue is a 16K Model I/III portfolio management package that uses a system I developed during 25 years of tracking investments (see Program Listing 1). It lets you record investments, calculate portfolio values at any time, and compare current valuations to original investments.

Stockvalue also keeps track of profits and losses from closed transactions. Because the program is divided into sections, you can easily add format revisions or additional reports. After years of using dog-eared, marked-up records, I find Stockvalue a pleasure.

Program Overview

Like most financial analysis programs, Stockvalue has sections for data entry, data processing and calculations, and reports.

I designed Stockvalue's data entry to be as fast and efficient as possible. You can enter data directly into the program using data statements. This requires some programming knowledge, but it avoids data input and output problems, such as the loss of data on unintentional

program exits. Alternatively, if you'd rather input all data in response to screen prompts, I've included program modifications at the end of this article.

Tables 1 and 2 list Stockvalue's simple variables and arrays. Table 3 gives you a breakdown of functions for the program lines.

Using the Program

Load Stockvalue and choose Option 5 from the main menu for instructions on how to enter transaction data (see Figs. 1 and 2). Note that you enter dates as five or six digits with no interrupting punctuation marks. After you replace the sample data on lines 5000-5100 and 6000-6030, run Stockvalue and choose

Option 1, Current Valuation, from the main menu. Your data entry is correct if Stockvalue applies the right prices to the appropriate securities. You can easily identify and correct common errors, such as leaving a security price out of the data line or including a price for a date after you sold the security.

Line 5999, "DATA END", indicates that all security transactions are entered and that price data will follow. Enter price data on line 6000 in the same sequence you used for security data in the previous lines. First enter the purchase date, followed by the price of each security in the portfolio as of that date. Stockvalue applies prices only to active holdings. If you eliminate a se-

Variable	Description
A	Counter
A\$	Dummy
B	No. of repeated securities
C	Counter
C\$	CHRS(34)
D	Dummy and counter
F	No. of closed transactions
FL\$	File name
I	No. of securities
I1	No. of repeat purchases—total
I1\$	INKEY\$
MO	No. of starting date
N	Counter
NA\$	Owner's name
P	LPrint identifier
P\$	On/off
R	No. of ending date
R1	Year sold
R2	Month sold
R3	Day sold
RO	No. of dates
X	Counter
Y	Counter
ZC	Cost of a security not yet sold
ZT	Total gain or loss on closed transactions

Table 1. Simple variables for Stockvalue.

Variable	Description
A\$(I)	Security name
D(I)	No. of shares of A\$(I)
DP(I)	Date purchased
DS(I)	Date sold
R1(I)	Month purchased
R2(I)	Day purchased
R3(I)	Year purchased
Z(R,I)	Security value/share on date R
Z%(I)	Gain or loss on closed transaction
ZC(I)	Cost for A\$(I)
ZS(I)	Sale price of A\$(I)
F(B)	Item no. of a security with repeat purchases
C(B)	No. of times a security is repurchased - 1
DB(B,R)	Total no. of shares of a repeat purchase security
ZB(B,R)	Total cost for a repeat purchase security
DA(R)	Date of valuation
R4(R)	Month of valuation
R5(R)	Day of valuation
R6(R)	Year of valuation
ZT(R)	Total value of portfolio on a date
ZU(R,B)	Total value of a security with repeat purchases on a date

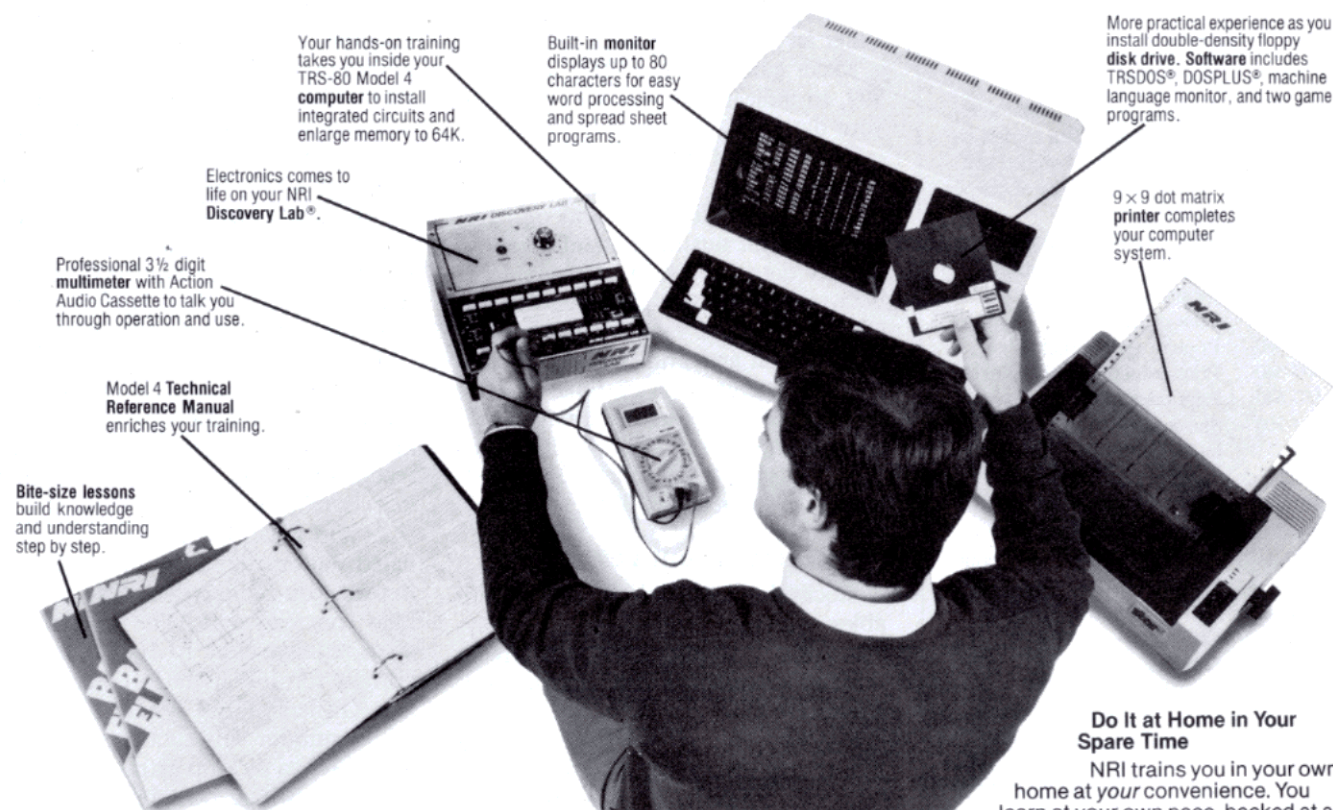
Table 2. Arrays for Stockvalue.

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curity from your portfolio before that date, don't enter a price; Stockvalue sorts data by dates to apply prices to active issues.

When you sell a security, enter an S after the purchase entry, followed by

Lines	Description
30-130	Initialize program, count numbers of various data entries, dimension arrays as needed and print a screen display of the process
150-280	Read data into memory, format it, and print a screen display of the process
300-330	Print menu
350-360	Printer on/off switch
400-540	Print detail of multiple purchases
550-640	Print table of closed transactions
650-700	Show valuation dates in memory and allow operator selection of these for printing
800-830	Save program on tape
840-860	Save program on disk
1000-1420	Perform calculations and print evaluation table
4800-4910	Data entry instructions
5000-7999	Data entry
8000-8020	Date handling
9000-9020	INKEY routing

Table 3. Program description.

Lines	Description
32-39	Print preselect menu
140, 305	Redirect program flow
1450-1480	Print keyboard input menu
1500	Initialization
1510-1570	Input purchase info from keyboard
1600-1680	Input price info from keyboard
1700-1750	Input sale info from keyboard
1800-1880	Edit info previously input
2000-2040	Save data on tape
2050-2090	Input data from tape
2100-2160	Save data on disk
2170-2230	Input data from disk
2240-2260	Array size control subroutines

Table 4. Keyboard input subprogram description.

MARY LYNCH PORTFOLIO VALUATION

```

0) TURN PRINTER OFF/ON: STATUS <ON>
1) CURRENT VALUATION
2) DETAIL OF MULTIPLE PURCHASES
3) CLOSED TRANSACTIONS LIST
4) CHANGE DATES
5) INSTRUCTIONS
6) SAVE PROGRAM TO TAPE
7) SAVE PROGRAM TO DISK

CHOICE

```

Figure 1. Stockval's main menu.

the date of the sale and the total sale price. Stockvalue makes the necessary calculations to report earnings or losses.

You should enter short sales as a negative number of shares (see Listing 1). You receive rather than spend money, so the cost is also a negative number. Enter an S to close the transaction.

Make sure that line 6999 is DATA 999, to indicate that you've entered all your data.

The final and most important part of Stockvalue is its report section. Option 0 toggles the printer off and on. This lets you print out the portfolio's status on any date for which you've entered data, and compares this value to the cost, or to other valuation dates. You can also call and print separate reports from the menu to give a table of gains and losses from closed securities. Figure 3 shows three reports Stockvalue prints using the sample data included in Listing 1 as of March 31, 1983.

Something About Features

Stockvalue automatically counts variables to dimension arrays, displays counts while loading data, and screens calculations to apply entries to the proper dates.

Changing the listings as you buy and sell securities is one of the most difficult tasks in any portfolio management system. Stockvalue uses extensive date screening routines to remove all securities not held during a requested comparison period while inserting them in any listing for a date when you held them.

Stockvalue adds shares and costs of repeat purchases when you print reports. You enter the current price only once; Stockvalue applies it to all appropriate repeat purchases. This is useful

for investment plans that rely on repurchasing the same stocks.

Keyboard Input Option

I've written a subprogram to Stockvalue that lets you enter all data directly from the keyboard in response to prompts (see Program Listing 2). It adds a preselect menu so that when you merge the new lines into the program you can input data either in data statements or in response to prompts.

You add only four new variables: A1 to identify which data input method you've selected, BI and BR, which control the array sizes, and FM\$, the file name for the data files. Table 4 outlines the subprogram.

The routines that accept purchase and price data are straightforward. Saving and reading data with tape and disk are direct but rather slow. To edit and record sales, you select the appropriate item number from mini-menus of securities and prices in memory. I've eliminated automatic array dimensioning; instead, you can increase array size each time you read data. The merged program requires close to 16K, so it's important for 16K users to control array size. Owners of 16K systems can delete the reminder instructions in lines 4800-4910 to pick up extra memory.

The modified program does not subtotal multiple purchase securities because of the amount of data manipulation and renumbering that would require. Otherwise, all reports are identical to those you get using read/data statements. ■

Program Listings begin on p. 90

You can reach Robert C. Bazzell at 7127 Pebble Park, W. Bloomfield, MI 48033.

```

Data Entry Format
Data is entered in DATA lines beginning with line 5000 in the
following format:
5000 DATA"Your name in quotes"
5010 DATA"Security name",no. of shares,date purchased(mmddyy),to
tal cost
5020 DATA"Security name",no. of shares,date purchased(mmddyy),to
tal cost
Continue in this format until all securities are entered
If a security is purchased more than once enter double quotes
"" on the same line. Then the program will handle totalling the
various purchases of the same stock and future price data need
be entered only once for that stock.
5999 DATA "END"
6000 DATAdate1(mmddyy),price this date of security one,price of
two,price of three,etc until a price is entered for all securi-
ties.
6010 DATAdate2(mmddyy),price this date of security one,price of
two,price of three,etc until a price is entered for all securi-
ties.
Continue entering date and prices as desired. Prices on any date
should be entered only for securities held on that date
7999 DATA999

```

Figure 2. Data entry format. Use this format to enter data in DATA lines.

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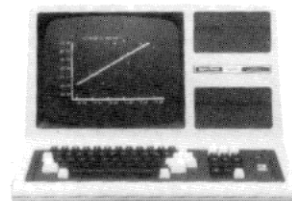
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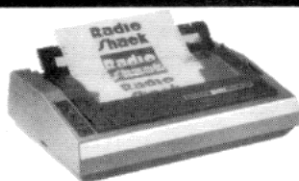
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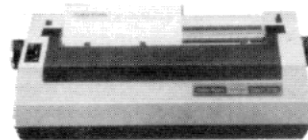
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#	SECONDS DELAY	PERCENT
STRINGS	NORMAL	TRASHMAN IMPROVEMENT
10	.1	.1
250	11.8	0.7
500	45.0	1.6
1000	179.6	3.5
2000	713.2	7.8

(Note: Not for use with The Home Accountant.)

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MARY LYNCH PORTFOLIO VALUATION

3/31/83	12/31/80	12/31/81	12/31/82	3/31/83
Shares	DatePurch	Cost	Price Value	Price Value
37 Fid Trend Multiple	731	22.10	741 20.83	698 31.07
40 Simplicity 4/ 7/76	671	12.50	500 13.50	540 7.63
65 Greyhound 1/ 5/78	871	14.13	918 13.63	886 17.25
0 Goodyear 1/ 5/78	0	16.50	825 17.50	875 35.00
112 OGE Multiple	1455	0.00	0 12.88	1288 19.38
54 Houston IndMultiple	1888	0.00	0 19.00	950 20.00
50 IBM 11/22/81	3120	0.00	0 60.00	3000 95.00
0 G+W Marl5put10/12/82	0	0.00	0 0.00	0 0.25
0 G'year Apr31/ 9/82	0	0.00	0 0.00	0 3.38
100 Gulf+Wester12/ 9/82	1646	0.00	0 0.00	0 16.75
Total	9582	2984	8236	13538

DETAIL OF MULTIPLE PURCHASES

Shares	DatePurch	Cost	Cost/sh	Cum/sh	Price	3/31/83-Value
22.000	6/ 1/75	374	17.00	17.00	34.89	768
8.000	12/ 5/77	160	20.00	17.80	34.89	279
3.524	1/16/80	92	26.11	18.67	34.89	123
0.870	1/18/82	26	29.38	18.94	34.89	30
1.953	2/16/82	51	25.99	19.32	34.89	68
0.948	1/24/83	28	30.01	19.59	34.89	33
37.295		731	19.59		34.89	1301

CLOSED TRANSACTIONS

Shares	Security	DatePurch	Cost	DateSold	SalePrice	Gain(-Loss)
50	Goodyear	1/ 5/78	877	1/ 8/83	1772	895
-100	G+W Marl5put	18/12/82	-79	3/15/83	0	79
-100	G'year Apr35	11/ 9/82	-190	2/15/83	0	189
Total						1163

Figure 3. Three reports using the sample data in Listing 1.

Program Listing 1. Stockvalue stock-tracking program.

```

20 'STOCKVALUE BY ROBERT C. BAZZELL, 7127 PEBBLE PARK
    WEST BLOOMFIELD, MI48033
30 CLS: CLEAR1500: DEFINT A-C, F-Y
40 READNA$: NA$=NA$+" PORTFOLIO VALUATION": PRINTTAB(6) NA$
50 FORI=0 TO 300: READA$: IFA$="S", I=I-1: F=F+1: READD, DELSEREADD, D, A:
    IFA$="", I1=I1+1: 'COUNT SALES AND REPEATS
60 IFA$<"END", NEXTI: PRINT<"END"> NOT READ IN DATA STATEMENTS": STOP
70 FORR=0 TO 300: READA: IFA=999 THEN 100: 'CHANGE 30 TO A GREATER NUMBER
    FOR MORE VALUATION DATES
80 FORX=1 TO I-1: READD: IFD=999 THEN R=R+1: GOTO 100 ELSE IFD>10000 THEN 9
    ELSE NEXTX
90 NEXTR: PRINT"999 NOT READ AT END OF PRICE ENTRIES. PROGRAM SET
    FOR A MAXIMUM OF 30 VALUATIONS. CHANGE LINE 70 TO ALLOW MORE"
: STOP
100 RESTORE: PRINT@148, "STOCKS": ; PRINTUSING"###"; I=I1: PRINT@202,
    "REPEAT PURCHASES": ; PRINTUSING"###"; I1: PRINT@263, "CLOSED TRANSACTIONS": ;
    PRINTUSING"###"; F: PRINT@330, "EVALUATION DATES": ; PRINTUSING"###"; R
110 PRINT@463, "TOTAL ITEMS": ; PRINTUSING"###"; 4*I+R*(I-I1)+2*F
120 DIMA$(I+1), DP(I), D(I), DA(R), DS(I), Z(R,I), ZS(I), ZT(R), ZC(I), Z
    U(R,I), R1(I), R2(I), R3(I), R4(R), R5(R), R6(R), F(I1)
130 MO=1: P$="OFF": RO=R: FL$="STOCKVAL": M$="Multiple": L$=STRING$(6
    3,45): LL$=STRING$(79,45)
150 READA$: PRINT: PRINTTAB(14) "READING ITEM:1": A=-3
160 FORN=1 TO I: A=A+4: PRINT@603, A
170 READA$(N): IFA$(N)="S", N=N-1: GOSUB 8000: GOTO 200 ELSE READD(N), DP
    (N), ZC(N): 'NAME, NO. SHARES, DATE PURCH, COST
180 IFA$(N)=" " THEN IFA$(N-1)<" " F(B)=N-1: B=B+1: ELSE C(B-1)=C(B-1)
    +1: F(B)=LINES OF STOCKS WITH MULTIPLE PURCHASES & C(B)=TOTAL NO.
    OF TIMES PURCHASED -2
190 R1(N)=DP(N)/10000: R2(N)=(DP(N)-R1(N)*10000)/100: R3(N)=DP(N)-
    R1(N)*10000-R2(N)*100: DP(N)=R3(N)*10000+R1(N)*100+R2(N)
200 NEXT
210 DIMDB(B,R), ZB(B,R), Z%(I)
220 READA$: 'READ OUT "END" FROM 5999
230 FORX=1 TO R: A=A+1: PRINT@603, A
240 READDA(X): 'X=DATES
250 R4(X)=DA(X)/10000: R5(X)=(DA(X)-R4(X)*10000)/100: R6(X)=DA(X)-
    R4(X)*10000-R5(X)*100: DA(X)=R6(X)*10000+R4(X)*100+R5(X)
260 FORY=1 TO I: 'Y=ITEMS

```

Listing 1 continued

Listing 1 continued

```

1010 C=CLS:PRINT:NAS:PRINT"CALCULATING";
1020 FORN=0TOB-1:FORA=MOTOR:DB(N,A)=0:ZB(N,A)=0:FORY=0TOC(N)+1:I
FDP(F(N)+Y)>DA(A)ORDS(F(N)+Y)<DA(A)ANDDS(F(N)+Y)<>0THEN1030ELSE
B(N,A)=DB(N,A)+D(F(N)+Y):ZB(N,A)=ZB(N,A)+ZC(F(N)+Y)
1030 PRINT":NEXTY:NEXTA:NEXTN
1040 PRINT#64,"-----":PRINTING##/##/##";R4(R),R5(R),R6(R);
PRINT":NEXTX:NEXTZ:PRINT
1050 PRINT"Shares
DatePurch Cost ";FORX=MOTOR:PRINT"
Price Value ";NEXT
1060 PRINT:A=0
1070 IFP.LPRINTLS:LPRINT"-----":LPRINTING##/##/##";R4(R),
R5(R),R6(R);:LPRINT"-----":FORX=MOTOR:LPRINTUSING"
##/##/##";R4(R),R5(R),R6(R);:NEXT:LPRINT"
1080 IFP.LPRINT"Shares
DatePurch Cost ";FORX=MOTOR:LP
RINT"Price Value ";NEXT:LPRINT"---:LPRINTLS
1090 ZT(0)=0:FORX=1TOI
1100 IFP(A)=XANDDB(A,R)>0,PRINTUSING"#### %
#### %";DB(A,R),AS(X),MS,ZB(A,R):ZT(0)=ZT(0)+ZB(A,R):GOTO1170
1110 IFDP(X)>DA(R)THEN1280
1120 IFDS(X)=DA(MO)ANDDS(X)<>0THEN1280
1130 IFDS(X)<DA(R)ANDDS(X)<>0THENZC=0ELSEZC=D(X):ZC=ZC(X)
1140 ZT(0)=ZT(0)+ZC
1150 IFAS(X)<"",PRINTUSING"#### %
####/##/##";D,
AS(X),R1(X),R2(X),R3(X),ZC;
1160 IFPANDAS(X)<>"",LPRINTUSING"#### %
####/##/##";D,AS(X),
R1(X),R2(X),R3(X),ZC;
1170 IFP(A)=XANDP-LANDDB(A,R)>0,LPRINTUSING"#### %
#### %";DB(A,R),AS(X),MS,ZB(A,R);
FORX=MOTO R
1180
1190 IFX=1THENZT(Y)=0:"0 DATE TOTALS
1200 IFP(A)=X,ZU(Y,X)=DB(A,X)+Z(Y,X)ELSEIFDP(X)=<DA(X)ANDDS(X)
>DA(X)ORDS(X)=0THENZU(Y,X)=D(X)+Z(Y,X)ELSEZU(Y,X)=0
1210 PRINTUSING"#### %
#### %";Z(Y,X),ZU(Y,X);
1220 IFPANDAS(X)<>"",LPRINTUSING"#### %
#### %";Z(Y,X),ZU(Y,X)
);
1230 ZT(Y)=ZT(Y)+ZU(Y,X)
1240 NEXTY:IFAS(X)<>"",PRINT
1250 IFP(A)=X,X=X+C(A)+1:A=A+1
1260 IFP=0ANDC=13,C=0:GOSUB9000
1270 IFPTHENLPRINT"
1280 C=C+1:NEXTX
1290 IFPTHENLPRINTCHRS(10)
1300 IFP.LPRINTTAB(24);"-----":FORX=MOTO R
1310 PRINTTAB(25)"-----":FORX=MOTO R
1320 PRINTUSING"
#### %
#### %";
1330 IFP.LPRINTUSING"
#### %
#### %";
1340 NEXT:PRINT
1350 PRINT"Total
";
1360 IFPTHENLPRINT"
";
1370 IFPTHENLPRINT"Total
";
1380 IFP.LPRINTUSING"#### %
#### %";ZT(0):FORX=MOTO R:LPRINTUSING"
#### %
#### %";ZT(X):NEXTX
1390 IFP.LPRINT"
"
1400 PRINTUSING"#### %
#### %";ZT(0):FORX=MOTO R:PRINTUSING"
#### %
#### %";ZT(X):NEXTX
1410 IFP.LPRINTLS:LPRINT"
"
1420 GOSUB9000:GOTO300
4800 CS=CHRS(34):CLS:PRINT,"Data Entry Format"
4810 PRINT"Data is entered in DATA lines beginning with line 500
0 in the
following format:
4820 PRINT"5000 DATA";CS;"Your name in quotes";CS;"no. of shares,date purchased(mmddy)";
A";CS;"Security name";CS;"no. of shares,date

```

```

total cost"
4830 PRINT"5020 DATA";CS;"Security name";CS;"no. of shares,date
purchased(mmddy)";total cost"
4840 PRINT"Continue in this format until all securities are ente
red"
4850 PRINT"If a security is purchased more than once enter doub
le quotes ";CS;CS;" on the same line. Then the program will han
dle totalling the various purchases of the same stock and futur
e price data need be entered only once for that ";
4860 PRINT"stock.":PRINT"5999 DATA";CS;"END";CS;GOSUB9000
4870 PRINT"6000 DATAdatel(mmddy);price this date of security on
e,price of two,price of three,etc until a price is entered for a
11 securi- ties."
4880 PRINT"6010 DATAdatel2(mmddy);price this date of security on
e,price of two,price of three,etc until a price is entered for a
11 securi- ties."
4890 PRINT"Continue entering date and prices as desired. Prices
on any dates should be entered only for securities held on that da
te"
4900 PRINT"7999 DATA999"
4910 GOSUB9000:GOTO300
5000 DATA"MARY LYNCH"
5010 DATA"Fid Trend",22,60175,374,"",8,120577,160,"",3,524,11680
,92,"",87,11882,25,56,"",1,953,21682,50,75,"",948,12483,28,45
5020 DATA"Simplicity",40,40776,671
5030 DATA"Greyhound",65,10578,877,"S",10883,1772
5040 DATA"Goodyear",50,10578,877,"S",10883,1772
5050 DATA"OGI",100,80681,1266,"",2,828,43082,44,"",3,271,73082,
46,"",2,941,102982,48,"",2,983,13183,51
5060 DATA"Houston Ind",50,111381,1002,"",1,341,91082,27,"",1,530
,121082,29,"",1,443,31083,30
5070 DATA"IBM",50,112281,3120
5080 DATA"G+W Mar15put",-100,101282,-79,"S",31583,0
5090 DATA"G Year Apr35",-100,110982,-190,"S",21583,0625
5100 DATA"Gulf+Western",100,120982,1646
5999 DATA"END"
6000 DATA123100,22,10,12,5,14,125,16,5
6010 DATA123181,20,83,13,5,13,625,17,5,12,875,19,60
6020 DATA123182,31,07,7,63,17,25,35,19,375,20,95,25,3,375,16,75
6030 DATA33183,34,89,8,875,24,25,18,875,20,5,104,24,25
6999 DATA999
7900 END
8000 READDS(N),ZS(N)
8010 R1=DS(N)/10000:R2=(DS(N)-R1*10000)/100:R3=DS(N)-R1*10000-R2
*100:IFR1>12RETURNELSEDS(N)=R3*10000+R1*100+R2
8020 RETURN
9000 IIS="":PRINTCHRS(14);IIS=INKEY$:PRINTCHRS(15);:IFIIS="THE
N9000
9010 IFIIS="Y",IIS="Y"
9020 RETURN

```

End

Program Listing 2. Modifications to be merged with Stockvalue for data input from keyboard.

```

20 'STOCKVALUE BY ROBERT C. BAZZELL, 7127 PEBBLE PARK
WEST BLOOMFIELD, MI48033
MAY 21, 1983: MODIFIED TO USE SCREEN DATA INPUT APR 15, 1984
32 PRINT," STOCKVALUE":PRINT," PORTFOLIO VALUATION":PRI
NT:PRINT"DO YOU WISH TO ENTER ALL NEW DATA FROM THE KEYBOARD OR
PREVIOUSLY STORED DATA?:PRINT
35 PRINT,"1 READ/DATE STATEMENTS WITHIN PROGRAM":PRINT,"2 KEYBOA

```

Listing 2 continued

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```

RD":PRINT,"3 TAPE":PRINT,"4 DISK":PRINT
38 PRINT,"CHOICE";GOSUB9000:A1=VAL(I1$):ONALGOTO39,1500,2050,21
70,30
39 CLS
140 IFAL>1,DIMZ$(I):RETURN
305 IFAL>1,THEN1450
1450 PRINT:PRINT,"0 TURN PRINTER OFF/ON: STATUS <";P$;">";PRINT
1460 PRINT:PRINT,"1 CURRENT VALUATION":PRINT,"2 CLOSED TRANSACTIONS LIST"
1460 PRINT:PRINT,"3 PRICE SECURITIES AS OF A DATE":PRINT,"4) CHANGE D
ATES":PRINT,"5) ADD MORE SECURITIES":PRINT,"6) RECORD SECURITY S
ALES"
1470 PRINT,"7) EDIT ENTRIES":PRINT,"8) SAVE DATA TO TAPE":PRINT,
"9) SAVE DATA TO DISK"
1480 PRINT:PRINT,"CHOICE";GOSUB9000:A=VAL(I1$):A=A+1:ONA GOTO35
0,1000,550,1600,650,1510,1700,1800,2000,2100
1500 CLS:PRINT:INPUT"OWNER OF PORTFOLIO",NAS:NAS=NAS+" PORTFOLIO
EVALUATION":X=1:I=10:R=10:GOSUB120:I=1:R=0:RO=0:BI=10:BR=10
1510 IFA=6,CLS:IFBI=1GOTO2240ELSEPRINT"ADD NEW ENTRIES":X=X+1
1515 PRINT"NAME OF SECURITY NO.":X;"A$(X)";":INPUTA$(X)
1520 PRINT"NUMBER OF SHARES":D(X);":INPUTD(X)
1530 PRINT"DATE PURCHASED(MMDDYY)":R1(X);R2(X);R3(X);":INPUT
DP(X)
1540 IFDP(X)<1300000THENR1(X)=DP(X)/10000:R2(X)=(DP(X)-R1(X))*1000
0/1000:R3(X)=DP(X)-R1(X)*10000-R2(X)*100:DP(X)=R3(X)*10000+R1(X)
*100+R2(X)
1550 PRINT"TOTAL COST(";ZC(X);":":INPUTZC(X)
1560 IFA=BI,1=X:GOTO300
1570 IFA>8,PRINT"ANOTHER SECURITY?(Y/N)":GOSUB9000:IFIIS="Y"TH
ENX=X+1,PRINT:PRINT:GOTO1515ELSEI=X:GOTO300ELSE1800
1600 CLS:IFBR=ROTHENGOTO2240ELSERO=RO+1:Y=RO
1610 INPUT"DATE OF VALUATION (MMDDYY)":DA(Y):IFDA(Y)>1300000THEN1
630
1620 R4(Y)=DA(Y)/10000:R5(Y)=(DA(Y)-R4(Y)*10000)/1000:R6(Y)=DA(Y)
-R4(Y)*10000-R5(Y)*100:DA(Y)=R6(Y)*10000+R4(Y)*100+R5(Y)
1630 IFDA(Y)<DA(Y-1),THEN1600
1640 PRINT"ENTER VALUE PER SHARE THIS DATE FOR EACH SECURITY"
1650 FORX=1TOI:IFDP(X)>DA(Y)THEN1670
1660 IFDS(X)>DA(Y)ORDS(X)=0THENPRINTA$(X);PRINT("";Z(Y,X);":":
INPUTZ(Y,X)
1670 NEXT:GOTO300
1680 PRINT"DATE MUST BE AFTER PREVIOUS LAST ENTRY(";R4(Y-1);"/"R5
(Y-1);"/"R6(Y-1);GOTO1610
1700 CLS:PRINT,"SECURITIES IN PORTFOLIO":PRINT:PRINT"0 RETURN T
O MENU";PRINTTAB(21)"1 ";A$(1);:PRINTTAB(42)"2 ";A$(2);:FORX=3TO
ISTEP3:PRINTX;A$(X);:IFX+1=<I,PRINTTAB(20)X+1;A$(X+1);
1710 IFX+2=<I,PRINTTAB(41)X+2;A$(X+2);:NEXT:LESENEXT
1720 PRINT:INPUT"ENTER THE NUMBER TO THE LEFT OF THE SECURITY SO
LD";N
1730 IFN=0THEN300
1740 CLS:PRINT"DATE OF SALE OF "A$(N)"("DS(N)");:INPUT DS(N):GO
SUB8010
1750 PRINT"AMOUNT RECEIVED FROM SALE("ZS(N)");:INPUTZS(N):A$(N)
=A$(N):GOTO1700
1800 CLS:PRINT,"SECURITIES IN PORTFOLIO":PRINT:PRINT"0 EDIT PRI
CE INFO";:PRINTTAB(21)"1 ";A$(1);:PRINTTAB(42)"2 ";A$(2);:FORX=3T
OISTEP3:PRINTX;A$(X);:IFX+1=<I,PRINTTAB(20)X+1;A$(X+1);
1810 IFX+2=<I,PRINTTAB(41)X+2;A$(X+2);:NEXT:LESENEXT

```

```

1820 PRINT:PRINTX"RETURN TO MENU"
1830 INPUT"TO EDIT A SECURITY ENTRY ENTER ITS ITEM NUMBER";X
1840 IFX=0,CLS:PRINT,"EVALUATION DATES":PRINTTAB(15)"0 RETURN
TO MENU":FORX=1TORO:PRINTTAB(14)USING"##/##/##";X,R4(X),R5(X)
X),R6(X):NEXT:LESENEXT
1850 INPUT"TO EDIT PRICES FOR A DATE ENTER THE NUMBER TO ITS LEF
T";Y:IFY=0GOTO300ELSEGOTO1880
1860 IFX+1+CLS:PRINT"SECURITY", " NO SHARES", "DATE PURCH", "COST
":PRINTA$(X),D(X),R1(X);R2(X);R3(X),ZC(X)ELSEIFX>I THEN300ELSE180
0
1870 PRINT"DO YOU WISH TO EDIT THIS ENTRY?(Y/N)":GOSUB9000:IFI
$="Y"THENPRINT:GOTO1510ELSE1800
1880 CLS:PRINT"DATE":R4(Y);R5(Y);R6(Y):PRINT"IS THIS THE DATE Y
OU WISH TO EDIT?(Y/N)":GOSUB9000:IFIIS="Y"THENPRINT:GOTO1640ELS
E1800
2000 CLS:PRINT"IS RECORDER READY WITH <PLAY> AND <RECORD> BUTTO
N DEPRESSED (Y/N)?:":GOSUB9000:IFIIS<>"Y"THEN300ELSEPRINT"-1,
NAS,1,RO
2010 FORX=1TOI:PRINT"-1,A$(X),D(X),DP(X),DS(X),R1(X),R2(X),R3(X)
,ZC(X),ZS(X)
2020 FORX=1TORO:PRINT"-1,Z(Y,X),NEXT:NEXTX
2030 FORX=1TORO:PRINT"-1,DA(Y),R4(Y),R5(Y),R6(Y):NEXT
2040 PRINT:PRINT"DATA SAVED. END SESSION?(Y/N)":GOSUB9000:IFI
$="Y",ENDELSGOTO300
2050 CLS:PRINT"IS RECORDER READY WITH <PLAY> BUTTON DEPRESSED?(Y
/N)":GOSUB9000:IFIIS<>"Y"THEN300ELSEINPUT"-1,NA$,I,R:PRINT:PRINT
"THESE ARE I"SECURITIES AND R"EVALUATION DATES IN THIS FILE"
2060 PRINT"DO YOU WANT TO RESERVE MEMORY FOR MORE ENTRIES?(Y/N)"
:GOSUB9000:IFIIS="Y"THEN GOSUB2250:GOSUB120:I=I-A:R=C:RO=R
2070 FORX=1TOI:INPUT"-1,A$(X),D(X),DP(X),DS(X),R1(X),R2(X),R3(X)
,ZC(X),ZS(X)
2080 FORX=1TORO:INPUT"-1,Z(Y,X),NEXT:NEXTX
2090 FORX=1TORO:INPUT"-1,DA(Y),R4(Y),R5(Y),R6(Y):NEXT:GOTO300
2100 CLS:INPUT"NAME OF FILE TO BE SAVED",FMS
2110 OPEN"O",1,FMS
2120 PRINT"-1,NA$,I";:I;RO
2130 FORX=1TOI:PRINT"-1,A$(X);":D(X);DP(X);DS(X);R1(X);R2(X);R3
(X);ZC(X);ZS(X)
2140 FORX=1TORO:PRINT"-1,Z(Y,X),NEXT:NEXTX
2150 FORX=1TORO:PRINT"-1,DA(Y),R4(Y);R5(Y);R6(Y):NEXT:CLOSE
2160 PRINT:PRINT"DATA SAVED. END SESSION?(Y/N)":GOSUB9000:IFI
$="Y",ENDELSGOTO300
2170 CLS:INPUT"NAME OF FILE TO BE READ",FMS
2180 OPEN"1",1,FMS
2190 INPUT"-1,NA$,I,R:PRINT"THESE ARE I"SECURITIES AND R"EVALUATI
ON DATES IN THIS FILE":PRINT"DO YOU WANT TO RESERVE MEMORY FOR M
ORE ENTRIES?(Y/N)":GOSUB9000:IFIIS="Y"THEN GOSUB2250
2200 BI=I:BR=R:GOSUB120:I=I-A:R=C:RO=R
2210 FORX=1TOI:INPUT"-1,A$(X),D(X),DP(X),DS(X),R1(X),R2(X),R3(X)
,ZC(X),ZS(X)
2220 FORX=1TORO:INPUT"-1,Z(Y,X),NEXT:NEXT
2230 FORX=1TORO:INPUT"-1,DA(Y),R4(Y),R5(Y),R6(Y):NEXT:CLOSE:GOTO3
00
2240 PRINT"NO MEMORY IS RESERVED FOR THIS. SAVE DATA AND RELOAD
IT":PRINT"YOU WILL THEN HAVE THE OPPORTUNITY TO RESERVE MORE M
EMORY":GOSUB9000:GOTO300
2250 PRINT:INPUT"HOW MANY NEW SECURITY ENTRIES";A:I=I+A
2260 INPUT"HOW MANY NEW EVALUATION DATES";C:R=R+C:RETURN

```


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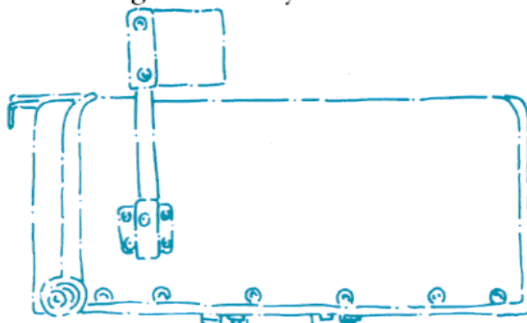
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THE DIRECT APPROACH

Directly access your Model 4 screen and keyboard by using these time-saving program routines.

Model III owners have it easy: if they want to write something directly to the screen or read something directly off the screen, they can use PEEK and POKE commands to do so. No such commands exist for the Model 4 owner—until now. I've developed a program that lets you gain direct access to the screen and keyboard without using PRINT @ statements or TRSDOS 6.0 Restart routines.

Directly controlling screen and keyboard input and output saves time, and it's especially useful for game writers. Also, many machine-language programs depend on the screen as their primary output.

A Peek at the Model 4's Memory

The Model 4's memory system is divided into several 32K banks of RAM memory and one 3K bank of video and keyboard memory. A 64K Model 4 has two 32K banks. A 128K computer has four, and the second two 32K banks can trade positions with the first two banks, for a total of four different combinations.

The Model 4 screen and keyboard's 3K bank can operate independently of the other memory banks, during which time the 3K bank is inaccessible to direct memory access. Alternatively, the 3K bank can "shadow" or override memory at two locations: 3800 hexadecimal (hex) in Model III mode, or F400 hex in Model 4 mode. The memory originally at these locations becomes inaccessible until you switch back the screen and

keyboard memory. The screen's source memory doesn't change, only the bank you access as main memory.

The first 1K of the video and keyboard bank is keyboard memory. The key formats are the same as the Model III's, except for some new keys and addresses. Figure 1 shows the keyboard layout in Model 4 and Model III modes. The remaining 2K of the 3K bank is the screen memory, which starts at F800 hex in Model 4 mode and 3C00 hex in Model III mode.

Controlling the Screen

You control the screen memory bank by sending control bytes out port 132 (84 hex). This works in Model III mode, because Model III Basic doesn't use port 132, and the screen isn't shadowed from main memory. In Model 4 mode, however, you can't PEEK and POKE to the screen without changing the configuration of port 132, because Basic keeps the 3K screen memory bank separate from main memory while it's not in use.

When you invoke an Out command from Basic that changes the screen configuration, you lose your screen format almost instantaneously because Basic continually writes its own configuration to this port. You can make Basic replace the port with your format, be-

cause Basic stores the value of port 132 at address 120 (78 hex). If you change the value at 120, Basic restores port 132 to your format just before returning to execute your program.

This method isn't without side effects, however. Basic gives you an "Internal Error" message when you try to run your program again. To correct this bug, POKE Basic's original value back into address 120 as soon as you complete your screen access.

Model 4 Basic usually keeps a value of 135 or 143 in address 120. Value 135 indicates a standard 80-column Model 4 mode. The value becomes 143 when you set the inverse video mode with a PRINT CHR\$(16) command. Be careful with the Print statement when you change to or from inverse mode by POKEing in address 120: Basic doesn't recognize a total inverse mode change, so you might get graphics characters instead of the inverse alphabet.

To reset bit zero of port 132 and put the screen and keyboard into normal memory, POKE 134 or 142 (for normal or inverse video, respectively) into address 120. Now PEEK and POKE work when you change screen memory.

You shouldn't use the disk drives while the screen is accessible because TRSDOS 6.0 stores certain drive-handling pointers in the memory that the screen uses.

The Key Box



Model 4 (not 4P)
64K RAM
Basic
TRSDOS 6.0, 6.1.2

Mod III	Mod 4	Bit 7	6	5	4	3	2	1	0
3801	F401	G	F	E	D	C	B	A	@
3802	F402	O	N	M	L	K	J	I	H
3804	F404	W	V	U	T	S	R	Q	P
3808	F408						Z	Y	X
3810	F410	7	6	5	4	3	2	1	0
3820	F420	*/	<	= -	>	+;	*	9	8
3840	F440	space	→	←	↓	↑	break	clear	enter
3880	F480		F3	F2	F1	caps	control	shift2	shift1

Figure 1. Keyboard memory map for Models III and 4 modes.

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The program below demonstrates this method of using address 120:

```
10 CLS: CLEAR, - 3073
20 POKE 120,134
30 FOR I=1 TO 1000
40 POKE &HF800,RND(255)
50 NEXT
60 POKE 120,135
```

When you type in and run this listing, you should see a random display of single characters in the upper left corner.

Line 10 sets memory size to F3FF hex, primarily to make the program compatible with TRSDOS 6.1.2. If you don't set memory size with this version, Basic will hang. TRSDOS 6.0 is unaffected.

Line 20 of the program makes the screen accessible by POKEing a value into address 120, Basic's storage position for port 132. Lines 30 and 50 set up a loop that repeats 1,000 times. Line 40 places the random character at the first position of the screen (F800 hex), and line 60 resets address 120 when the loop is complete, so you don't get an error when you run the program.

Be warned that when you debug programs using this technique, after you hit the break key, address 120 might still contain the alternate value that could give you an "Internal Error" message. If you hit the break key, follow it up immediately with a POKE 120,135. Another solution is to have the program check for another key (such as control-X) that invokes a jump to a line containing the required POKE and an End statement.

Figure 2 shows a map of port 132's bits, according to the *Model 4 Technical Manual*. Here's a more detailed run-down:

Setting bit zero of port 132 separates the screen and keyboard bank from main memory.

Bit 1 controls whether the entire computer runs in Model 4 mode (set) or Model III mode (reset). This bit also determines the area of memory that the video bank shadows when you reset bit

Bit	Page
6	Fix upper memory
5	Memory bit 1
4	Memory bit 0
3	Invert video
2	80/64 columns
1	Select 1
0	Select 2

Figure 2. Memory map of Model 4's port 132.

*The program
points each field
into screen memory
so that printing
an element of M\$
returns a string
of characters from
the indicated field.*

zero. Don't change this bit; the computer will freeze up.

Bit 2 controls screen size. Set this bit for the 80-column mode; reset it for 64 columns.

Bit 3 selects inverse video. Setting this bit gives you inverse video characters; resetting it gives you default graphics characters.

Bits 4, 5, and 6 control the placement of the two extra 32K memory banks in a 128K computer. These bits are usually reset and don't affect a 64K Model 4. You can exchange only one of the two extra memory banks with a main memory bank at a time.

Bit 4 determines which of the two extra 32K banks you want switched. Bit 5 tells the internal circuitry that you're switching a 32K bank, and bit 6 determines whether the bank selected will shadow the first or the second of the first two 32K banks. Bit 6 is reset for the top 32K (8000-FFFF hex), and set for the bottom 32K (0000-7FFF hex).

Bit 7 selects the 1K page on which screen memory starts. When you set this bit in Model III mode, the screen begins at the second 1,024 bytes in the 2K of screen memory, giving the Model III a second page of screen memory. When you reset this bit in Model 4 mode, the screen twists into a strange format: PRINT@1024 becomes the PRINT@0 position and vice versa.

Although you can use these functions on a Model 4 in Model III mode, programs using port 132 won't work on a regular Model III. One of the few advantages of using a Model 4 in Model III mode is that you can share the port with TRSDOS.

Screen Control for Machine Language

Machine-language programmers don't have to use address 120 to store port 132's value because the language gives them direct control over the machine. Configuring port 132 is no prob-

lem: Simply load the A register with the value you want and invoke an Out 132 command with A. However, TRSDOS 6.0 has many enabled interrupt vectors (especially relating to the cursor and keyboard) that will change port 132's format, making the screen inaccessible again.

You can use disable interrupts (DIs) to eliminate this problem as long as you don't use TRSDOS 6.0 routines. But, if your program relies on any of these routines, only invoke a disable interrupt before directly accessing the screen. You can enable the interrupts again with an enable interrupt opcode after you use the screen.

Because of the instability of the memory area for F400-FFFF hex, and because of TRSDOS pointers, don't use this region for storage of machine-language programs. Keep these routines below F400 hex and set memory size with a Clear statement.

The Formatted Input Routine

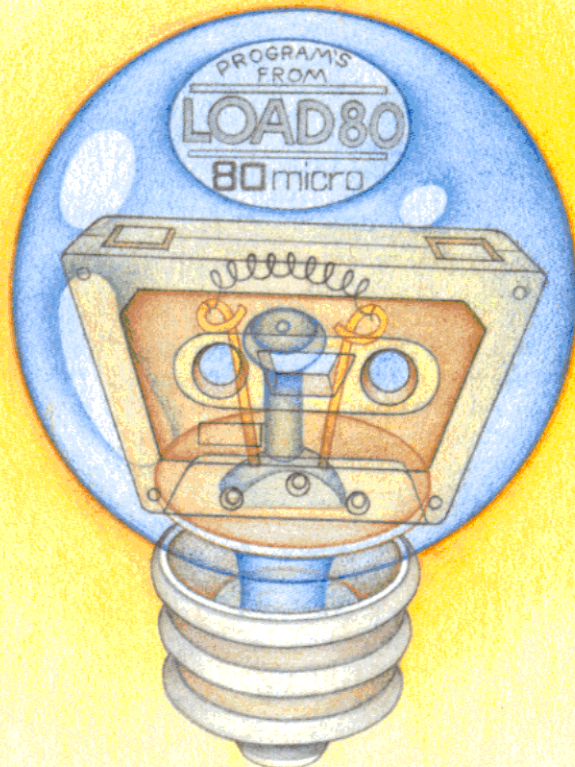
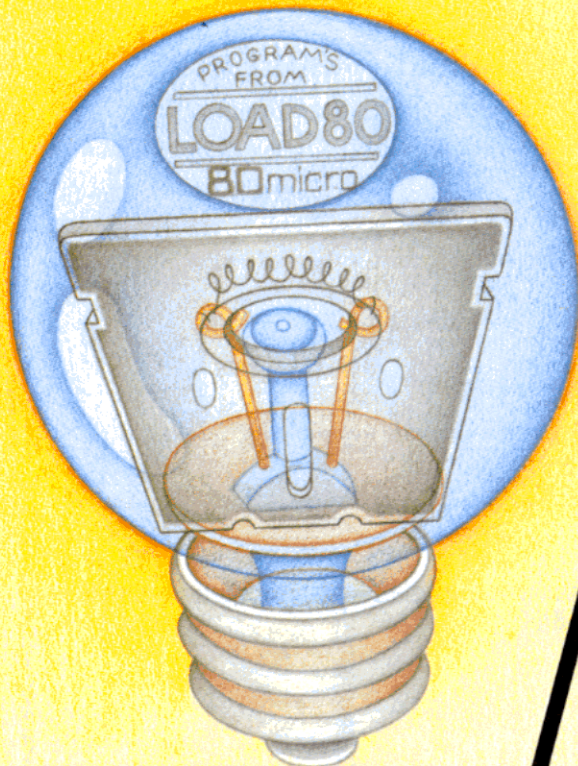
The Program Listing shows a subroutine (lines 10000-10200) for Model 4 Basic that uses the techniques I've discussed. This routine acts as a formatted Input statement that allows only a certain number of characters per field. Model 4 Basic is fast enough; you don't need machine language.

The heart of the routine is the array M\$, which is dimensioned into the number of fields you want. The program points each field into screen memory so that printing an element of M\$ returns a string of characters from the indicated field. This provides a useful way to manipulate the fields in Basic. Basic doesn't allow System and Open commands while the screen is accessible, but once you open a file you can use the Get, Put, Close, and Field commands with an accessible screen; however, I don't advise doing so.

This collection of fields is called a mask. It fits over the screen and provides invisible slots or fields to or from which you can write or read data. The mask doesn't interfere with anything on the screen.

A Basic program references each field by its assigned element number. Use the fields only while the screen is accessible; otherwise, you can lose Basic pointers or put the wrong data in the field. You must make changes in a field with PEEK, POKE, LSET, or RSET commands to ensure that the referenced field points at the screen. Changing pointed strings without these statements causes Basic to relocate them out of screen memory.

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Lines 10-104 of the Listing are an example program using the formatted Input routine. When you run the entire program, the screen displays eight field names; five underline marks follow the field named Account #. A fast-blinking cursor rests on the first character of the field. You can type in a value for the field, or push the up- or down-arrow key, control-X, or the enter key. The special keys stop the update on the current field and return from the subroutine with a value in F showing which key you pressed. If the cursor still sits on the first character, the field is left unchanged; otherwise, the new data remains.

Depending on which key you press, the program either ends or updates the next field. The up-arrow key returns the program to the previous field, and the enter or down-arrow key advances it to the next field. Using these keys, you can change all the fields. Control-X takes you out of the update mode. In real applications, the program would probably return to a menu after you pressed control-X, but in this example the program ends.

Line 10 of the program clears the screen and dimensions MS to eight

```

10 CLEAR,-3073:CLS:DIM MS(8)
20 FOR I=1 TO 8:READ X,Y,X$:PRINT@Y-LEN(X$),X$;Y=Y+634881
30 V=VARPTR(M$(I)):POKE V,X:POKE V+1,Y-INT(Y/256):POKE V+2,
  INT(Y/256):NEXT
40 PRINT@0,"THIS IS A SAMPLE MASK OF EIGHT FIELDS";
50 I=1
60 GOSUB 10000
70 I=I+F:IF I<1 OR I>8 THEN I=I-F
80 IF F=0 THEN END ELSE 60
100 DATA 5,170,"Account#","20,250","Name:",30,330,"Address:"
102 DATA 15,410,"City:",2,490,"State:",5,570,"Zip Code:"
104 DATA 64,730,"History:",64,810,"Comments:"
10000 '**** Routine INPUT@
10002 'I...subscript for masking array MS
10004 'flag showing movement status...F
10006 'resulting data contained in...X$
10010 POKE &H78,142:LN=LEN(M$(I)):PS=1:PRINT CHR$(15);X$=M$(I)
10015 AD=0:X=VARPTR(M$(I)):AD=PEEK(X+1)+PEEK(X+2)*256:LSET
  M$(I)=STRING$(LN,95)
10100 X=PEEK(AD):POKE AD,X+128:POKE AD,X:IS=INKEY$:IF IS=""
  THEN 10100
10110 IF IS=" " AND IS<="z" THEN POKE AD,ASC(IS):IF PS<LN THEN
  PS=PS+1:AD=AD+1:GOTO 10100 ELSE 10100
10115 IF IS=CHR$(8) THEN POKE AD,95:IF PS>1 THEN PS=PS-1:AD=AD-1:
  POKE AD,95:GOTO 10100 ELSE 10100
10117 IF IS=CHR$(24) THEN F=0:GOTO 10150
10120 IF IS=CHR$(13) OR IS=CHR$(10) THEN F=1:GOTO 10150
10125 IF IS=CHR$(11) THEN F=-1:GOTO 10150
10130 GOTO 10100
10150 IF PS=1 THEN LSET M$(I)=X$:GOTO 10200
10155 IF PS=LN AND PEEK(AD)<>95 THEN 10200
10160 X$=M$(I):LSET M$(I)=LEFT$(X$,INSTR(X$,CHR$(95))-1)
10200 X$=M$(I):POKE &H78,135:PRINT CHR$(14);:RETURN

```

Program Listing. Sample program using the formatted Input routine.

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fields. Lines 20 and 30 form a Read loop that prints the field names and points each field in the mask to the screen.

The Read statement contains three variables. X is the length of the field referenced by I. Y is the PRINT@ position of the field, and X\$ is the name of the field. The program prints the field name before the first character of the field. The last part of line 20 converts Y, the PRINT@ position, to its equivalent screen memory address.

Line 30 takes the VARPTR of the field and assigns the current field length X. Then the program points the field to the position in Y. The Next statement completes the loop.

The VARPTR function returns the location in memory where Basic describes the variable within VARPTR's parentheses. This location on string variables (the only kind I'm concerned with here) is the length of the string. POKEing another value into this address changes the length of the variable. The next 2 bytes form the address of the starting byte of the variable's data. By POKEing new values into these bytes, line 30 moves the string variable's data location to the screen.

*One word of warning:
Basic might execute
several statements
of your program's code
before responding to
a screen mode change.*

Line 50 determines that field 1 is the field the subroutine updates. Line 60 calls the routine, and line 70 processes the result.

The variable I, which points to the field the program updates, is added to the flag in line 70, providing an easy way to select the next field you want updated and a way to check for an out-of-bounds value. F is zero if you press control-X in the formatted input routine. If the up-arrow key ends the routine, F is -1. If the down-arrow or enter key ends the routine, F is 1. By adding F to I, you automatically point I to the next field to be updated. Conversely, if I goes out of bounds, subtracting F from I corrects the error. You can create a

wraparound effect with the right formula in this line.

If you need to validate a field, the formatted input routine returns the current value of the selected field in X\$. X\$ isn't pointed at the screen, so you don't have to worry about it. If you want to change the value of a field, you can print the new value to the correct position on the screen, or you can make the screen accessible, LSET or RSET the value into the field you want, and switch the screen back.

One final word of warning: Basic might execute several statements of your program's code before responding to a screen mode change. That could cause you to access the wrong memory bank, especially when you use LSET and RSET commands. You can force Basic to accept the new screen configuration by immediately following a POKE 120,x statement with an OUT 132,x—where x is the value of the port configuration. Lines 10010 and 10200 of the Listing demonstrate this procedure. ■

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Parallel Printer Buffer: Set Your Computer Free

The fable of the tortoise and the hare parallels the relationship between most computers and printers. Computers are relatively fast, especially when compared with the printers to which they are connected. If, like me, you do a lot of writing, you can appreciate how slow printers can be. A slow printer also slows down the computer since you can't use the computer while it sends information to the printer. The computer only sends characters to the printer as the printer accepts them. Printing out a column text in my printer's correspondence-quality mode can easily take a half hour or more, a half hour when I'd like to be using my computer for other things.

Enter the buffer. A printer buffer receives characters from the computer and stores them in its memory; it then sends them to the printer as the printer can accept them. With a printer buffer, it takes only seconds for your computer to send out a large print file, letting you use your computer for other tasks while your information is printed. If you use your computer for printing information regularly, and if your computer time is valuable, a printer buffer can quickly and easily pay for itself.

While many printer buffers are on the market, it's considerably more economical to build your own. This month's column will delineate the construction, while next month I'll describe the operation of the printer buffer.

Printer buffers vary in type and character storage capacity. There are two primary types of printer buffers: serial and parallel. Serial printer buffers are for systems using an RS-232C port for computer-to-printer communications. Parallel printer buffers serve systems using a Centronics-type parallel interface for computer-to-printer communications. Nearly all parallel printers on the market, including those from Radio Shack, use the Centronics interface. Since the parallel

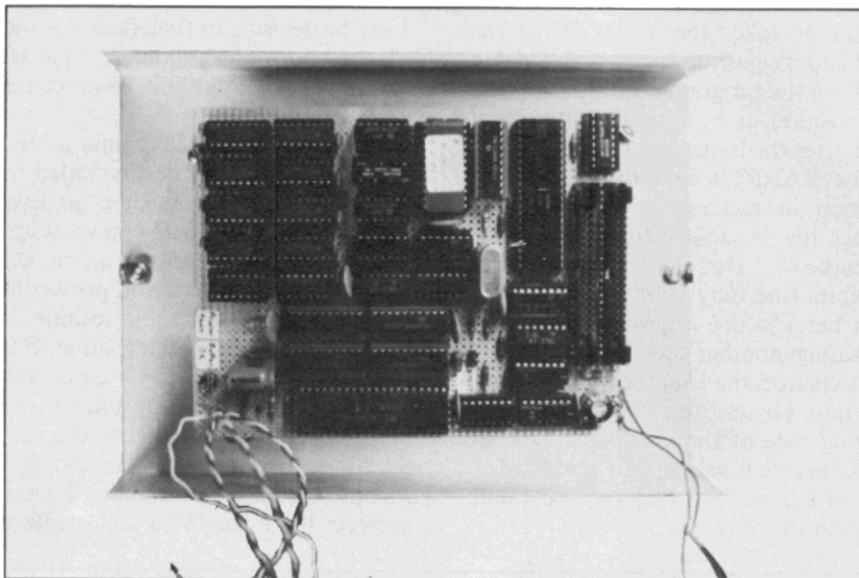


Photo. Completed printer buffer board.

interface is somewhat more common than the serial interface for external communications (and particularly since my own system uses a parallel interface), I've chosen to make a parallel printer buffer. Memory size varies considerably among printer buffers. Some start at 8K or 16K RAM, and some can handle 128K RAM or more. Since 64K dynamic RAMs have been dropping in price lately, I put 64K of RAM into my buffer: more RAM than my computer itself has.

This project, unlike previous projects, isn't specific to TRS-80s. Since the Centronics parallel interface is an industry standard, any system using this interface can use the printer buffer described here.

Parallel Interface Communications

Before I get into a further description of the printer buffer, I'll consider how a parallel printer interface works, and the timing behind it. Table 1 shows the pinout and signal names for a standard 36-pin interface connector. Lines 2-9 are the data lines, low-order to high-order, respectively. Line 1, the Data Strobe, indicates to the printer

when a new character is available on the data lines. Line 11, the Busy line, lets the printer indicate its ready status to the computer. If this line is high, the printer is busy and cannot accept any characters.

Line 10, Acknowledge, is a signal from the printer to the computer to acknowledge receipt of a character. Other signals indicate various printer status and fault conditions, acts as signals, grounds or power lines, or reset the printer. You won't always implement all of the signals.

To construct a project like this, you should understand the handshaking and timing between computer and printer. Handshaking refers to special control signals used to indicate when information is available and to signal receipt of information. In the parallel printer interface, the Data Strobe and Acknowledge signals are handshaking signals. As the timing diagram in Fig. 1 indicates the data is first put onto the data lines to the printer (lines 2-9). The computer then drops the Data Strobe line (line 1), and keeps it low for at least 500 nanoseconds (ns). The falling edge of Data Strobe makes the



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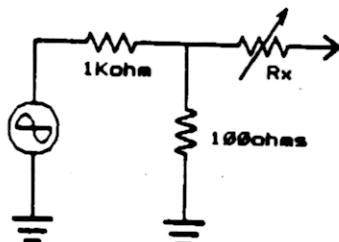
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printer's busy line go active (high) within 400 ns, and the rising edge of Data Strobe makes the printer's Acknowledge line go active (low) within 400 ns. The busy line stays active until the printer call accepts another character. The Acknowledge line stays active for an indefinite period of time, usually until the printer reads the character into its own processor.

You must design the hardware to meet these interface timing requirements. The printer buffer must provide the necessary hardware to act like the printer portion of the timing as well as the computer portion. Fortunately, there are devices available to make this a relatively simple task.

The 8255A Parallel Peripheral Interface

I used the Intel 8255A parallel peripheral interface (PPI) in two previous "Project 80" projects, but they involved using the PPI's Basic input/output (I/O) mode (Mode zero). The 8255A, with its 24 I/O lines, has three operating modes (zero, 1, and 2). This month's project uses the strobed I/O mode (Mode 1). This mode of operation provides handshaking lines similar to those involved with the parallel printer interface, thus making it an ideal chip for the job.

Figure 2 shows a block diagram of the 8255A, indicating how I used the

Pin Number	Signal Name	Direction*	Description
1	Data Strobe	To	Synchronizes data to the printer
2-9	DATA1-DATA8	To	Printer data bits
10	Acknowledge	From	High to low = completion of data input
11	Busy	From	High = data cannot be received, low = OK to receive data
12	Paper End	From	High = out of paper
13	Select	From	High = printer selected
14, 16, 33	GND		Signal ground
17	Chassis GND		Chassis ground
18	+5 V	From	Low current supply
19-30	GND		Signal returns for 1-11
31	Input Prime	To	Printer reset
32	Fault	From	Low = printer fault
15, 34, 35, 36	unused		

*Direction to or from printer

Table 1. Centronics connector pinout.

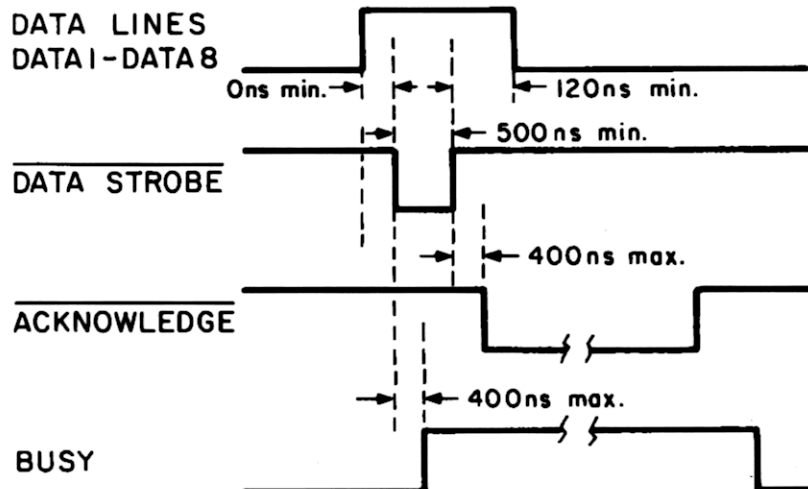


Figure 1. Parallel printer interface timing requirements.



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signals for this particular application. As shown, the eight Port A lines (PA0-PA7) receive the character data from the computer. The PC4 bit connects to the computer's Data Strobe output signal. The data bits on the Port A lines are latched into the 8255A when the PC4 bit goes low. The 8255A will then raise its PC5 line (IBF—input buffer full) within 300 ns of the falling edge of PC4. The PC5 line, then, generates the busy signal and sends it to the computer. Within 300 ns of the rising edge of the PC4 line, the PC3 line (INTR—interrupt request) goes high. You can invert this signal to generate a Z80 interrupt, as well as send the Acknowledge signal to the computer.

When the Z80 services its receive character interrupt, it will read the latched character in the 8255A Port A. Reading the value will make the PC3 line (INTR—acknowledge) and the PC5 line (IBF—busy) go inactive, getting the 8255A ready for another character. This completes the communications requirements for the computer-to-buffer interface.

The second section of the 8255A shown in Fig. 2 is used for buffer-to-printer communications. The Port B lines (PB0-PB7) transmit character data from the buffer to the printer. When the Z80 writes a value to Port B of the 8255A, it latches the value internally and also appears on the Port B output lines. The Data Write operation also makes the PC1 line (OBF—output buffer full) go active (low). This signal triggers a digital "one-shot" (74LS161) to generate a low pulse of approximately 1.6 microseconds (μ s). This pulse is sent to the printer as the Data Strobe signal.

If the printer is operating properly, it should respond with an active (low) Acknowledge signal, which is connected to the 8255A PC2 line (ACK/). When the 8255A sees the PC2 line go low, it makes the PC1 line (OBF/) inactive. On the rising edge of PC2, the 8255A sets PC0 (a second interrupt request), which you could use to interrupt the Z80, although I don't use it in this system. This completes the communications between the buffer and the printer.

Parallel Printer Buffer Functions

As shown in Fig. 3, the buffer has 64K dynamic RAM, up to 4K of ROM, two flip-flops, a Z80 micropro-



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cessor, line buffers, and an 8255A PPI. A clock generator circuit generates the Z80 timing clock, and resets circuitry for power-up or pushbutton reset.

If you're familiar with the Z80, you'll notice something peculiar about the amount of memory on the board. Since the Z80 has only 16 address lines, it can address up to 64K (2^{16}) of memory, but the block diagram shows 68K (if you use a 4K ROM). When designing the board, I had a few memory options. I could have maintained my total memory, including RAM and ROM, at fewer than 64K, keeping things somewhat simpler, at least conceptually. Another option was to stay with my 64K RAM and 4K ROM, with 4K RAM inaccessible to the Z80. Thus, 4K ROM would be available, but only 60K RAM would be available.

Although 60K RAM is still a considerable amount of storage memory, it seemed a waste not to use all of the board's available memory. I decided on a design that broke the Z80 address space into four 16K blocks. I set aside the bottom 16K (addresses 0000 hex-3FFF hex for ROM space. The Z80 boots from location 0000 hex, so the buffer control program must start there.

I use the three remaining 16K memory blocks for RAM, resulting in only 48K of RAM; the bottom 16K do not appear in the addressing space. To make the unused RAM available, I include a flip-flop (74LS74) for RAM "block select" (see Fig. 4) that lets the unused 16K block appear in the upper 16K byte (0C000 hex-0FFFF hex) address space, under software control, swapping out the 16K of RAM that normally reside there and giving the Z80 access to the full 64K RAM—

though only 48K are directly available at any given moment. Since the 16K of address space set aside for ROM space is far more memory than a printer

buffer needs, I include only one 24-pin ROM socket—for up to 4K of ROM. Since the printer buffer is a general-purpose computer programmed for a

Continued on p. 110

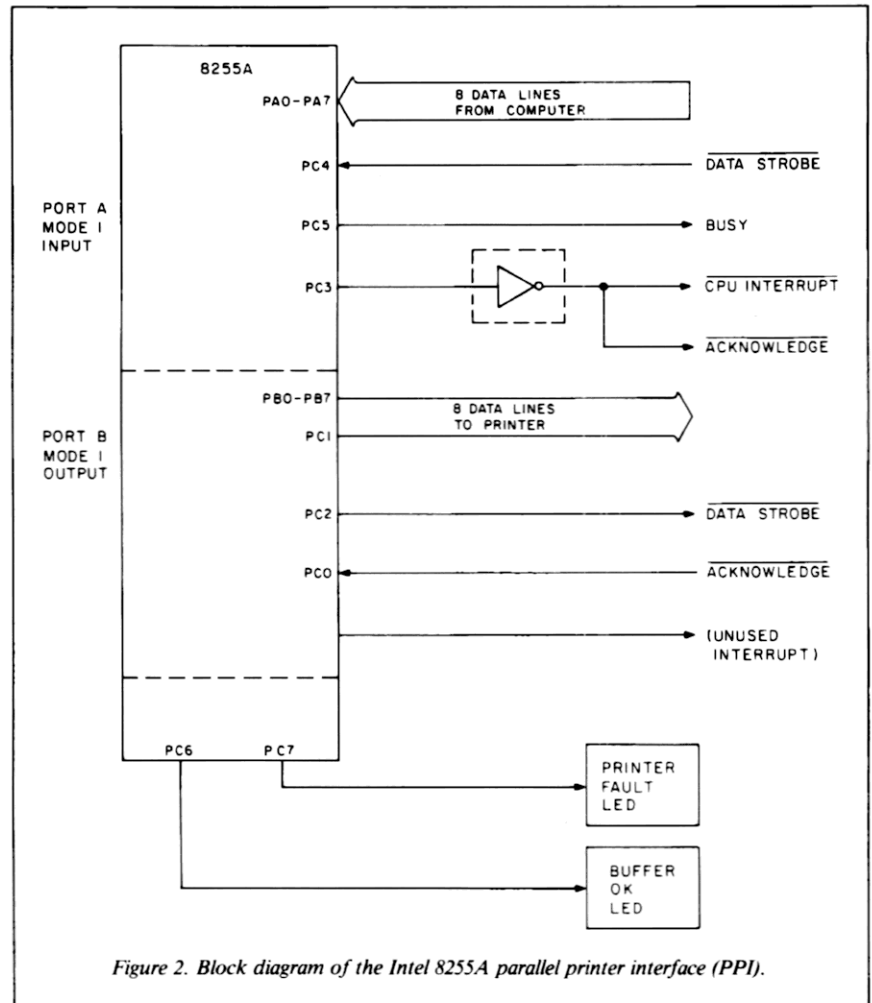


Figure 2. Block diagram of the Intel 8255A parallel printer interface (PPI).

IC Number	GND	VCC	Number of Pins
U1	29	11	40
U2, U3, U4, U7, U22	10	20	20
U6	7	26	40
U8	12	24	24
U5, U10, U23-U31	7	14	14
U9, U11, U12, U13	8	16	16
U14-U21	16	8	16

Table 2. IC power pins.

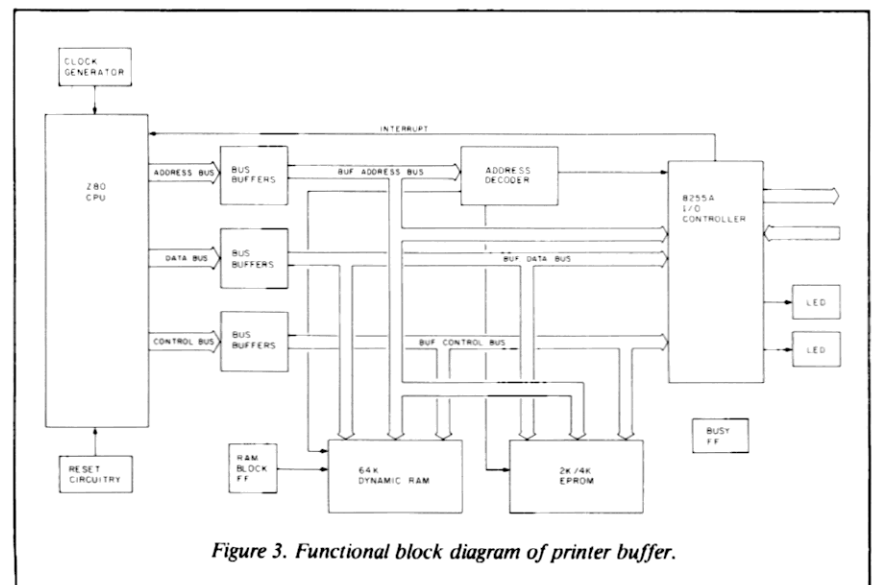


Figure 3. Functional block diagram of printer buffer.

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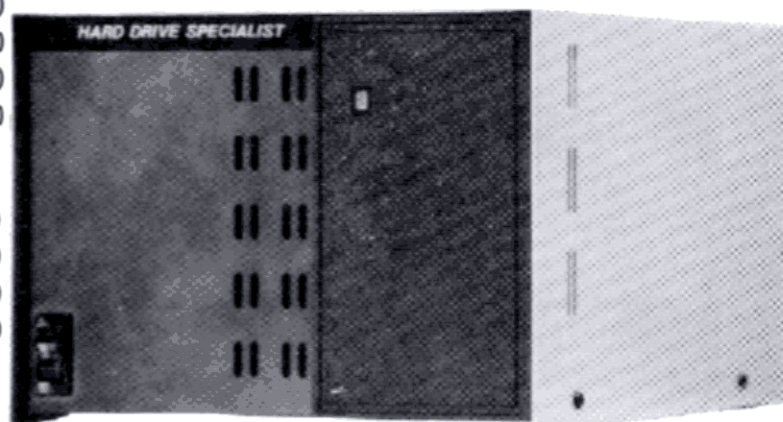
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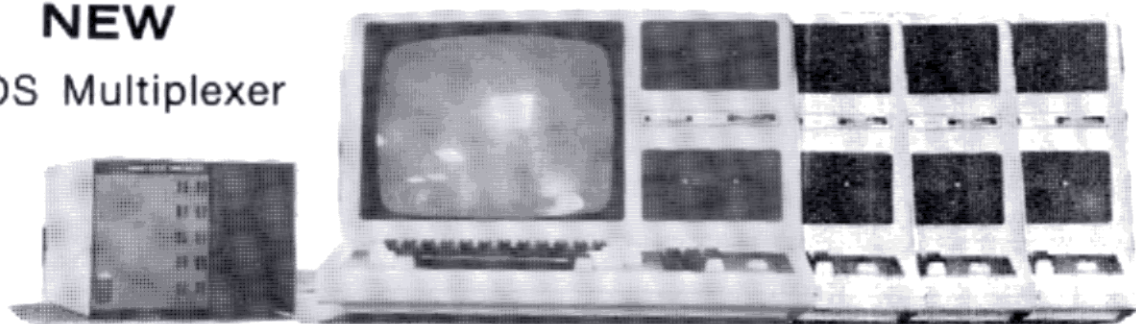
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1	2.5 MHz crystal	DK X029	1.35
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1	1N4148 G.P. signal diode	RS 276-1122	.10
1	N.O. reset button	RS 275-1571	.80
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17	0.1 μF/25V capacitor (ceramic)†	JDR —	.12
1	100 μF/16V capacitor	JDR —	.18
2	34-pos. header connector (w/w)	DK R228-ND	3.32
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*You can use either a 2716 or a 2732A EPROM.

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Note: A burned 2716 EPROM (with the control program) is available from the author for \$12 plus \$1 shipping and handling. Michigan residents add 4 percent tax.

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Table 3. Parts list and ordering information.

specific application, you can easily add other ROM sockets for additional ROM storage for a different control application.

A second flip-flop shown in the block diagram is an on-demand, busy flip-flop. As I mentioned above, the 8255A normally generates the busy signal from the buffer to the computer. The on-demand, busy flip-flop provides for other times when the buffer won't accept characters, regardless of the ready state of the 8255A. It is set upon buffer reset, letting the buffer complete its initialization operations with the busy signal active, keeping the computer from sending characters. It can also be set at other times under software control, although this is not generally necessary.

I include an interrupt line from the 8255A to the Z80 (see Fig. 3). The buffer is designed to let the 8255A interrupt the Z80 on receiving a character so the Z80 operates without continually checking for a character input. The Z80 is asynchronously interrupted from its normal task whenever a character is received.

Finally, using two spare lines on the 8255A PPI, I designed two status LEDs on the buffer. The "Buffer OK" LED (PC6) is turned on after buffer initialization. The "Printer Fault" LED will be on or off as appropriate to indicate the fault status of the printer. If the printer is out of paper, deselected, or not ready for any other reason, this LED lights up.

Construction of the Printer Buffer

The schematic for the printer buffer (Figs. 5a-5e) shows a total of 31 integrated circuits (ICs), including the digital delay line (which isn't technically an IC) (see Table 2). While I indicate there's only one distributor for each item in the parts list (see Table 3), most items are available from other distributors, too.

Because of the size of the project, I suggest you either wire-wrap your board, as I did, or (if you really want to work) make up your own PC board from the schematic. You will need two 40-pin IC sockets, one 24-pin socket, five 20-pin sockets, 11 14-pin sockets, and 12 16-pin sockets. Figure 6 shows the board layout I used, which is reasonably optimized. The Photo shows the completed board, using this layout. Package the board in an appro-

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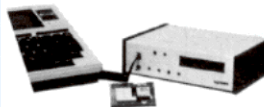
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appropriate project box since the board layout shown, as well as the cable/connector arrangement I'll describe shortly, was designed to support this. Mount the two LEDs and the reset button on the front, with the input connector and power connector on the rear. Be sure the output cable (to the printer) exits from the rear of the box.

Two connector designations appear on the schematic: J1 and J2. You may have noticed that the connector pinout shown in the schematic differs from that shown in Table 1 for the 36-pin Centronics printer connector. The J1 and J2 connectors are, in fact, 34-pin header connectors. These connectors are easy to wire on a prototype board. Once you finish the wiring, make up cables for the computer interface and the printer interface.

The cable for the J1 connector, which goes to the computer, consists of about 2 inches of 34-conductor ribbon cable, with a 34-pin socket connector on one end and a 36-pin female Centronics printer connector on the other. The Centronics connector can mount on the rear of the project box, if you use one, since the printer cable from the computer plugs into this connector.

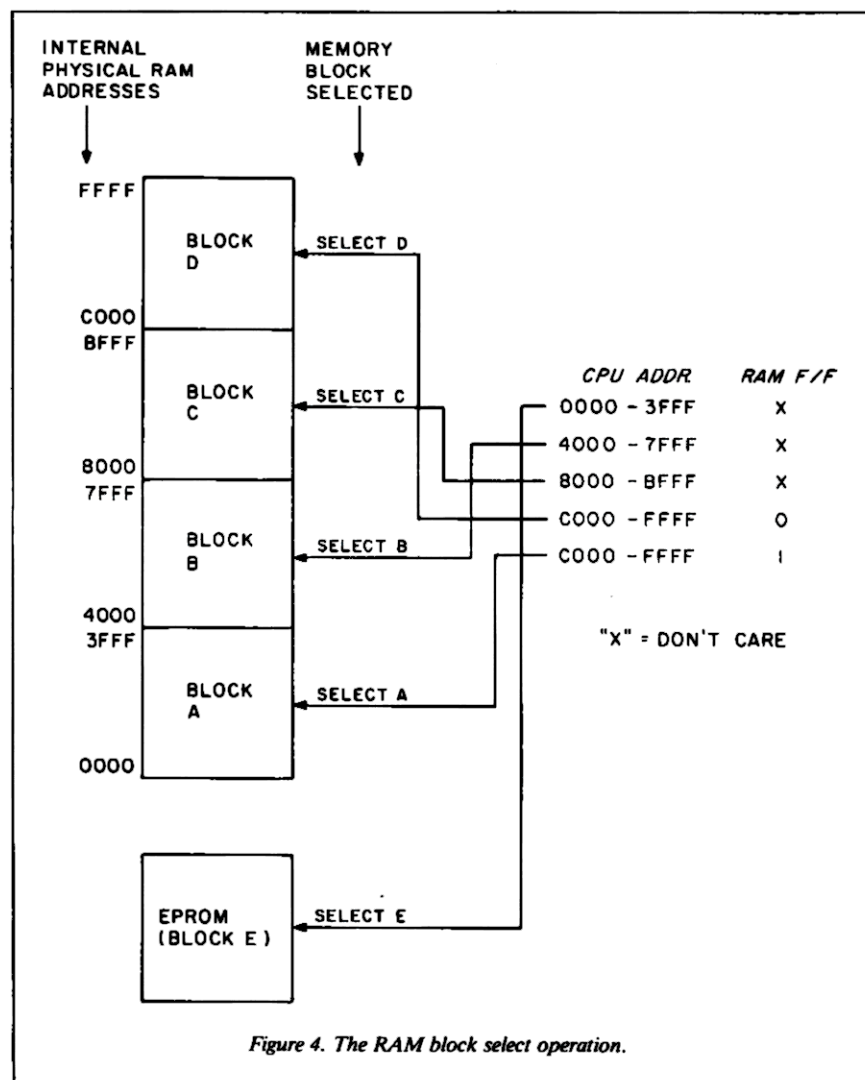


Figure 4. The RAM block select operation.

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The cable for the J2 connector, which goes to the printer, consists of up to 6 feet of 34-conductor ribbon cable, with a 34-pin socket connector on one end and a 36-pin male Centronics connector on the other. The Centronics connector plugs into the printer, of course.

There are both male and female Centronics connectors available as IDC (insulation displacement connector) connectors. When you make up the cables, route the ribbon cable from pin 1 of the socket connector to pin 1 of the Centronics connector (for each cable). There will be two unused pins on the 36-pin Centronics connector. Proper alignment of the ribbon cable before crimping (using a connector crimper or vise) is essential for an operational cable. The socket connectors plug into their respective header connectors on the prototype board, with pin 1 of the socket connector connecting to pin 1 of the header connector. Figure 7 shows the proper construction of the cables.

Figure 5b of the schematic shows three lines going to connector J1: lines 23, 25, and 28. These lines are printer fault conditions lines which are buffered on the printer buffer board and can be routed to the computer (connector J1). Like me, most of you will not want to connect these lines through to the computer. Some computer systems use them to warn the operator of a printer deselect or paper-out condition, but only use the busy line for the ok-to-send determination (what the printer buffer software does).

If this is the case with your computer, go ahead and connect the three lines to the J1 connector, as shown. If a printer fault condition appears, the computer will send characters to the buffer anyway—as long as the buffer gives the computer an inactive busy signal.

My Model I, like most computers, won't send any characters to the printer if any printer fault condition exists, regardless of the Busy bit status. So don't route the three signals through to the J1 connector and the computer will send characters to the printer buffer even if, for example, the printer runs out of paper. The buffer will still receive characters from the computer, though it won't send them to the printer until you remedy the fault con-

Continued on p. 119

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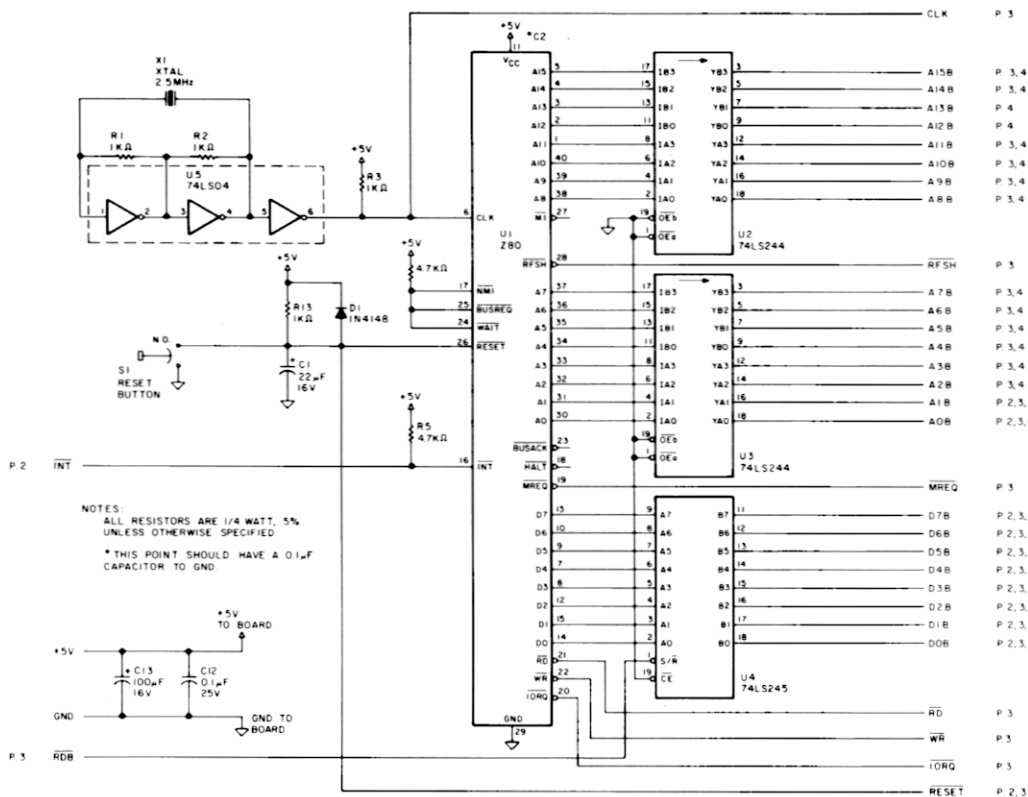


Figure 5a. Schematic of the printer buffer: Part 1 (P.1). Connections to be made from one section to another are indicated by corresponding references to P.1, P.2, P.3, P.4, and P.5 on individual lines.

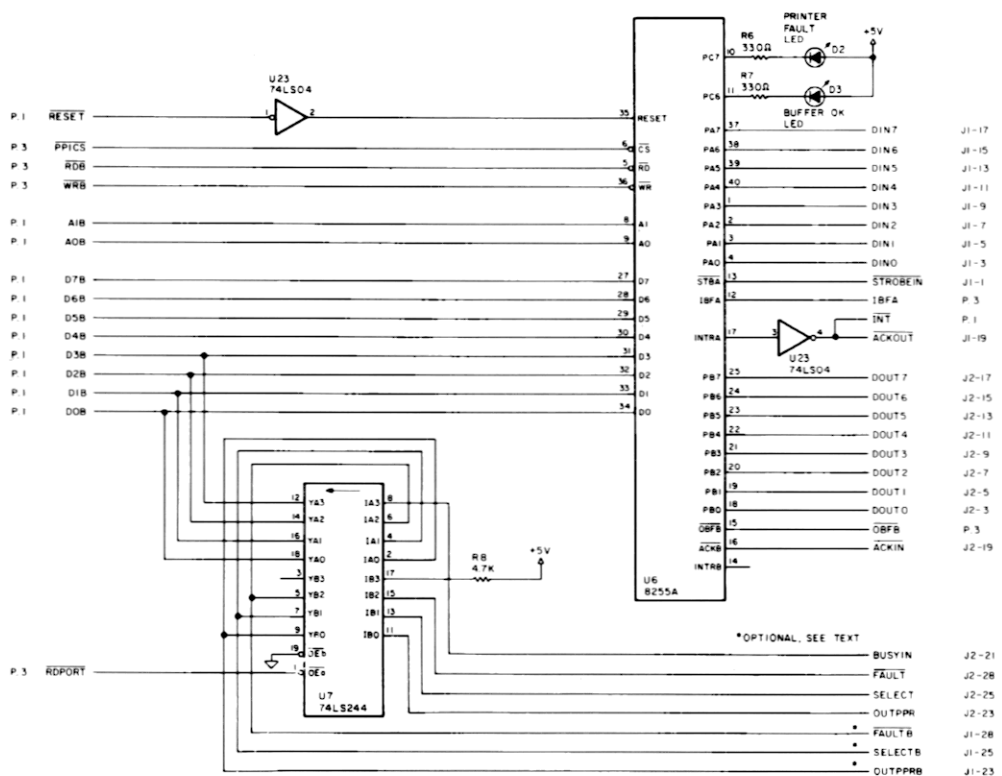


Figure 5b. Schematic of the printer buffer: Part 2 (P.2).

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PROJECT 80

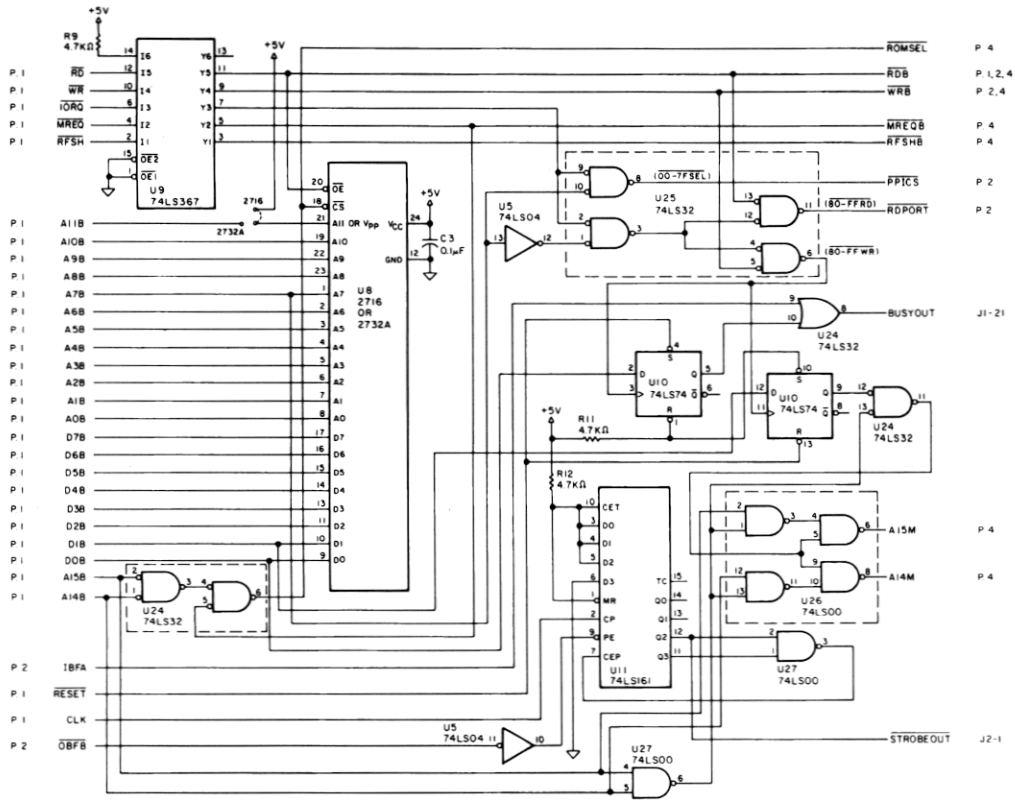


Figure 5c. Schematic of the printer buffer: Part 3 (P.3).

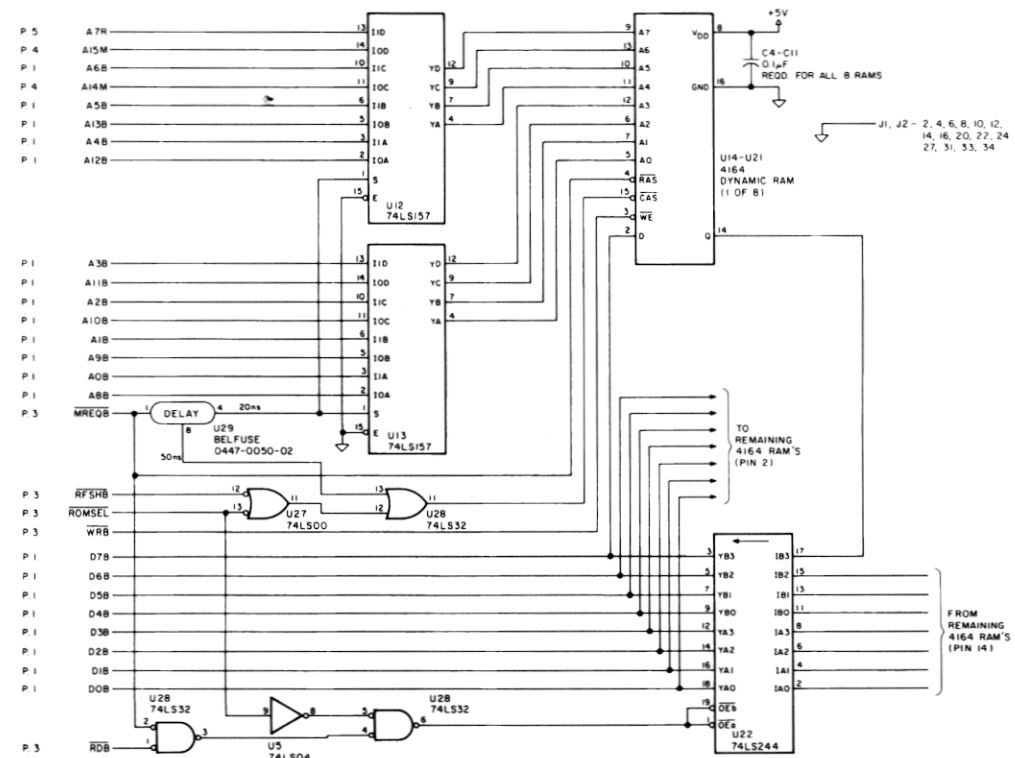


Figure 5d. Schematic of the printer buffer: Part 4 (P.4).

Continued from p. 113

dition. Instead of leaving the three J1 lines floating, however, you should tie them to the appropriate levels for proper computer operation. Tie the J1-23 line to ground, and tie the J1-25 and J1-28 lines together and to a 1K ohm resistor (ROPT in Fig. 6) which goes to the +5 volt (V) supply.

To make the printer buffer more flexible, I designed the 24-pin ROM socket to accept 2716-type (2K bytes) or 2732A-type (4K) EPROMs. Since the software required to operate a printer buffer is relatively simple, you need very little ROM: only 328 bytes for the printer buffer control program I'll describe in next month's column—a small portion of a 2716 EPROM. But, as I mentioned earlier, the printer buffer board is really a general-purpose computer, programmed for a specific application. If you want to add fancier features to your buffer (diagnostics, for example), or want to use the single-board computer for a different application, the 2732A ROM capability may be advantageous.

In any case, you must place a jump-

er on the board to specify the ROM type used. If you use a 2716, pin 21 of U8 is jumpered to the +5 V supply. If you use a 2732A, jumper pin 21 of U8

to the A11B address line.

The schematic (Fig. 5d) shows only one of the eight dynamic RAM chips. There is one 4164 RAM chip for each

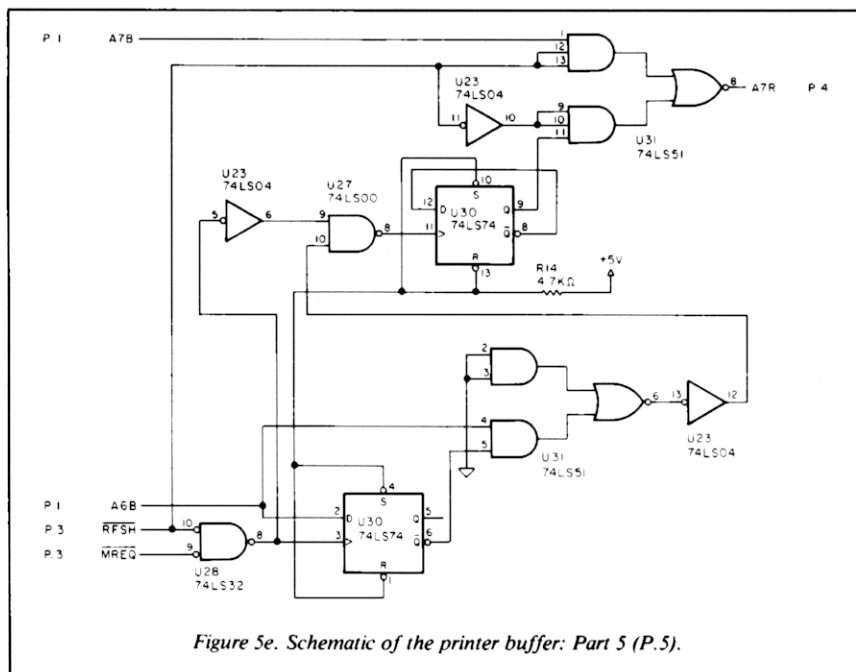


Figure 5e. Schematic of the printer buffer: Part 5 (P.5).

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PROJECT 80

of the eight bits of the data bus. The pin 2 lines of the RAMs come off the output side of U22, while the pin 14 lines of the RAMs go to the input side of U22.

Make sure to include the eight 0.1 μ F decoupling capacitors (C4-C11). Certain portions of the access cycles of dynamic RAMs require more current than others; the capacitors help meet the high-current needs when they arise. The board power input capacitor, C13, helps recharge the decoupling capacitors as they become discharged.

If you make a PC board, I suggest you get a copy of the data sheet for Intel's 2164A dynamic RAM delineating the suggested power/ground layout pattern that you should follow.

I chose a 2.5 MHz Z80 microprocessor to control the printer buffer, for several reasons. First and foremost is the fact that the Z80 allows easy refresh of the dynamic memory (see next month's column); this significantly reduces the hardware requirements that might otherwise have been

necessary. Secondly, it is economical: you can get a Z80 microprocessor for under five dollars. It also has a non-multiplexed data bus, which, for this application, also reduces hardware re-

quirements. Finally, it is the processor used in many of the TRS-80s, making it easy for most Project 80 readers to find an assembler for this project, if necessary.

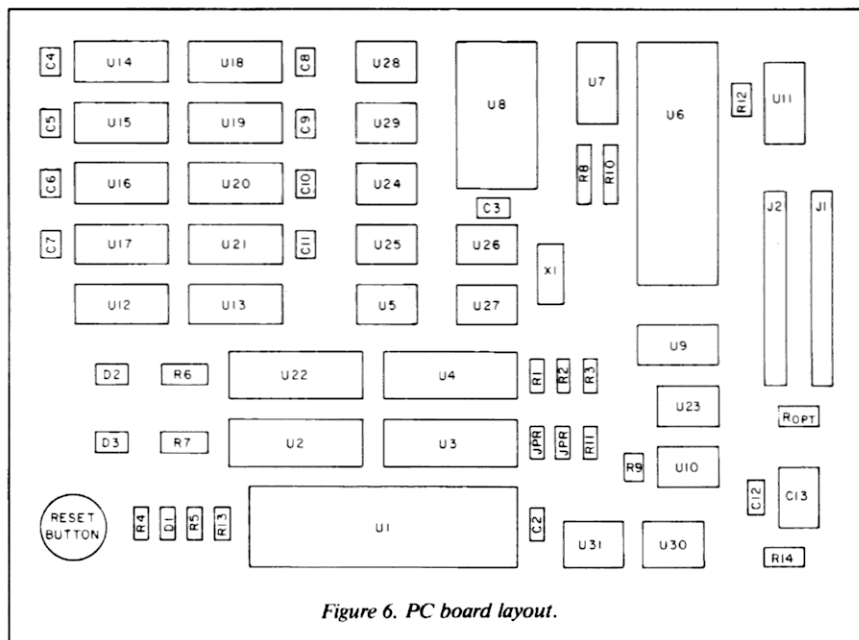


Figure 6. PC board layout.

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APPLE DMP - DEC LA50-RA	1/2x18	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$15/2 \$42/6 \$ 78/12	
C ITOH Starwriter F10/CARBON FILM BLACK	5/16	\$24/6 \$42/12 \$234/72	\$5 ea 3-11 \$4 ea 12 or more	\$18/3 \$60/12 \$348/72	
DIABLO MYTYPE II A FABRIC BLACK	5/16x17	\$21/3 \$78/12 \$510/72	\$8/1 \$7 ea 2 or more	\$18/2 \$51/6 \$ 96/12	
RADIO SHACK					
CARBON FILM - DWP-210 Black (1445)	5/16x145	\$24/6 \$42/12 \$234/72	\$5 ea 3-11 \$4 ea 12 or more	\$18/3 \$60/12 \$348/72	
DAISY WHEEL II-DWP-410 Black (1419)	1/4x145	\$24/6 \$42/12 \$234/72	\$5 ea 3-11 \$4 ea 12 or more	\$18/3 \$60/12 \$348/72	
Red, Green, Blue, Brown Colors (1419)	1/4x130	\$30/6 \$54/12 \$288/72	\$6 ea 3-11 \$5 ea 12 or more	\$21/3 \$72/12 \$420/72	
FABRIC (Long-Life) DWP-210 Black (1458)	5/16x17	\$21/3 \$78/12 \$510/72	\$8/1 \$7 ea 2 or more	\$18/2 \$51/6 \$ 96/12	
DAISY WHEEL II Black (1449)	1/4x25	\$21/3 \$78/12 \$510/72	\$8/1 \$7 ea 2 or more	\$18/2 \$51/6 \$ 96/12	
LP I-II-IV 700 Zip Pack (1413)	9/16x16	\$12/3 \$45/12 \$252/72			
CENTRONICS 730/737/739/779					
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DMP-500 (1482)	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$24/2 \$72/6 \$144/12	
DMP-2100 - TOSHIBA P1340-P1350 (1442)	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$15/2 \$42/6 \$ 78/12	
LP III-V (1414)	1/2x15	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$15/2 \$42/6 \$ 78/12	\$12/3 \$44/12 \$252/72
DMP-400/420, LP VI-VIII (1418)	5/16x14	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$15/2 \$42/6 \$ 78/12	\$11/3 \$40/12 \$228/72
DMP-100, LP VII-Commodore 1525, Gorilla Banana (1424)	Inner Loop			\$16/2 \$48/6 \$ 96/12	
OKIDATA-PACEMARK 2350-2410 Black	1/2x100	\$30/3 \$108/12 \$576/72	\$20/1 \$18 ea 2 or more	\$32 Each	OKIDATA SPOOL 12 Yards \$48/12 40 Yards \$84/12
EPSON MX/FX/RX 70/80 - IBM PC	1/2x20	\$15/3 \$54/12 \$288/72	\$7/1 \$6 ea 2 or more	\$14/2 \$36/6 \$ 66/12	\$12/3 \$44/12 \$252/72
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PROJECT 80

The reason I used the 2.5 MHz Z80 instead of the faster 4.0 MHz Z80A is two-fold. First, the extra speed isn't necessary. The printer buffer receives characters as fast as nearly any system can send them, and far faster than any printer can print them. Any differences in speed between the Z80A and the slightly less expensive Z80 would be negligible for this application. The second reason is purely economical. Using the slower processor also lets you use slower, less expensive memories. Thus you can use 200 ns dynamic RAMs and 450 ns ROMs.

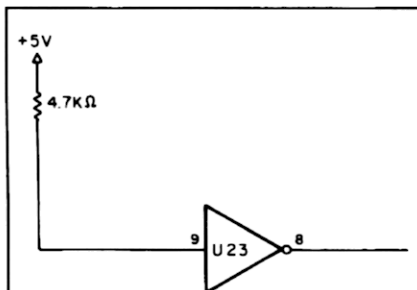


Figure 8. Spare gates and corresponding ties.

Besides everything shown in the parts list, you will also need a +5 V @750 mA power supply.

Tie unused gates high or low, as appropriate. The spare gates and their appropriate ties are shown in Fig. 8.

A final note: To reduce noise, add 0.1μF decoupling capacitors to about one-third of the ICs (not including the RAM chips). Merely place these ce-

ramic capacitors across the power and ground pins of the ICs, dispersing them around the board as much as possible. ■

To correspond with Roger C. Alford, send a self-addressed, stamped envelope c/o Washtenaw Digital Systems, P.O. Box 2014, Ann Arbor, MI 48106.

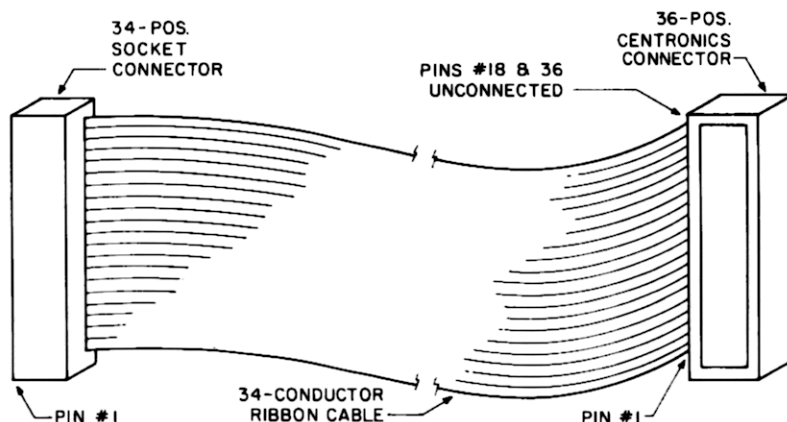


Figure 7. Proper cable construction for parallel printer buffer.

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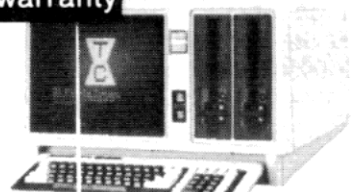


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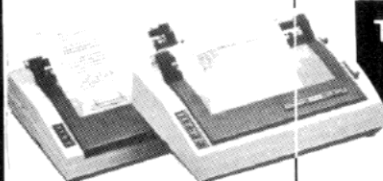


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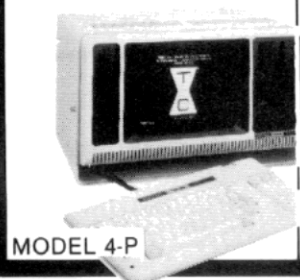


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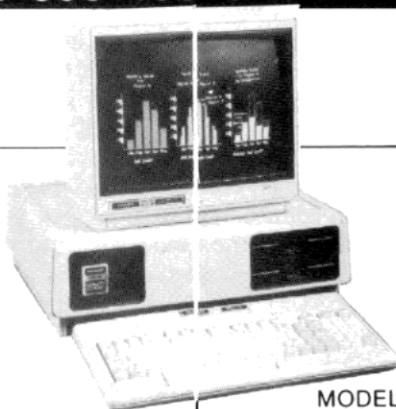
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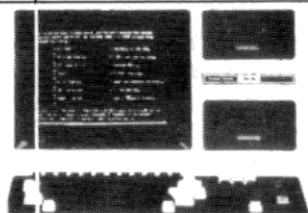
MODEL 100



MODEL 4-P



MODEL 2000



MODEL 4

Controlling the Flow: The BBS File Structure

In previous columns we've discussed communications theory and developed the Assembly-language communications module for the BBS Express. Eventually, you'll write the program that lets Basic interact with that Assembly code.

This month, though, we're going to set aside communications theory and begin building the bulletin board structure. To do this, you might need some background on file management in Basic.

Basic Data Files

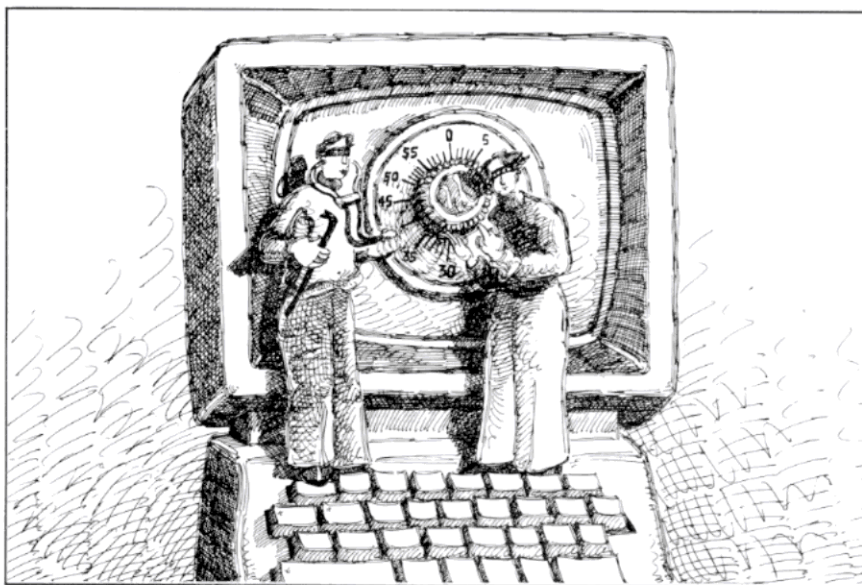
In the BBS Express, a Basic program handles the greeting, file management, and the machine/user interface. Using the groundwork already laid, Basic hosts the bulletin board. We'll review how Basic treats data files.

You can store data in Basic as a sequential file or as a random-access file. You use both file types in your BBS, so if you're unsure about this aspect of Basic programming, this explanation should help you.

Sequential Files

A sequential file starts reading or writing from the beginning of a line and finishes reading or writing at the end of a line. To retrieve information from the middle of a sequential file, your program must read it from the beginning. To change the information, you read the whole file into memory, make the changes you want, and then write the file back to disk.

For our BBS, sequential files are too inconvenient for storing items that you want to change, such as a user log or list files. However, sequential files are excellent for storing information of uncertain length that doesn't change, like messages. That's just how we use them, as you'll see in the Program Listing.



Random Files

Random files consist of many records of equal size that you can select, bring into memory, and change without disturbing the rest of the file. They're handy for logs and lists, like headers on messages or data files, but they're impractical for storing text because their logical record length is always the same.

A text file, such as a message on the BBS Express, probably isn't an even multiple of the logical record length, so random files would waste disk space.

Another reason for not using random files for storing text is the Field statement. A single record in a random file can contain several pieces of information. The first 20 bytes in the record might contain a name, the next 25 an address, and so on.

Basic uses the Field statement to assign field names to the space in a record so that it can manipulate the information. For example, look at the BBS Express's Field statements in the Listing. Imagine how convoluted the

code would become if you stored the text in a random file.

LDOS vs. TRSDOS

This brings us to a difference between the two operating systems we've chosen to work with, LDOS and TRSDOS. Using LDOS, you can open an existing sequential file for random access, pull something out of the middle of the file, change it, and then put it back.

TRSDOS, however, can't do this because of a problem with the logical record length. TRSDOS assumes that the logical record length of all files is 256 bytes long (255 on a Model I), unless you specify variable-length files by answering the Basic prompt, "How Many Files?" with a number and the

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16. The TAB function will now tab 255 columns on a printer. (BASIC cannot tab past column 64.)
17. NEWDOS 80 2.0 USERS can use the CMD "dos command" function! (DOSPLUS may use name "dos command")
18. NEW and EASIER to use USB COMMANDS.
19. New math functions to calculate XOR and INTEGER REMAINDERS of a DIVISION.
20. Logical STRING COMPARISONS are now supported.
21. The disk commands INSTR, MIDS ASSIGNMENT are now supported on both DISK AND TAPE ZBASIC.
22. DEFSTR is now supported.
23. Eight disk files may be opened simultaneously, random, sequential or mixed.
24. LINE INPUT# is now supported.
25. Invoke the compiler by simply hitting these two keys: " - "
26. NEW 60+ PAGE MANUAL WITH DESCRIPTIONS AND EXAMPLE.
27. 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:

1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC., although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. 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:CLERR:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME#
40 FOR I=1 TO 127 STEP 2 :FOR J=47 TO 1 STEP -3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+J):XX=ABS(INT(RND(I+J)-AA)+7):RESET(I,J)
60 XX=PEEK(I+J):POKE15360+I+J,J:OUT255,J AND (3+J):XX=INP(I)
70 ABS=STR$(I+J):BAS=LEFT$(ABS,2):AA(I/2,J/2)=VAL(BAS)+AA*3
80 BAS=BAS+RIGHT$(BAS,RND(3)):XX=INSTR(1,BAS,"9"):XX=SQR(I+J)
90 BAS=MID$(BAS,2,2):MID$(BAS,1,1)=Z:IF XX THEN 100 ELSE CLS
100 IF LEN(BAS)>3 OR SGN(XX)=1 AND ASC(BAS)=32 THEN PRINT"***":
110 IFPOS(0)62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 AS=INKEY$:IF AS="Y" OR AS="y" AND I>120 THEN PRINT"TRUE.."
130 RESTORE:READA,C,Z(J),D:GOSUB170:GOSUB170:GOTO210
140 NEXT:PRINT" ":NEXTI:CLS:PRINT#512,ST$,"STOP TIME "+TIME#
150 STOP'===== END OF MAIN TEST LOOP =====
160 DATA 12345,-1,"TEST",-9999
170 ON AND(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
    
```

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letter V (for variable). If you fail to do so, Basic can't handle a logical record length of anything other than 256 bytes.

If you do specify variable-length records, TRSDOS 1.3 lets you specify the logical record length for the file when you create it. Thereafter, you have to specify the same logical record length to get at the file. If you specify a logical record length different from that used at the file's creation, TRSDOS will give you strange results, ranging from refusing to retrieve anything from the file to generating an error.

LDOS is much more flexible. It assumes that you want to use variable-length records unless you go to the trouble to tell it otherwise. LDOS lets you open a file with a logical record length different from that set at creation, and still handles everything correctly.

Headers

Computer bulletin boards like the BBS Express are, among other things, message-switching programs. The BBS you're writing here stores and displays messages from one user to another. Each message on the message board needs a header to identify it. Each message also needs a place to store the text of the message.

Our headers contain four pieces of information for you, and an additional two pieces of invisible, secret information used by the system. You can change the invisible information, so you should make the file for headers, Messages/BBS, a random file. The key to that decision is that the information is changeable.

Because the text of the messages remains unchanged and is of uncertain

length, we assigned the information to a sequential file. The BBS represents each message on the board by a sequential file containing the text, and by a record in a header file, Messages/BBS.

The Table sets out the field names in the records of all of the BBS's files. The Listing shows the Open and Field statements for all files.

Messages/BBS's line 220 opens the file, and sets the logical record length to 97. Why 97? Because the information we keep in each record for each message on the board equals 97, so Messages/BBS's logical record length is 97.

The reference to SD\$ probably needs some explanation. The BBS is designed to work with a two-drive system, and you need to specify the drive where a given file can be found. Earlier in the program (in line 100 for those with a copy), SD\$, the system drive, is set to drive zero and DD\$, the data drive, to drive 1. Line 220 Opens Messages/BBS, on drive zero. If you want to use another drive, change the definition in line 100.

The first four fields in a record from Messages/BBS are self-explanatory. But what about the secret information, F2\$ and S2\$?

Invisible Files

F2\$ is the file name of the sequential file that contains the text of the message. F2\$ safely tucks this file's name away, never displaying it to the user.

The secret files protect you from telecommunications vandals, people who delight in leaving messages named "System" in the hope of zapping a board.

However, only the BBS Express can put a file name on the disk's directory.

```
190 OPEN "R",3,"SYSTEM/BBS"+SD$
200 FIELD 3,2 AS SL$,2 AS SH$,2 AS SN$,2 AS SV$,16 AS SP$,1 AS SF$
    ,16 AS SA$,2 AS SC$,2 AS SM$,2 AS NM$,2 AS ND$,2 AS DS$:RETURN
210 FOR X=0 TO 15:FIELD 3,X*16 AS DUMMYS$,16 AS F$(X+1):NEXT:RETURN
220 OPEN "R",1,"MESSAGES/BBS"+SD$,97
230 FIELD 1,20 AS T1$,20 AS F1$,32 AS S1$,17 AS T2$,7 AS F2$,1 AS
    S2$:RETURN
240 OPEN "R",2,"MEMBERS/BBS"+SD$,113
250 FIELD 2,20 AS N1$,25 AS A1$,25 AS C1$,1 AS L1$,2 AS V1$,16 AS
    A2$,2 AS M1$,2 AS C2$,16 AS P1$,2 AS UH$,1 AS LP$,1 AS RP$:RETURN
260 OPEN "R",2,"XASPACE/BBS"+SD$,181
270 FIELD 2,20 AS N1$,16 AS P1$,128 AS D1$,9 AS F2$,2 AS XA$,4 AS
    XL$,1 AS LP$,1 AS RP$:RETURN
280 OPEN "R",3,"USER/BBS"+SD$,62
290 FIELD 3,20 AS U1$,17 AS U2$,17 AS U3$,8 AS U4$:RETURN
```

Program Listing. Program for storing information in sequential files.

File: System/BBS Lines 190-210

Field Variable	Contents
SL\$	Low message number on system
SH\$	High message number on system
SN\$	Number of message on system
SV\$	Default video width
SP\$	System password
SF\$	System line feeds
SA\$	Default access
SC\$	Number of callers to system
SM\$	Maximum number of messages on system
NM\$	Number of members
ND\$	Number of data files
DS\$	Data slot
FS(Section names
NM\$	Index string

File: Messages/BBS Lines 220-230

Field Variable	Contents
T1\$	To whom addressed
F1\$	From whom
S1\$	Message subject
T2\$	Date and time sent
F2\$	Invisible file name
S2\$	Bit-mapped

File: XASPACE/BBS Lines 260-270

Field Variable	Contents
N1\$	XA file's public name
P1\$	XA file's password
D1\$	Description of file
F2\$	XA file's secret name
XA\$	Number of times accessed
XL\$	File's length in bytes
LP\$	Left pointer
RP\$	Right pointer

File: Members/BBS Lines 240-250

Field Variable	Contents
N1\$	Member's name
A1\$	Street address
C1\$	City/State/Zip
L1\$	Line feed after carriage return
V1\$	Video width
A2\$	User's authorized access
M1\$	Number of messages left
C2\$	Number of calls
P1\$	User's password
UH\$	High number retrieved
LP\$	Left pointer
RP\$	Right pointer

File: User/BBS Lines 280-290

Field Variable	Contents
U1\$	User's name
U2\$	Time in
U3\$	Time out
U4\$	Elapsed time

Table. Field variables.

The vandals can leave messages named whatever they wish, but these names never get on the disk's directory.

What file name should the BBS Express use? We assigned each message a number. We construct a unique file name using the message number, which stores the text. For example, the text of message 2 will be stored in a sequential file named MSG0002/BBS, message 100 in MSG0100/BBS, and so on.

The final field is S2\$. This is bit-mapped, like the bit-mapped port we talked about at the start of this series (see "The BBS Express," May 1984, p. 42). Each bit in the byte is assigned a different meaning. Next month, we'll show you how to map information into S2\$ and then retrieve it.

In addition to the message board, the BBS Express offers a data base of permanent files of interest to its users. This area (often referred to as the XA space, perhaps in deference to CompuServe Information Service, which uses the same term for data base) requires the same kind of management

*Vandals can leave
messages named
whatever they wish,
but these names
never get on
the disk's directory.*

as the message board. Lines 260 and 270 field the records in the header file, XASPACE/BBS.

There's some invisible information here as well. The real name of the sequential file containing the text is hidden in F2\$, and there are two mysterious pointers, labeled Left and Right. The pointers work with a binary tree which you'll construct in a future issue. You can see the same fields in the membership log, lines 240-250.

That leaves two files, User/BBS and System/BBS. User/BBS stores

the names and log-in and log-out times for your visitors. It's a random file. Periodically, you can kill this file when it gets too long.

System Defaults

The BBS Express's bulletin board lets you set certain system defaults, such as the line width, establishing a line feed after a carriage return, the names of the sections of the board (more on this in a later issue), and various other parameters that the BBS needs for a new user. This is stored in System/BBS, along with an in-memory string that Record 1 is fielded one way (line 200), Record 2 in another (line 210), and Record 3 still another (various program lines not listed here). You get a lot of information into just three System/BBS records.

Catch the BBS Express next month and we'll explain an advanced level of secret-keeping—bit mapping. ■

Contact J. Stewart Schneider and Charles E. Bowen at P.O. Box 404, Catlettsburg, KY 41129.

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Knowing Your LEFT\$ From Your RIGHT\$

On my computer screen, a character named Louie picks up a stick of dynamite and starts flicking his Bic.

"I've got a gun," I type. "Drop the fire." The screen blanks. Then this message appears from Louie: "Don't shoot! I give up!"

Louie is a character in a computer adventure game I invented. He surrendered not because I was so well armed, but because I manipulated strings in my Basic program.

Using just a few Basic statements, you can give your computer the intelligence to recognize, change, and act on information you enter or store.

The Basic statements that give you these capabilities are ASC, CHR\$, FRE, INKEY\$, LEN, LEFT\$, RIGHT\$, MID\$, STR\$, VAL\$, and STRING\$ (Model 100 Basic has an additional command: INSTR). They're the subjects of this month's column; I'll explain each one in detail.

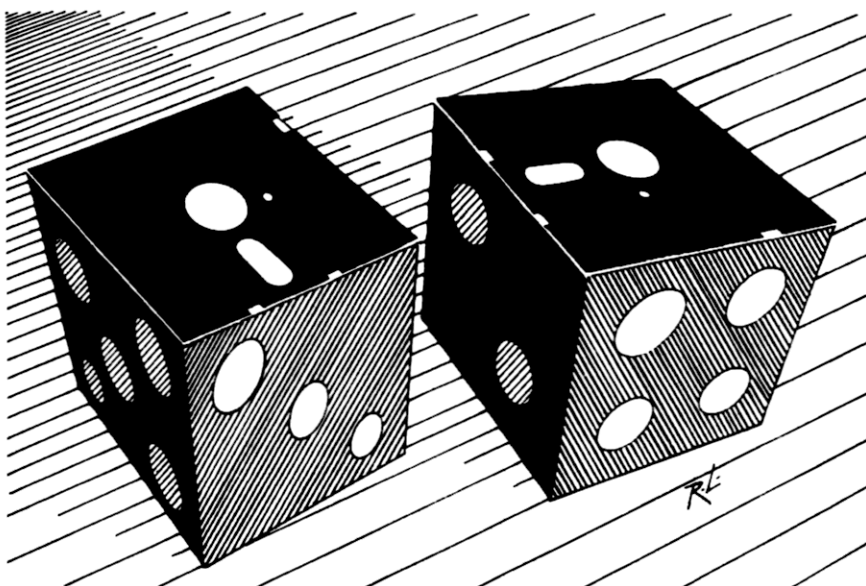
Before you're finished, you'll see some routines that demonstrate what these statements do. First, I'll define each statement with short examples. Turn on your computer; you'll be using it.

The ASC Statement

The ASC command returns the ASCII code for a specified character. The American Standard Code for Information Interchange (ASCII) consists of 255 numbers that correspond to specific characters and symbols. Every character on your keyboard has a numerical ASCII equivalent. I'll discuss only the ASCII numbers 32-127.

To produce the alphabet, type in `PRINT ASC("A")`. The computer prints a 65 on the screen. Now type in `PRINT ASC("Z")`. The computer prints a 90. These numbers represent the ASCII values for the uppercase alphabet.

The ASCII numbers for the lowercase alphabet are 97-122. It's easy to determine the ASCII value of any low-



er case letter: add 32 to its uppercase value.

Use the ASC statement with any string variable. Type in `A$="A"` and press the enter key. Then type in `PRINT ASC(A$)`. You should get a 65 in both cases.

Notice the statement's format in the above example: In `ASC("A")` the A is within quotes because it's a literal (i.e., the letter A only). In `ASC(A$)`, the A is not within quotes because A is a program variable.

Now type in `A$="ANDREW"`, press the enter key, and type in `PRINT ASC(A$)`. The number 65 appears because the ASC statement examines only the first character in the string.

Your computer manual's appendix includes a list of ASCII characters. It's probably referred to as the TRS-80 Code for Information Interchange (TRSCII).

The routine below prints the ASCII code for any key you press:

```
100 A$ = INKEY$
110 IF A$ <> "" THEN PRINT ASC(A$)
120 GOTO 100
```

The CHR\$ Statement

The CHR\$, or character string statement, is the opposite of the ASC statement: It converts the ASCII code in parentheses to the alphanumeric character it represents. For example, type in `PRINT CHR$(65)` and hit the enter key. The computer will display an A.

CHR\$ converts all numbers in the ASCII character set (1-255). Numbers below 32 are printing control codes. Numbers above 122 produce graphics that you can't create with the keyboard.

In discussing string handling, I'll concentrate on ASCII numbers 65-90 (the uppercase alphabet), 97-122 (the lowercase alphabet), and 48-57 (numerals 0-9).

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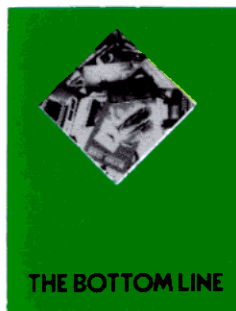
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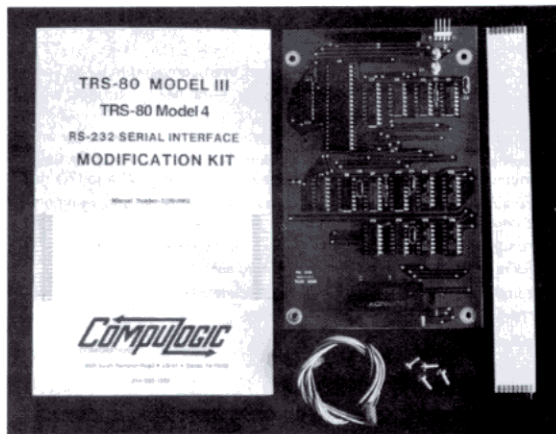
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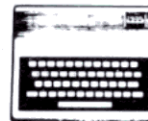
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The following routine displays these characters:

```
CLS: FOR X=65 TO 90: PRINT
CHR$(X);:NEXT
CLS: FOR X=97 TO 122: PRINT
CHR$(X);:NEXT
FOR X=48 TO 57: PRINT CHR$(X);:NEXT
```

Don't be confused that numbers have different ASCII number values. Zero, for example, has an ASCII value of 48, but Basic treats the number zero as a character.

The FRE Statement

Your computer automatically reserves a certain number of bytes for strings when you turn it on. To see how many bytes your system reserves, turn off your computer, turn it on again, press the enter key once or twice, type in `PRINT FRE("A")`, and press the enter key.

The `FRE` statement also displays the amount of memory available for string storage. The computer can run out of string space; if a program uses too many bytes for storage it produces an out-of-string (OS) error. Avoid this by using the `Clear` command to free enough memory to hold all the string characters you're using.

It's important to start all Basic programs with a `Clear` statement. If the program has no strings, type in `CLEAR 0` to save space. Enter the `Clear` command first, and Basic will only address it once. For example, the program line

```
110 CLEAR 500
```

reserves 500 bytes of computer memory for strings.

However, if you go from this program to one that contains strings but no `Clear` statement, you'll get an OS error when you try to run the program.

The INKEY\$ Statement

Type in and run this program line:

```
100 PRINT INKEY$;: GOTO 100
```

Now type in anything you want. Whatever you type in appears on the screen. That isn't so interesting until you realize that it's happening while your one-line program runs. This technique demonstrates the difference

between the `INKEY$` and `Input` commands. You can use `INKEY$` while a program runs, but the `Input` command stops the program and waits for you to type in a response.

The `INKEY$` command returns a one-character string in a lightning-quick scan of the keyboard. If you don't press a key, the computer returns a null or zero-length string. Otherwise, the program displays whatever you type in.

Here's a short routine using `INKEY$`:

```
100 CLS
110 A$=INKEY$
120 IF A$<>"" THEN PRINT @ 0,A$
130 GOTO 110
140 END
```

Run this program, and you'll notice that it differs from the previous one because the value of `INKEY$` passes to `A$` on each keyboard scan.

It's also possible to store a character string while you run the program using `INKEY$`:

```
100 CLS
110 A$=A$+INKEY$
120 PRINT @ 0,A$
130 GOTO 110
140 END
```

The LEN Statement

The `LEN`, or length command, displays the number of characters in a specified string. For example, typing `PRINT LEN("HARMONICA")` returns a 9, since the string contains nine characters. When you type in `A$="HARMONICA"`, and `PRINT LEN(A$)`, Basic returns the same answer.

Notice the format: The string you're testing must be within parentheses. If it's a literal string, it must also be between quotes.

The LEFT\$, RIGHT\$, And MID\$ Statements

`LEFT$`, `RIGHT$`, and `MID$` are the most powerful string commands. Although they're simple by definition, their uses are complex.

Type in `A$="ROBERT"` and then `PRINT LEFT$(A$,3)`. The computer prints `ROB`, the first three characters in the string. The first value in parentheses is the variable you're testing, and the second value is the number of characters you want to print starting from the string's left.

You can also use this with string literals: `PRINT LEFT$("HARMONICA",6)` returns the same answer.

The `RIGHT$` command, as you've probably guessed, is similar to the `LEFT$` command, but works from the right side of the string. Try typing in and running the following lines:

```
100 PRINT RIGHT$("HANDSOME",4)
110 PRINT RIGHT$("CAVAN",3)
```

The computer responds by displaying the words `SOME` and `VAN`.

The program below uses `LEFT$` and `RIGHT$`.

```
100 REM * FRANKLY, MY DEAR
110 CLS
120 A$="I REALLY DON'T CARE"
130 PRINT "I SAY " A$ " BUT INSIDE "
LEFT$(A$,9);RIGHT$(A$,4)
140 END
```

The `MID$` command lets you pull out characters from the middle of a string. Type in `PRINT MID$("POST-HUMOUSLY",5,6)` and hit the enter key. Basic displays the word `HUMOUS`.

The first position in the parentheses again tells the program what string to examine. The next position tells Basic to go to the fifth position in the character string, and the last position tells Basic to display the next six characters.

Now type in `PRINT MID$("POST-HUMOUSLY",6)`. Notice that there are only two positions in parentheses. In this form, the statement displays all characters from the sixth character to the end of the string.

The STR\$, VAL, and STRING\$ Statements

The `STR$` command converts a number into a character string. `VAL` returns the numeric value of a string. You can use them together to juggle values and strings.

Calculator, in Program Listing 5, shows a use for `VAL`. To clarify the use of the `STR$` and `VAL` statements, I'll discuss the available forms for each.

Type in `PRINT VAL("1234")` and press the enter key. To start, `1234` is a string, but its value (`VAL`) is a numeric value.

Now type in `A$="100"`, hit the enter key, type in `B$="50"`, and hit the enter key. If you type in `PRINT`

A\$+B\$, the computer simply shoves the strings together: 10050. This isn't a mathematically correct answer. But you can use strings in arithmetic equations. Type in A=VAL(A\$), hit the enter key, type in B=VAL(B\$), and hit the enter key again. Then type in PRINT A+B to get a mathematical answer derived for the original string values.

STR\$ works in reverse of VAL. Type in A=25, then type in A\$=STR\$(A) and press the enter key. A\$ is now a string of the characters 25.

You might confuse the STRING\$ statement with STR\$. STRING\$ returns a string made of a stated number of the same character.

Type in PRINT STRING\$(10,"*") and press the enter key. The result is a row of 10 asterisks.

You can print a string of a character that's not on the keyboard if it has an ASCII value. This is possible because the ASC number also works: PRINT STRING\$(10,42).

You can't mix characters in a STRING\$ command, but you can

print one or more groups of characters in a row, as in PRINT STRING\$(10,42);STRING\$(10,43);STRING\$(44).

You can also compress a STRING\$ value into a letter variable. Type in A\$=STRING\$(32,"-"). If this is in a program, you can print a line of dashes anytime you include the line PRINT A\$.

If you experiment with the STRING\$ command using ASCII numbers, you may stumble onto the graphics characters I cover next month. Type in CLEAR 300 and press the enter key to be sure you have enough string space available. As a preview, type in PRINT STRING\$(64,153) and press the enter key (Model 100 users, try PRINT STRING\$(40,252) instead).

STRING\$ is good for borders, lines, and graphics charts. Dice Odds, in Program Listing 1, presents the odds for the outcomes of rolling two dice. It might teach you something about the game of craps.

The INSTR Statement

INSTR is short for INSTRING. This is a statement in itself on the Model 100, but it isn't part of Model I, III, or 4 Basic. INSTR tests to determine whether a large string contains a smaller string. No matter which computer you have, consider what comes next. It will help you to understand what happens in INSTR in Program Listing 2. This is a short routine that works on the Models I, III, and 4.

If you have a Model 100, type in A=INSTR("MY NAME IS CLARA BELLEFLEUR","CLARA"). Then type in PRINT A. The answer is 12 because A is given the value of the starting position of the characters sought—CLARA—within the larger string. If A is zero it means CLARA is not in the larger string.

Consider the form: A=INSTR("HELLO","HE"). First comes the numeric variable, then the statement INSTR, then the larger string and smaller string separated by a comma between parentheses.

My examples don't make much sense. It's perfectly obvious the characters CLARA exist within the first string. In practice, however, you'll perform INSTR tests on letter variables: Z=INSTR(A\$,B\$). The tests might concern variables that don't change as the program runs. With that we get back to Louie, with whom we started this column. With INSTR, your computer understands a larger vocabulary.

More serious uses of the INSTR function include a word-processing program that finds specified character groups within the text, or a program that automatically collects data and correlates it by comparing material stored within strings.

Quite often, you might want to test the yes or no answer in a program as a condition for doing something else. Assume that a no answer yields a zero and yes yields a number higher than zero. Here's an example given as a short listing. If in response to the prompt, you enter one of the numbers in the LUCKY\$ string, you win.

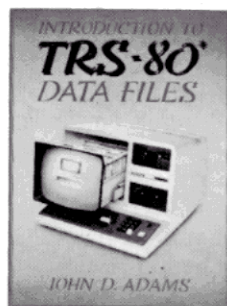
```
100 REM * DICE ODDS * TRS-80 MODELS I, III AND 4
110 CLS
120 CLEAR 500
130 PRINT @ 0, "DICE ODDS -- BELL CURVE"
140 DIM A(13): RANDOM
150 B=RND(6)+RND(6)
160 A(B)=A(B)+1
170 C=2
180 FOR D=64 TO 704 STEP 64
185 IF C<10 THEN PRINT @ D+1,""; ELSE PRINT @ D,"";
190 PRINT C;"-STRING$(A(C),"");
200 C=C+1
210 IF A(C)=59 THEN PRINT @ 896,"";: END
220 NEXT D
230 T=T+1
240 PRINT @ 32,"TRIAL:"T;
250 GOTO 150
260 END
```

Program Listing 1. Dice Odds.

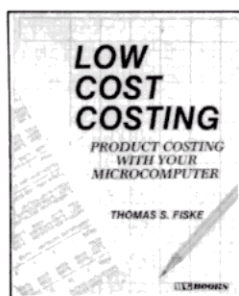
```
100 REM * INSTRING ROUTINE * TRS-80 MODELS I, III AND 4
110 CLS
120 CLEAR 500
130 INPUT "TYPE A SENTENCE AND PRESS ENTER";A$
140 INPUT "NOW TYPE ONE WORD TO TEST WHETHER IT EXISTS WITHIN THE SENTENCE YOU JUST TYPED";B$
150 FOR A=1 TO LEN(A$)+1-LEN(B$)
160 IF MID$(A$,A,LEN(B$))=B$ THEN 210
170 NEXT A
180 PRINT "THE WORD "B$" ISN'T FOUND IN THE FOLLOWING SENTENCE:"
190 PRINT A$
200 END
210 PRINT "YES, THE WORD "B$" BEGINS AT CHARACTER"A
220 PRINT "WITHIN THE FOLLOWING SENTENCE:"
230 PRINT A$
240 END
```

Program Listing 2. INSTR demonstration program.

```
100 REM * LUCKY TICKET/ MODEL 100 ONLY*
110 CLS
120 LUCKY$="324 567 444 678"
130 LOSERS="SORRY. YOU DIDN'T WIN."
```

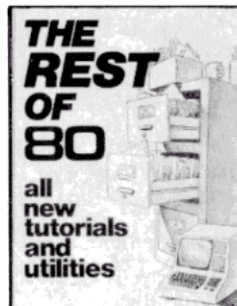
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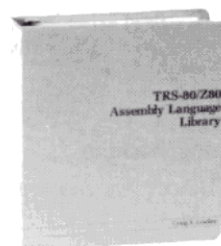
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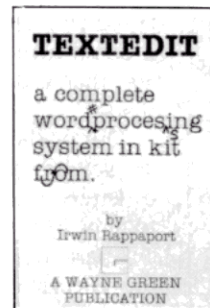
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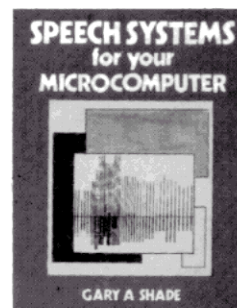
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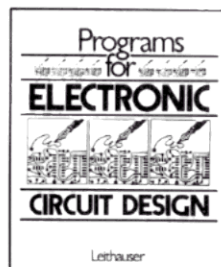
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```
140 WINNERS$="YOU WIN A TWO-WEEK
VACATION IN WEST PETERBOROUGH."
150 INPUT "TYPE YOUR TICKET NUM-
BER AND PRESS ENTER";TICKETS
160 TICKETS$=" "+TICKETS+" "
170 A=INSTR(LUCKYS,TICKETS)
180 IF A>0 THEN PRINT WINNERS$ ELSE
PRINT LOSERS$
190 END
```

String Packing

Before we move to the listings, be aware that you can pack up to 255 characters in a one-letter variable. Some ways to do this include:

- Adding literals: A\$= "GOOD-" + "BY" (a nonsensical method).
- Adding literals and/or variables: A\$= Z\$ + M\$.
- Gathering values from keyboard input: Z\$= Z\$ + INKEY\$.
- Using the LEFT\$, RIGHT\$, and MID\$ statements to isolate characters and place them in a new variable: A\$= LEFT\$(B\$,3) + MID\$(Z\$,3,4) + RIGHT\$(L\$,5).

A string can hold 255 characters, and there are 255 ASCII code numbers. The first 31 don't show up on the string, but by using the following routine you can pack them into a single variable called G\$. The routine shows another way of packing a

You can't mix characters in a STRING\$ command.

string, by values found within a For...Next loop. In this case, the loop goes from 1 to 255, and the program adds each CHR\$ value and then prints the result.

```
100 CLS
110 CLEAR 1000
120 FOR X=1 TO 255
130 G$=G$+CHR$(X)
140 NEXT X
150 PRINT G$
160 END
```

Now consider the five short listings with this column. Each shows a different aspect of string manipulation.

Dice Odds, in Program Listing 1, demonstrates that rolling two six-sided dice on the average produces more 7's than any other total. This is because more combinations of seven are possible. The other totals are less likely as they range down to 2 and up to 12.

This program produces a kinetic graph of dice rolls, and the statistical

result produces a bell curve formed of asterisks, one for each time the program rolls a given total, the bell forms horizontally to the right of the screen.

Line 150 contains the dice roll: two random 6's. Lines 180 and 220 loop, printing each total's result on the left of the screen.

Line 200 prints the possible dice total, C, and a STRING\$ series of asterisks equal to the number of times that particular total has been thrown.

When any total comes up 59 times, line 210 ends the program. For a slower, more accurate bell curve, make these line changes:

```
190 PRINT C;" "STRING$(A(C)/10, "");
210 IF A(C)=590 THEN PRINT @ 896,
"";END
```

Line 160 starts another loop, from one to the length of the array word.

Line 170 is the secret of the routine. The program gives a growing value to which it adds the ASC value of each character in the array word. The MID\$ statement in this line recognized the character and the ASC statement converts it into a number.

If the data words of line 110 are typed correctly Z should total 2133. If it doesn't, the program suggests in line 190 that a data entry error has been made.

This method has its failings. For example, an unfortunate transposition of letters in any data word results in a total of 2133 for Z.

Apart from string considerations, the checksum method can be used when data numbers, rather than string characters, are in question. In such a case, Z is the value of each number added to it.

Alphabet Race, in Program Listing 4, tests how fast you can type in the alphabet. Try running it. The character @ repeats until you hit B. You must type in the letters of the alphabet in sequence and in capital letters. If you have an upper- and lowercase keyboard, lock it into uppercase for this program.

Line 130 sets B\$ to @ because that character has the ASCII value just before the letter A.

An INKEY\$ command in line 140 waits for you to tap a key to give A\$ a value.

Line 150 contains GOSUB to line 200 to test the key you tapped, and in line 160, B\$ is @ or the last correct key

```
100 REM * CHECKSUM DEMO * TRS-80 MODELS I, II AND 4
110 DATA THIS,IS,A,TEST,OF,A,STRING,CHECKSUM
120 CLS: CLEAR 200
130 DIM A$(8)
140 FOR B=1 TO 8
150 READ A$(B)
160 FOR X=1 TO LEN(A$(B))
170 Z=Z+ASC(MID$(A$(B),X,1))
180 NEXT X,B
190 IF Z<>2133 THEN PRINT "CHECK LINE 110 FOR DATA ENTRY ERROR":
END
200 PRINT "LINE 110 DATA SEEMS TO BE CORRECT"
210 END
```

Program Listing 3. Checksum Demo.

```
100 REM * ALPHABET RACE * TRS-80 MODELS I, III, 4, 100
110 CLS
120 CLEAR 300
130 B$="@ "
140 A$=INKEY$
150 IF A$<>" " THEN GOSUB 200
160 PRINT B$:
170 IF B$<>"@ " THEN N=N+1
180 IF A=26 AND B$="Z" THEN 220
190 GOTO 140
200 IF ASC(A$)=ASC(B$)+1 THEN B$=A$: A=A+1
210 RETURN
220 PRINT
230 PRINT "SCORE:"1000-N
240 END
```

Program Listing 4. Alphabet Race.

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MODEL I/III* BEATS OUT

```

10 generate prime nu
20
30 DEFINT A-Z
40 PRINT TIMES
50 S=7000
60 DIM F(7001)
70 C=0
80 FOR I=1 TO S
90 F(I)=1
100 NEXT I
110 FOR I=0 TO S
120 IF F(I)=0 THEN 200
130 P=I+1
140 K=I+P
150 IF K>S THEN 190
160 F(K)=0
170 K=K+P
180 GOTO 150
190 C=C+1
200 NEXT I
210 PRINT C, "pri
220 PRINT TIMES
230 END

```

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8
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BASIC TAKES

tapped in the alphabetical sequence.

If B\$ doesn't equal @ then the timer starts in line 170 and the program adds 1 point.

If A equals 26 and B\$ equals Z, then you've typed the last letter, so the program goes from line 180 to 220 for scoring.

If the ASCII value of the letter you typed equals the ASCII number of the next letter in the alphabet, B\$ becomes that next letter in line 200.

Line 230 keeps your score as 1000 minus N, the timer.

Calculator, in Program Listing 5, does chain calculations. It performs continuing computations using addition, multiplication, subtraction, and division.

When you run the program, the screen shows only this:

Total: 0
Number:

Type in numbers and they appear at the right of the word NUMBER:. When the number reads as you want it, press any of the four keys with the * + - / signs on them. You don't need to press shift. As you press an operator key, the program performs that function on the number and the running total and the new total printed to the right of the word TOTAL:.

To start, type in 20 and press the +

key without using shift. The total becomes 20. Now type in 40 and press the + key. The total is 60. Now type in 30 and press the / key. The program divides 60 by 30 for a result of 2.

If you make an entry mistake, press C to clear the NUMBER: value. Press X to clear both the Number and the Total.

Now run the program and see how it works. Then take a look at the listing.

Line 130 creates an eraser that consists of a string of 30 blanks, that gets rid of useless screen material.

Line 140 builds a value into A\$ by using INKEY\$ input.

Line 160 makes INKEY\$ (which is also the rightward character of A\$) worth B\$, which is examined by the program to see if you want to add, subtract, divide, multiply, or clear values.

Line 170 transforms the left part of A\$ (minus the operation command) into a numeric variable of A, for mathematical manipulation in lines 190-200. In this program, if you attempt to divide by zero, the program lets you off with a warning instead of an error message.

Coming attractions—next month I'll look at the 255 ASCII values. ■

Contact Richard Ramella at 1493 Mountain View Ave., Chico, CA 95926.

```

100 REM * CALCULATOR * TRS-80 MODELS I, III, 4, 100
105 REM * SEE MODEL 100 CHANGES IN LINES 1060-1110
110 CLS
120 CLEAR 500
130 S$=STRING$(30,32)
140 A$=A$+INKEY$
150 B$=RIGHT$(A$,1)
155 IF B$="C" THEN A$="": CLS: C=0: GOTO 140
160 IF B$="X" THEN A$="": CLS: GOTO 140
170 IF B$="+" OR B$="-" OR B$="/" OR B$="*" THEN A=VAL(LEFT$(A$,
LEN(A$)-1)): A$="": GOTO 190
175 PRINT @ 65,"TOTAL: "C;S$;
177 PRINT @ 128,"NUMBER: "A$;
180 GOTO 140
190 IF B$="*" THEN C=C*A
200 IF B$="-" THEN C=C-A
210 IF B$="+" THEN C=C+A
215 IF A=0 AND B$="/" THEN GOSUB 1000: GOTO 230
220 IF B$="/" THEN C=C/A
230 PRINT @ 136,S$
240 GOTO 140
1000 PRINT @ 896,"DIVISION BY ZERO IMPOSSIBLE"
1010 FOR T=1 TO 1000
1020 NEXT T
1030 PRINT @ 896,S$;
1040 RETURN
1050 END
1060 REM * FOR MODEL 100 MAKE FOLLOWING CHANGES:
1070 REM * 175 PRINT @ 41,"TOTAL: "C;S$;
1080 REM * 177 PRINT @ 80,"NUMBER: "A$;
1090 REM * 230 PRINT @ 48,S$;
1100 REM * 1000 PRINT @ 240,"DIVISION BY ZERO IMPOSSIBLE";
1110 REM * 1030 PRINT @ 240,S$;
1120 END

```

Program Listing 5. Calculator.

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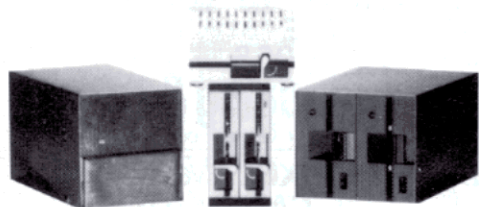
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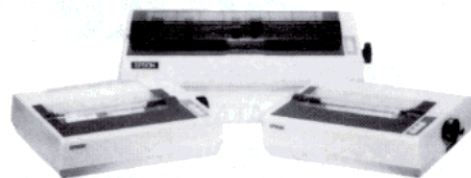
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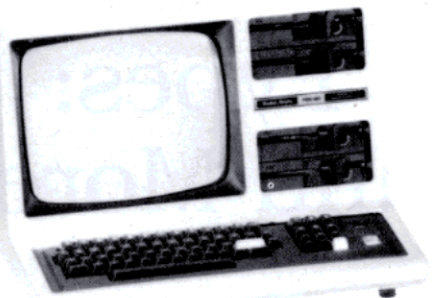
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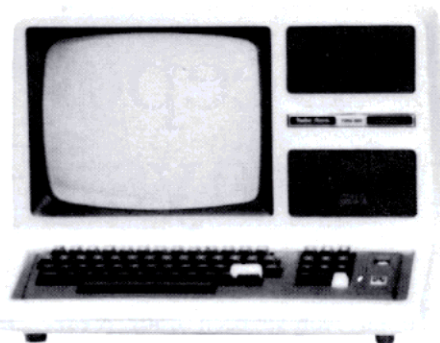


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Deeper into Data Types: Arrays, Records, and More

So far, you've been using predefined data types in your Pascal programs. This month, I'll show you how to create and use your own data types for simple, straightforward program development. The variety of data types permitted in Pascal is one of its most important advantages over Basic.

User-Defined Data Types

Any data type not predefined in Pascal is a user-defined data type. (Remember, integer, Boolean, character, and real data types are predefined.) Arrays, records, and subrange or enumerated data types are user-defined.

Admittedly, Basic can simulate any data type used in Pascal. But Pascal lets you think another step away from how the computer thinks.

In Basic, to code a variable describing a color, you have to use numeric values (e.g., red = 1, orange = 2, blue = 3, black = 4) or string variables and comparisons ("RED", "ORANGE", "BLUE", "BLACK"). The former method makes the program hard to write and read. The latter method uses more space for the variables, and string compression can increase a program's execution time.

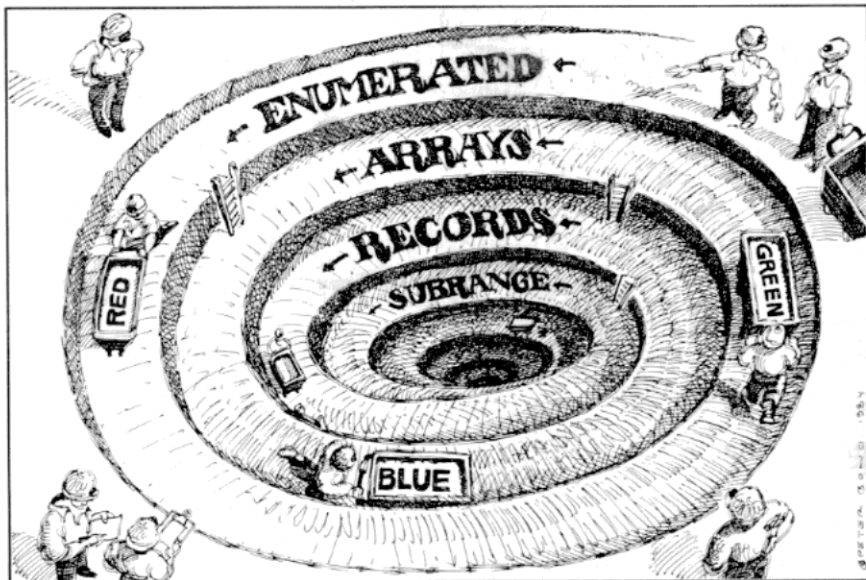
In Pascal, you simply define a type called color and declare variables of that type:

```
type
  color = (red, orange, blue, black);
var
  ScreenColor, flowerColor, carHue: color;
```

To use the variables, you can indicate the allowed values directly:

```
screenColor := orange;
if screenColor = blue then ...
  else if screenColor = orange then ...
```

Pascal makes the program easier to write (you don't have to remember what color the number 3 represents) and easier to read.



Arrays

Pascal's arrays resemble Basic's arrays. They can have one dimension or several. But while Basic lets you dimension an array with a variable during program execution, a Pascal program must know the size of the array before it can compile. So, you must determine the size of the array at compile time, not at run time.

To declare an array variable, you must use the VAR statement. For example:

```
var
  a: array [1..10.] of real;
  b: array [-1..1.] of char;
  c: array [5..50.] of integer;
```

Array "a" has 10 elements; each is a real number. An index of 1-10 references each of these elements uniquely. Array "b" is a character array (char) with three elements. The allowed indices are -1, 0, and 1. If b = xyz, then b[-1] = x, b[0] = y, and b[1] = z. Array c has 45 integer values, referenced by indices 5-50.

Notice that you use square brackets instead of parentheses. If you don't have a convenient way to produce

them (Newsprint's editor and Alcor's Blaise Text Editor have brackets), use periods instead of the brackets. So, b(.1.) is the same as b[1].

You can also define an array type in a TYPE statement:

```
type
  vector = array [1..10] of integer;
var
  a: vector;
  b: array [1..10] of integer;
```

Data types defined in the TYPE section of a Pascal program use the equal sign (=) to indicate equivalence to the described type, as shown above. This differs from the colon (:) used in the VAR section to declare variables.

Note also that you indicate the range of permitted subscripts by the lower subscript followed by two periods and the upper subscript. For instance, a..b limits the range of subscripts to a, b, and all the integer values between them.

In the example above, vector is a user-defined data type; in this case it's an array of 10 integer values. However, b isn't a vector type, even though the variable declarations for a and b



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are equivalent. Because their names aren't identical, they aren't identical types. This is important when passing parameters to procedures and functions, as you'll see further on.

Program Listing 1 illustrates the use of arrays; the program lets you enter a group of reals and then computes the average value.

One of the nice things about Pascal's complex types is that if two variables are of the same type, you can assign one the value of the other. If arrays *a* and *b* are vector types, you need only a single assignment statement to move all the elements of array *b* into array *a*:

```
a := b;
```

You don't have to loop, assigning each element of *a* to its corresponding element in *b*, as you would in Basic.

This only works if *a* and *b* are identical types. If *a* is vector-type (as defined above), and *b* is LongVector-type, defined to be the same as vector, then *a* and *b* are different types.

You can declare other types of arrays. Standard Pascal uses character arrays instead of string arrays. Alcor's string type is better in many ways, but having character arrays is useful, too. You can even declare arrays of arrays. You can think of a two-dimensional array, for example, as an array of which each element is an array.

You can declare two-dimensional arrays in two ways, as shown below:

```
type
vector:    array [1..20] of real;
matrixA:   array [1..10] of vector;
matrixB:   array [1..10,1..20] of real;
matrixC:   array [1..10] of array [1..20] of real;
```

```
program sampleArray
type
vector = array [1..100] of integer;
var
numbers: vector;
max: integer;
average, sum: real;
begin
write('How many numbers will you enter? ');
readln(max);
sum := 0;
for i := 1 to max do
begin
write('Enter value #', i, ': ');
readln(numbers[i]);
sum := sum + numbers[i];
end;
compute average;
average := sum/max;
writeln('The average is ', average:10:5);
end.
```

Program Listing 1. Using arrays to compute the average value of a group of reals.

Types *matrixA*, *matrixB*, and *matrixC* are equivalent; they use the same amount of space, and if they contain the same order of real numbers, the same indices will refer to the same values.

Records

Records are similar to arrays, except that the elements don't have to be of the same type. You must declare the record type you use in the Type section.

In Program Listing 2, *cRec* is a user-defined data type. It has elements called fields that are of different types. *Customer* is a variable declared to be of type *cRec*. You refer to fields of customer by putting a period between the name of the variable and the field. For example, *customer.id* refers to the *id* field (type integer) of the variable "customer."

If you want it understood that you're referring to a particular variable, you can use the *With* statement. Program Listing 3 shows another way to write the program in Listing 2. In Listing 3, the statement *id := 1* means *customer.id := 1*; the *With* statement indicates that "customer" is understood.

Record types help you simplify program development. You can adapt the program in Listing 3 to accommodate many customers by declaring an array of customer variables called *cList* (Program Listing 4). In this case, *cList* is an array of 100 elements, each a *cRec* type. Each record is an element of the list, so you must refer to it with an index. Follow the index with the field to which it refers. *cList[1].name* refers to the "name" field (a string type) of the first record in the *cList* array.

Note that you can manipulate complex data items easily in Pascal. If you want to set the second record equal to

```
program sample;
type
cRec = record
id: integer;
name: string;
address: string;
amountDue: real;
end;
var
customer: cRec;
begin
customer.id := 1;
customer.name := bldstr('Jane Doe');
customer.amountDue := 14.37;
end.
```

Program Listing 2. Declaring the record type.

the first, simply use the statement *cList[2] := cList[1]*—each field in *cList[2]* has the same value as its corresponding field in *cList[1]*. In Basic, you'd have to loop through different arrays.

Record types put data fields together in logical groups even if their fields have different types. Suppose you want to write a program to store students' answers to true/false tests and you want each record to include student name, ID number, grade on the test, and the answers. It's easy in Pascal:

```
type
sRec = record
id: integer;
name: string;
grade: char;
answers: array [1..100] of boolean;
end;
var
students: array [1..50] of sRec;
```

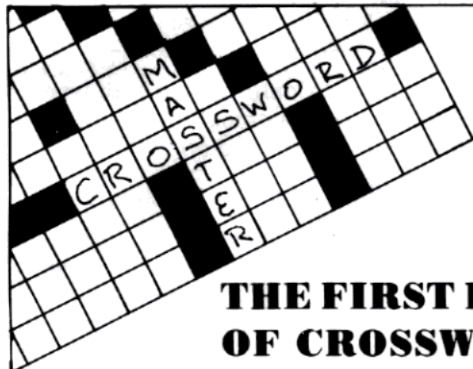
You have declared the type *sRec*, which contains the fields *ID* (integer type), *name* (string), *grade* (char type, such as A or F), and the *answers* (a Boolean array). Because "answers" is an array of 100 elements, you can store a true/false test with 100 questions. The variable "students" is an array of 50 of these

```
program sample;
type
cRec = record
id: integer;
name: string;
address: string;
amountDue: real;
end;
var
customer: cRec;
begin
with customer do begin
id := 1;
name := bldstr('Jane Doe');
amountDue := 14.37;
end; { end with }
end.
```

Program Listing 3. Using the *With* statement when declaring record types.

```
program sample;
type
cRec = record
id: integer;
name: string;
address: string;
amountDue: real;
end;
var
cList: array [1..100] of cRec;
begin
cList[1].id := 1;
cList[1].name := bldstr('Jane Doe');
cList[1].amountDue := 14.37;
cList[2] := cList[1];
end.
```

Program Listing 4. Using the record type to list customer variables.



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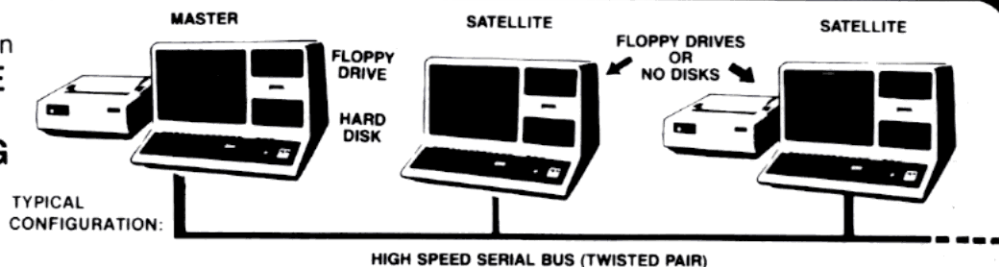
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records, so you can store the test answers of 50 students.

In standard Pascal, you can declare variables as a packed array of ..., or a packed record. In many Pascal uses, this greatly reduces storage requirements at the expense of increasing access time to those data items. In Alcor Pascal, the key word Packed has no effect; packed and unpacked variables are the same. That's one way Alcor Pascal differs from UCSD Pascal.

Subrange and Enumerated Data Types

Subrange data types let you limit the range of permitted values. For example, you can indicate that the type unsignedByte can contain only values 0-255, and the type signedByte can contain values -128 to 127:

```
type
  unsignedByte = 0..255;
  signedByte = -128..127;
var
  a: unsignedByte;
  b: signedByte;
```

Variable a can have values between 0 and 255, inclusive, while b can contain values from -128 to 127. UnsignedByte and signedByte are called subrange types because they are a subrange of a larger type. Remember, the two periods between the lower and upper boundaries on the subrange mean "and all values in between."

You can use subrange types with other types. For example:

```
type
  lowerCase = 'a'..'z';
  upperCase = 'A'..'Z';
  allLetters = 'A'..'Z';
var
  a: lowerCase;
  b: upperCase;
  c: allLetters;
```

*In standard Pascal,
you can declare variables
as a packed array
or a packed record.
In Alcor Pascal,
the key word Packed
has no effect.*

These variables are all subranges of a character data type. They work just like a character-type variable, but they have a smaller range of permitted values; variable a can only have the values a-z.

You can use subranges with any ordinal type, that is, any type in which there is an implicit order. The integers, for example, are ordered by value: 1, 2, 3, and so on. The characters are ordered similarly: A is less than Z, a is greater than Z, z is greater than a.

Another ordinal data type is the enumerated type, for which you list all possible values. For example, you can declare a type called month, with permitted values of January-December:

```
type
  month = (January, February, March,
           April, May, June, July, August,
           September, October, November,
           December);
  summer = June..August;
var
  currentMonth: month;
  birthMonth: summer;
begin
  currentMonth := November;
  birthMonth := June;
end.
```

The currentMonth is a month-type variable. You can build an entire date type from enumerated types (Program Listing 5).

Applications

Using enumerated and subrange types can be tricky. If you have a date-type variable, as declared in Listing 5, you can't enter it with a Read or READLN statement. Read only works with simple, predeclared variable types. If you want to enter the month June from the keyboard, and currentDate is declared to be date-type, you can't just type in:

```
readln(currentDate.month);
```

because currentDate.month is not a simple data type. There are two approaches you can use. Each requires you to enter a month number; e.g., 5 for June.

The first method is to use the ORD function to go through the months (starting with January) until you get to the proper month (Program Listing 6). The ORD(monthNow) statement returns the ordinal value of the variable monthNow. This value is 0 for January, 1 for February, and 11 for December. The succ(monthNow) function returns the next item in the ordinal type for monthNow. If monthNow is January, then succ(monthNow) returns February.

The While loop continues until the ordinal value of monthNow equals the integer value of monthNumber. When it does, monthNow is set to the correct month. CurrentDate.month is then set equal to this month. If you enter a value of 5 for monthNumber, the While statement loops until ORD(month

```
type
  monthType = (January, February, March,
              April, May, June, July,
              August, September, October,
              November, December);
  dayOfTheMonth = 1..31;
  yearType = 1900..2000;
  date = record
    month: monthType;
    day: dayOfTheMonth;
    year: yearType;
  end;
var
  currentDate: date;
begin
  currentDate.month := November;
  currentDate.day := 12;
  currentDate.year := 1984;
end.
```

Program Listing 5. Building a date type from enumerated types.

```
program sample;
{ date declared as before }
var
  currentDate: date;
  monthNumber: 0..11;
  monthNow: month;
begin
  write('Enter month number (0..11): ');
  readln(monthNumber);
  monthNow := January;
  { loop until ORD(monthNow) equals
    month number }
  while ORD(monthNow) <> monthNumber do
    monthNow := succ(monthNow);
  { monthNow is the correct month
    after this loop }
  currentDate.month := monthNow;
end.
```

Program Listing 6. Using the ORD function to enter a month from the keyboard.

```
program test;
type
  monthType = (January, February, March,
              April, May, June, July,
              August, September, October,
              November, December);
  month = record
    case boolean of
      true: (name: monthType);
      false: (number: 0..11);
    end;
var
  currentMonth: month;
begin
  write('Enter month number (0..11): ');
  readln(currentMonth.number);
  { currentMonth.name is now set to
    the proper month }
  writeln(currentMonth.name);
end.
```

Program Listing 7. Using variant records to enter a month from the keyboard.

*By giving
the same field
two names,
you can bypass
some of Pascal's
strong type checking.*

Value) equals 5; that is, until month Value equals June.

The other method uses variant records. Some purists would insist that this method goes against the spirit of structured programming, but I think it's the best way to get the job done. So far, all the records I've dealt with have had fixed fields. However, records can have fields of different types.

Program Listing 7 is an alternative to Listing 6. Month is now a variant record. It can hold different value types; either a type monthType or an integer subrange. You can assign currentMonth.number a value and currentMonth.name is automatically set to the proper month.

This isn't the primary use for variant records, but it does work. That's because Pascal stores the enumerated values internally as numbers from 1 up to 11 (for 12 months). The compiler is strongly typed, so you can't just set currentMonth := 5; Pascal checks types for assignment statements. But by using variant records, you can set currentMonth.number := 5, meaning that currentMonth.name is now June.

It's important to note that the variant fields of month (i.e., name and number) refer to the same field; they are simply different names for it. By giving the same field two names (and types), you can bypass some of Pascal's strong type checking. In general, this is a good idea only when you know that the two variants for the field occupy the same amount of space. In this case, you used a subrange of the same size as the user-defined field, so you know they occupy the same space. ■

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If you've been using one of the "bare bones" editor/assemblers, such as Apparat's EDTASM or Radio Shack's Series 1, you've been missing out on half the fun and power of programming in Assembly language.

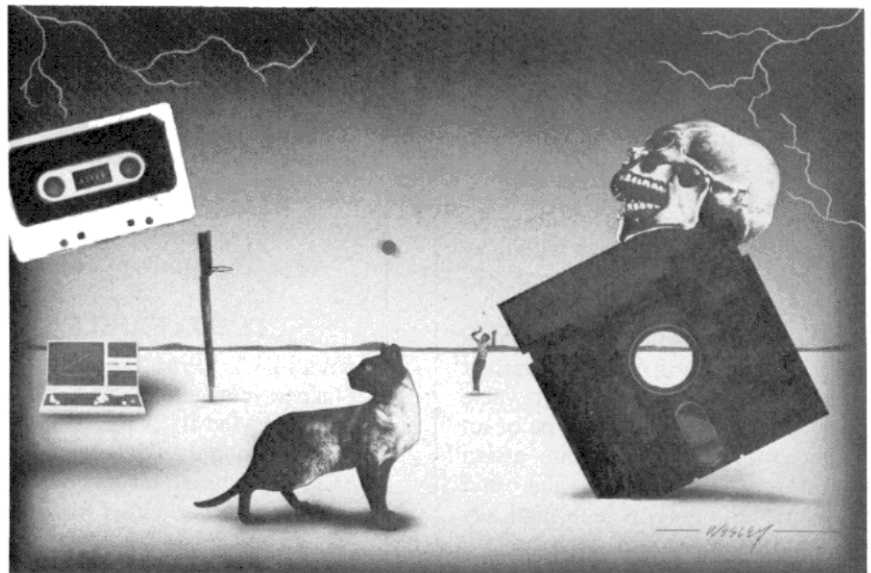
While these relatively simple packages will assemble the complete Z80 instruction set, they're missing two significant classes of Assembly-language instructions: conditionals and macros. Conditional commands are useful when you're writing several versions of a single program at once. They direct program flow by incorporating subroutines that are executed only if certain conditions you've specified are met. For example, with one source program, you could write versions of a machine-language utility for tape-based and disk-based Models I, III, and 4.

Conditionals also let you create complex macro instructions; you can use them to force the assembler to decide which set of instructions should be included in a program.

Most programmers use macro commands more often than conditionals. A macro is a tool for adding several lines of source code to a program with a single command. If you use one of the most powerful editor/assemblers, such as EDAS, M-ZAL, or ALDS, you're probably already familiar with them. If you don't, you may not even be familiar with the term.

From a programmer's point of view, an assembler with macro capabilities lets you define new opcodes. (For a review of all TRS-80-compatible editor/assemblers, see "Making Your Selection," p. 58 of this issue.)

For example, suppose you're writing a program that moves a lot of information around in memory. You might find several places in your program where you have to load one val-



ue into DE, another into HL, a third into BC, and then execute an LDIR command. You may also find that you usually have to save the values in the BC, DE, and HL registers on the stack before the block move and then recover those values afterward.

If you consider writing a subroutine to move the block, you'll realize that you could only replace one instruction, LDIR, with a subroutine—you would still have to save and then load the registers before the subroutine call. There is, however, a simpler way. If your assembler has macro capabilities, you need only define a Move macro once, then call it whenever you need to move a block.

To use a macro, you need to include lines of code similar to those in Fig. 1 (each assembler has slightly different syntax). These lines should appear near the beginning of your program. Then, if your program later requires a block move of 256 bytes from 7000@@ hexadecimal (hex) to 3C00 hex, you need simply include the fol-

lowing single source line in the program:

```
MOVE 3C00H,7000H,100H
```

The assembler translates that single line into 10 lines, writing code based on the macro template that you already defined, and substituting the values 3C00 hex, 7000 hex, and 100 hex for the parameter names in the macro definition. If you use an assembler that supports both macros and conditionals, you could write the macro in such a way that the assembler

MOVE	MACRO	#DEST, #SOURCE, #COUNT
	PUSH	BC
	PUSH	DE
	PUSH	HL
	LD	HL, #SOURCE
	LD	DE, #DEST
	LD	BC, #COUNT
	LDIR	
	POP	HL
	POP	DE
	POP	BC
	ENDM	

Figure 1. Sample lines of code.

would decide if the source and destination blocks would overlap, would choose whether to use an LDIR or LDDR block move, and would calculate the correct values to use in each case.

Macros are useful not only because they help you avoid writing repetitious code over and over, but also because they let you move your Assembly-language code up a notch toward a higher-level language. Once you've defined a library of macro definitions (and debugged those definitions), you've essentially defined a new set of higher-level opcodes that you can use in all your programs.

In many ways, you can think of higher-level languages, especially compiled languages, as a complex set of macros defined in a lower-level language. Though much different in internal structure, an assembler with macro capabilities is somewhat akin to languages like Forth, Lisp, and Logo, because it lets you write new commands in the same language.

Macros on a Budget

If you're using a simple assembler, you may think that macros are fine, but you're not about to spend \$100 or more for a new, fancy assembler just to avoid writing 10 lines of source code now and then. With Program Listing 1, you won't have to.

Listing 1 was inspired by Zen, an assembler that doesn't directly support macros but that includes a Basic program that adds macros from a special library file to standard source code. Normally, you write machine-language routines to add power to Basic programs; there is more than a bit of irony in using a Basic program to help write those machine-language routines in the first place.

Though Zen provided the inspiration for Listing 1, this Basic program is entirely original and, at this stage, more primitive than the macro capabilities of EDAS, ALDS, and M-ZAL. Listing 1 should have enough internal documentation for you to understand how it works, though the string handling gets fairly complex at times. Listing 1 insists on some strict syntax in the macro definitions and calls that let the Basic program run much more quickly than it would otherwise:

- You must store the macro defini-

tions in a separate source code file; the first line of that file must contain a remark.

- In both the macro definition file and regular source code file, you must separate all fields by a tab (CHRS(9)), which is normally generated by pressing the right-arrow key when you're using an editor/assembler.

- The first line of the macro definition must contain the macro name in the label field, the pseudo-op MACRO in the opcode field, and a list of up to nine parameters in the operand field.

- Write each parameter as a pound sign (#) followed by a P and then a sin-

gle digit (e.g., #P3). Separate parameters by commas but no spaces.

- End each macro definition with the pseudo-op ENDM in the operand field.

- Labels and symbols that are local to the macro should contain a double question mark, ??, which a unique two-digit number will replace during expansion; this avoids "multiply defined symbol" errors in the final source code.

- Invoke a macro in the source code file by putting an exclamation mark and the macro name in the opcode field, followed, in the operand field,

Example of a macro definition in the format required by Program Listing 1:

```
00010 ;Macro ADTBL adds a constant value to all
00020 ;elements of a table.
00030 ;#P1 = address of table, #P2 = table length
00040 ;#P3 = value to be added
00050 ;
00060 ADTBL MACRO #P1,#P2,#P3
00070 PUSH AF
00080 PUSH BC ;Save registers
00090 PUSH HL
00100 LD HL,#P1 ;HL==>table
00110 LD BC,#P2 ;BC = table length
00120 ADT?? LD A,(HL) ;Get one element
00130 ADD A,#P3 ;Add constant
00140 LD (HL),A ;Put back in table
00150 INC HL ;HL==> next element
00160 DEC BC ;Decrement counter
00170 LD A,B ;Get MSB of counter
00180 OR C ;Merge with LSB
00190 JR NZ,ADT?? ;Loop back until done
00200 POP HL
00210 POP BC ;Restore registers
00220 POP AF
00230 ENDM ;End of macro definition
```

You could invoke this macro in your source code by a line like

```
01310 !ADTBL 8000H,400H,20H
```

which would cause every element of a 1K table to be increased by 20 hex (32 decimal). The resulting source code after macro expansion would look similar to this:

```
00151 PUSH AF
00152 PUSH BC ;Save registers
00153 PUSH HL
00154 LD HL,8000H ;HL==>table
00155 LD BC,400H ;BC = table length
00156 ADT03 LD A,(HL) ;Get one element
00157 ADD A,20H ;Add constant
00158 LD (HL),A ;Put back in table
00159 INC HL ;HL==> next element
00160 DEC BC ;Decrement counter
00161 LD A,B ;Get MSB of counter
00162 OR C ;Merge with LSB
00163 JR NZ,ADT03 ;Loop back until done
00164 POP HL
00165 POP BC ;Restore registers
00166 POP AF
```

Notice that values have replaced the #P parameters and that the label ADT?? has been replaced by ADT03 both times it was used. The 03 indicates that this is the third expanded macro in the source code.

Figure 2. Example of how Program Listing 1 works.

Program Listing 1. Macro expander.

```

1 'MACRO Pre-Processor --
2 '   Takes a normal EDTASM Source File with MACRO calls
3 '   and a MACRO Library File (in source-code format)
4 '   Creates a new source code file with all macros
5 '   expanded.
6 '
7 '   Inspired by the ZEN editor/assembler, but all code
8 '   is original.
9 '
10 '   Written by Hardin Brothers
11 '
12 'Variable definitions:
13 '   MN$ ..... Name of Macro Library File
14 '   IS$ ..... Name of original source file
15 '   OS$ ..... Name of new output source file with
16 '   expanded macros
17 '   MS(100) .. Names of macro definitions (maximum of 100)
18 '   MP(100) .. Position of macro definitions in MN$ file
19 '   PS(9) .... Parameters from source file
20 '   P ..... Highest parameter number in macro file
21 '   LA ..... Number of macros expanded
22 '   LA$ ..... LA in string form for '??' substitution in
23 '   local labels
24 '   LC ..... Line number counter for output file
25 '   LCS$ ..... Line number in string form (length = 5)
26 '   with high bits set
27 '   M$ ..... Macro name
28 '   MIS$ ..... Input line from macro (MN$) file
29 '   SIS$ ..... Input line from source (IS$) file
30 '   SOS$ ..... Output line to expanded (OS$) file
31 '   SS$ ..... Temporary SI$ form during processing
32 '   TB$ ..... Holds TAB value (CHR$(9))
33 '   Z,ZZ ..... Loop counters
34 '   Z$ ..... Temporary string for output file header
35 '
36 '   File format (EDTASM source files)
37 '
38 '   Each line of source code contains
39 '   1. 5-digit line number (including leading 0s)
40 '   with high bit of each digit set
41 '   2. A single space (20H)
42 '   3. An optional label field
43 '   4. An op-code field
44 '   5. An optional operand field
45 '   6. An optional remark field
46 '   All fields are separated by tab characters (09H)
47 '   The file contains a 7-byte header before
48 '   the first line number consisting of a 0D3H byte
49 '   and the first six characters (without extension)
50 '   of the source file name, left justified.
51 '   The end of the file is marked by a single byte
52 '   of LAH.
53 '
54 '   SERIES 1 (Radio Shack's Editor-Assembler) files
55 '   are identical except that the file starts with
56 '   the first line number. The 0D3H and 6-byte
57 '   header are absent.
58 '
59 '   To modify this program to work with the SERIES 1
60 '   Editor-Assembler, delete lines 3030 to 3100.
61 '
62 '
63 '   Initialize variables and arrays
64 '
65 '   51 CLEAR 5000
66 '   52 DEFINT A-Z
67 '   53 DIM MN$,IS$,OS$,P,LA,LA$,LC,LCS$,M$,MIS$,SIS$,SOS$,SS$
68 '   54 DIM Z,ZZ,Z$
69 '   55 TB$ = CHR$(9) 'TB$ is tab character
70 '   56 DIM M$(100),MP(100)
71 '   57 '
72 '   99 '
73 '
74 '   Program outline
75 '
76 '   100 GOSUB 1000 'Get file names
77 '   110 GOSUB 2000 'Read macros
78 '   120 GOSUB 3000 'Read source and process macros
79 '   130 '
80 '   140 CLOSE:END 'End of program
81 '   150 '
82 '   999 '
83 '
84 '   Get file names for all three files
85 '
86 '   1000 CLS:PRINT"Macro Instruction Pre-processor"

```

Listing 1 continued

by the strings that replace the #P parameters in the macro definition.

● Macro definitions can't invoke other macros; that is, nested macros are not allowed.

As written, Listing 1 works with EDTASM and assemblers such as ALE that support EDTASM-format source codes. If you want to use Listing 1 with the Radio Shack Series 1 Editor/Assembler, modify it as shown in Listing 1.

You won't be able to use Listing 1 directly with Instant Assembler or Zeus. Both check each line of source code as you type it in (or load it from disk) for syntax errors, and therefore don't let you write either the source file or macro library file. However, you can write both files with a word processor such as LeScript (which can save the code in EDTASM format), run Listing 1 to expand the macros, and then assemble the resulting code with either assembler.

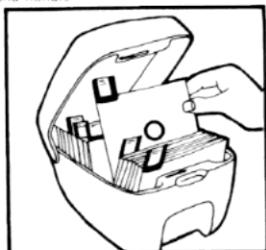
To help you start building a macro library, Program Listing 2 contains several general-purpose macros that you might find useful. One way to add to your macro library is to look through your own programs to find sections of code that you often use. Translating those sections into macros usually isn't difficult, but finding macro names and parameter orders that make sense to you can often be a challenge.

If you can't quickly recall the name and syntax of the macros in your library, they aren't as useful to you as they should be. I keep a reference list of the macros and their parameters next to my computer; it speeds up my programming and encourages me to use the macros more often.

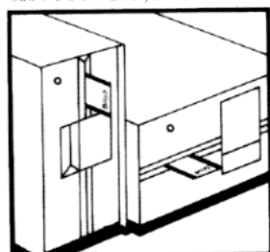
Once you get used to using macros in your own programming, you'll probably wonder how you ever managed to write anything without them. ■

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Listing 1 continued

```

1010 PRINT: PRINT
1020 LINEINPUT "File name of Macro Library"
1030 LINEINPUT "File name of original source code"
1040 LINEINPUT "File name of expanded source code"
1050 CLS
1060 PRINT "Macro Library File"
1070 PRINT "Original Source Code"
1080 PRINT "Expanded Source Code"
1090 PRINT "Input Okay";
1100 IF RIGHT$(Z$,1) <> "Y" AND RIGHT$(Z$,1) <> "y" THEN GOTO 1000
1110 RETURN
1120
1199
    Read macro file, collect macro names in M$( ) and
    save the position of each in MP( )

2000 OPEN "1",MNS
2010 MC = 0: MP = 1

2020 CLS: PRINT "MACRO definitions found:"
2030 LINEINPUT#1, M$
2040 IF INSTR(M$, "MACRO") = 0 OR
    (INSTR(M$, "MACRO") - INSTR(M$, "TB$")) < 1
    THEN GOTO 2090
2050 MC = MC + 1
2060 M$(MC) = MID$(M$, 7, INSTR(M$, CHR$(9)) - 7)
2070 PRINT M$(MC)
2080 MP(MC) = MP
2090 MP = MP + 1
2100 IF EOF(1) THEN CLOSE: RETURN
2110 GOTO 2030
2120
2195
    Main Processing Routine

3000 OPEN "1",I$,IS$
3010 OPEN "O",2,OS$
3020 LC = 1
3030
    Process 1st source line (may not contain a macro call)

3040 LINEINPUT#1, SI$
3050 GOSUB 4000
3060 Z$ = STRING$(6, " ")
3070 LSET Z$ = LEFT$(OS$, INSTR(OS$, "/") - 1)
3080 SO$ = Z$ + LC$ + MID$(SI$, 13)
3090 PRINT SO$
3100 PRINT#2, CHR$(4)HD3 + SO$
3110
    Now loop to process all the rest

3120 LINEINPUT#1, SI$
3130 IF SI$ = CHR$(4)H1A THEN
    PRINT#2, SI$;: RETURN

```

```

3140 SI$ = MID$(SI$, 7)
3150 IF INSTR(SI$, "I") <> 0 AND
    INSTR(SI$, "I") - INSTR(SI$, "TB$") = 1
    THEN GOSUB 5000: GOTO 3200
3160 LC = LC + 1: GOSUB 4000
3170 SO$ = LC$ + " " + SI$
3180 PRINT SO$
3190 PRINT#2, SO$
3200 GOTO 3120
3210
3999
    Change line count (LC) into 5 char. string (LC$)

4000 LC$ = MID$(STR$(LC), 2)
4010 IF LEN(LC$) = 5 THEN GOTO 4040
4020 LC$ = "0" + LC$: GOTO 4010
4030
    Set high bit of each character

4040 FOR Z = 1 TO 5
4050 MID$(LC$, Z) = CHR$(ASC(MID$(LC$, Z, 1)) OR &HB0)
4060 NEXT Z
4070 RETURN
4080
4999
    Process and expand a macro definition

5000 S$ = MID$(SI$, INSTR(SI$, "I") + 1)
5010 IF INSTR(S$, "TB$") = 0 THEN M$ = S$
    ELSE M$ = LEFT$(S$, INSTR(S$, "TB$") - 1)
5020 FOR Z = 1 TO MC
5030 IF M$ = M$(Z) THEN GOTO 5070
5040 NEXT Z
5050 PRINT "Macro "; M$; " not found."
5060
5070
    Stop if macro not found in list

5070 OPEN "I", 3, MNS
5080 FOR ZZ = 1 TO MP(Z)
5090 LINEINPUT#3, M1$
5100 NEXT ZZ
5110
5120 IF INSTR(M1$, M$) <> 7
    THEN PRINT "Macro file read error -- "; M$
    :STOP
5130
    Find # of parameters expected by macro

5140 IF LEN(M1$) = LEN(M$) + 7 THEN GOTO 5260 'no macros
5150 IF INSTR(M1$, ";") <> 0
    THEN M1$ = LEFT$(M1$, INSTR(M1$, ";") - 2)
    'strip comment and its leading tab
5160 IF RIGHT$(M1$, 1) = CHR$(9)
    THEN M1$ = LEFT$(M1$, LEN(M1$) - 1)
    'strip trailing tab
5170 P = VAL(RIGHT$(M1$, 1))
    'get highest parameter #
5180 IF P = 0 THEN GOTO 5260
    'go if no parameters
5190

```

Listing 1 continued

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Listing 1 continued

```

Read parameters from S$
5200 IF INSTR(S$,TB$)=0
    THEN PRINT "Expected parameters not found for ";M$:STOP
    ELSE S$=MID$(S$,INSTR(S$,TB$)+1)
5210 IF INSTR(S$,TB$)<>0
    THEN S$=LEFT$(S$,INSTR(S$,TB$)-1)
    'strip everything after
    'last parameter
5220 FOR Z = 1 TO P
5230 IF INSTR(S$,") <> 0
    THEN P$(Z) = LEFT$(S$,INSTR(S$,")-1)
    :S$ = MID$(S$,INSTR(S$,")+1)
    ELSE P$(Z) = S$:S$=""
    'Read source parameters
    'into P$()
5240 NEXT Z
5250 '

Read the macro definition and place in
output file
5260 LA = LA + 1: LA$ = MID$(STR$(LA),2)
5270 IF LEN(LA$)<2 THEN LA$ = "0" + LA$
5280 LINE INPUT#3, M$
5290 IF INSTR(M$, "ENDM")<>0
    THEN CLOSE 3: RETURN
    M$ = MID$(M$,7)
5300 IF INSTR(M$, "??")<>0 THEN
    MID$(M$,INSTR(M$, "??")) = LA$
    'Make label local
5310 IF INSTR(M$, "#") = 0 THEN GOTO 5380
    'Go if no params.
    M$ = LEFT$(M$,INSTR(M$, "#")-1)
    +P$(VAL(MID$(M$,INSTR(M$, "#")+2,1)))
5320 IF LEN(M$) > INSTR(M$, "#")+2
    THEN M$ = M$ + MID$(M$,INSTR(M$, "#")+3)
    'add rest of line
5330 M$ = M$
    'Copy output line
    'to M$
    'Check for another
    'Get line #
    'Put in file
    'And display
    'Loop back for next
5340 GOTO 5320
5350 '
5360 '
5370 '
    Prepare M$ for output
    LC = LC + 1: GOSUB 4000
    M$ = LC$ + " " + M$
    PRINT#2, M$
    PRINT M$
5420 GOTO 5280
End

```

Program Listing 2. General-purpose macros.

```

00100 ;MACRO LIBRARY
00110 ;
00120 ;Indirect load (ILD)
00130 ;loads the two-byte value pointed
00140 ;to by any register pair into any
00150 ;register pair.
00160 ;#P1 = pointer.
00170 ;#P2 = Register to receive LSB
00180 ;#P3 = Register to receive MSB
00190 ;MACRO #P1,#P2,#P3
00200 ILD
00210 PUSH IX
00220 POP #P1
00230 LD #P2,(IX+0)
00240 LD #P3,(IX+1)
00250 POP IX
;Save IX
;Transfer pointer
;to IX
;LSB to #P2
;MSB to #P3
;Restore IX

```

Listing 2 continued

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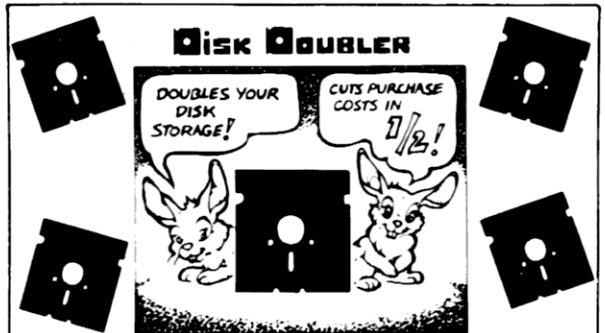
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THE NEXT STEP

Listing 2 continued

```

00260 ENDM
00270 ;
00280 ;FILL -- fill any block of memory (including
00290 ; video memory) with any value.
00300 ;#P1 = address of block
00310 ;#P2 = length of block
00320 ;#P3 = fill byte
00330 FILL MACRO #P1,#P2,#P3
00340 PUSH AF
00350 PUSH BC ;Save registers
00360 PUSH HL
00370 LD HL,#P1 ;HL==>beg. of block
00380 LD BC,#P2 ;BC = byte count
00390 FILL?? LD (HL),#P3 ;Set one address
00400 INC HL ;Bump pointer
00410 DEC BC ;Decrement counter
00420 LD A,B ;Get MSB of count
00430 OR C ;Merge LSB
00440 JR NZ,FILL?? ;Loop until done
00450 POP HL
00460 POP BC ;Restore registers
00470 POP AF
00480 ENDM
00490 ;
00500 ;SWAP -- exchanges the values of any two register pairs
00510 ;#P1 & #P2 are the names of the pairs
00520 SWAP MACRO #P1,#P2
00530 PUSH #P1 ;Place both on stack
00540 PUSH #P2
00550 POP #P1 ;Pop off stack in
00560 POP #P2 ; reverse order
00570 ENDM
00580 ;
00590 ;AD816 -- Adds an 8-bit value to a 16-bit register pair
00600 ;#P1 is the 16-bit register pair
00610 ;#P2 is the 8-bit value or register
00620 AD816 MACRO #P1,#P2
00630 PUSH AF ;Save registers
00640 PUSH HL
00650 PUSH #P1 ;Transfer 16-bit value
00660 POP HL ; to HL
00670 LD A,L ;Get LSB of reg. pair
00680 ADD A,#P2 ;Add 8-bit value or reg.
00690 LD L,A ;Save back in HL
00700 JR NC,AD?? ;Skip if no carry
00710 INC HL ;Else move carry to H
00720 AD?? PUSH HL ;Transfer 16-bit value
00730 POP #P1 ; back where it came from
00740 POP HL ;Restore registers

```

```

00750 POP AF
00760 ENDM
00770 ;
00780 ;PSHAL -- Saves all non-prime registers on stack
00790 ; no parameters
00800 PSHAL MACRO
00810 PUSH AF
00820 PUSH BC
00830 PUSH DE
00840 PUSH HL
00850 PUSH IX
00860 PUSH IY
00870 ENDM
00880 ;
00890 ;POPAL -- Pops all non-prime registers from stack
00900 ; no parameters
00910 POPAL MACRO
00920 POP IY
00930 POP IX
00940 POP HL
00950 POP DE
00960 POP BC
00970 POP AF
00980 ENDM
00990 ;
01000 ;CPL6 -- Compares two 16-bit register pairs, #P1 & #P2
01010 ; Changes AF register pair.
01020 ; Status flags after compare:
01030 ; #P1 = #P2 Z
01040 ; #P1 <> #P2 NZ
01050 ; #P1 < #P2 C
01060 ; #P1 > #P2 NC
01070 ;
01080 CPL6 MACRO #P1,#P2
01090 PUSH DE ;Save registers
01100 PUSH HL
01110 PUSH #P1 ;Store #P1
01120 PUSH #P2 ;Transfer #P2
01130 POP DE ; to DE
01140 POP HL ;#P1 TO HL
01150 LD A,H ;MSB to A
01160 SUB D ;H - D
01170 JR NZ,CPL6?? ;Go if unequal
01180 LD A,L ;LSB to A
01190 SUB E ;L - E
01200 CPL6?? POP HL ;Restore registers
01210 POP DE
01220 ENDM
01230

```

End



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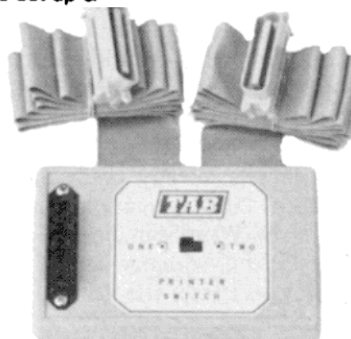
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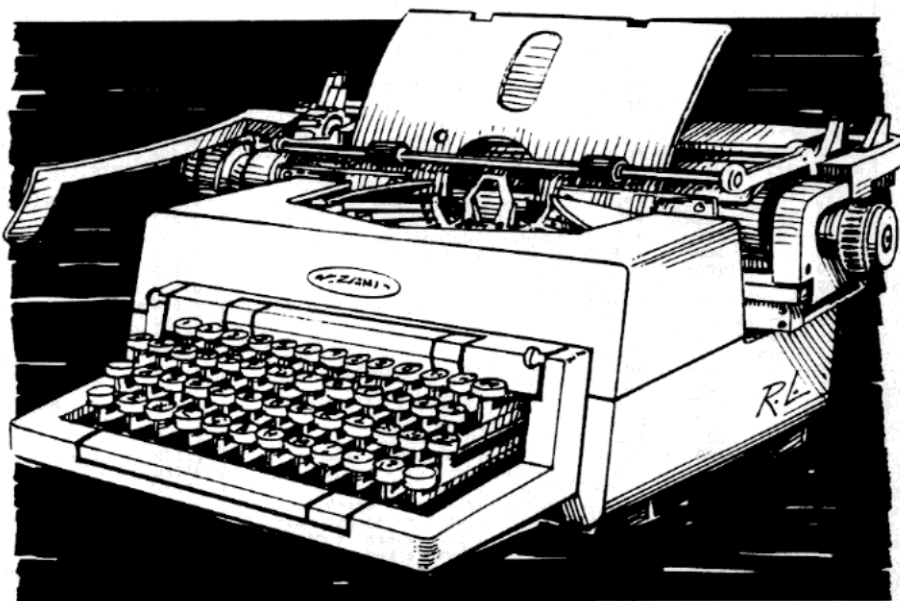
Minding Your Business: Software for the 2000

I'd like to address a problem I mentioned in last month's column first. Just before I got my Model 2000, I bought a new printer (no, it wasn't a Radio Shack printer—that's the essence of the problem). Any time that I list or print a file, my printer works in the extreme-paper-save mode: it puts everything on one line. Imagine the Model 2000 directory listed in one small black splotch.

If you have experience with CP/M, you know that you have to physically terminate all text lines with a carriage return (0D hexadecimal [hex]) and a line feed (0A hex) character. MS-DOS uses an identical technique for terminating text lines. Much to my chagrin, I couldn't make the printer work with the sense switches in the proper positions. I spent lots of time and a long trip across town to determine that the printer worked fine. Could the problem be within the Model 2000?

Then I suddenly realized what was wrong. Radio Shack configures all its printers to generate an automatic line feed whenever they detect a carriage return. When Radio Shack tailored the MS-DOS Basic input/output system (BIOS) for the Model 2000, they must have made it compatible with their printers. The Tandy BIOS won't transmit the line feed code any time it detects CR/LF codes in sequence.

I soon tired of leaving the printer case unscrewed to change the sense switches every time I wanted to shift from my word processor to dBase II. Several phone calls to Tandy produced a partial solution to this problem. The fix requires setting a flag byte in low memory to reflect whether you're using a Radio Shack or non-Radio Shack printer (see Table 1 for the necessary Debug command sequence). Unfortunately, the solution doesn't change the BIOS permanently. I'll let you know as soon as I discover a way to do this. In the meantime, any suggestions would be appreciated.



Current Software—WordStar

First on the list of currently available software is the ever-present WordStar (Micropo International Corp., available through Radio Shack on the Express Order System described below), the first word processor I've used on the Model 2000. This isn't the first time that 80 Micro has discussed WordStar (see), so let me dispense with commentary and proceed to how it performs on the Model 2000.

This WordStar implementation (version 3.31) is specifically designed for the 2000 and, basically it's ready to run when you open the package. All you do is install the printer and change any of the WordStar default features (such as disk directories, help level, and so on) to initialize as you wish. You can't make any terminal changes, however. This is already preinstalled for the Model 2000—a real plus since this version of WordStar directly accesses the screen memory and thus runs much faster than the generic installation.

One of the most outstanding features of this package is the full support

for Radio Shack's entire printer line. No other word processor outside of the Radio Shack product line provides this support. WordStar even offers color printing support for the Color Graphics Printer (CGP-220).

Although WordStar has been around for ages, it's an extremely capable package that provides many fea-

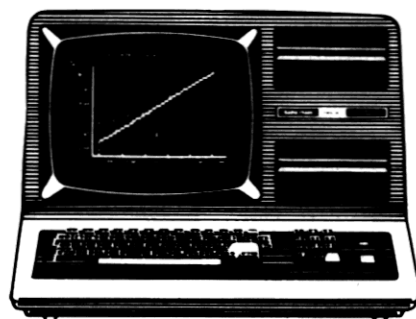
Command	Comments
DEBUG	Invoke the MS-DOS dynamic debugging environment to allow patching the BIOS.
E40:DA	Display the byte located at segment 0040, address 00DA (absolute address 004DA hex).
00	If it is OFF hex, then line feed filtering is enabled and you must change the byte to 00 hex to disable line feeds.
Q	The patch is installed and entering Q tells Debug to exit and return to MS-DOS.

Table 1. Patch to disable line feed filtering. You must terminate all entries in the command column by pressing the enter key.

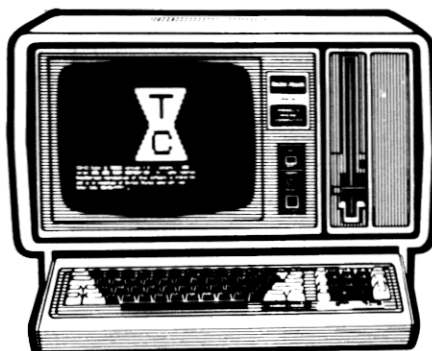
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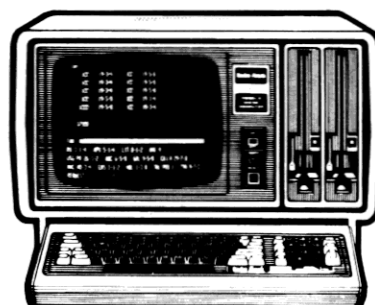
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The Great Purge

by Frank Winter

Just when my disk files were getting out of hand, I became intrigued with the apparent simplicity of using MS-DOS routines. I decided to write an Assembly-language routine that would simplify removing unwanted files.

The design structure would follow the concepts used in the NEW-DOS80 2.0 Purge command. This command reads and displays one file name at a time, asks whether you want to delete the file, performs the operations if you so select, and continues on to the remaining files on the disk.

I needed DOS routines for reading from the keyboard, writing to the

screen, reading a file name from the disk directory, and deleting a file. I defined the DOS calls as macros so I could use them in other Assembly-language programs (see the Fig.).

The macro "read_kbd_and_echo" reads a character from the keyboard and types it onto the screen. The "display" macro types a character to the screen. The "search_first" macro reads the first directory entry, and "search_next" reads all other directory entries. The "delete" macro erases a file.

You can use Microsoft's assembler and linker to assemble and link the Program Listing (Purge) and the macros into an Execute file. Next time you want to delete a large number of files, simply type PURGE at the DOS command level and erase each one with a single keystroke. ■

Program Listing. Purge.

```

page 60,132
Name      PURGE
Title     Purge utility, prompts with filenames

;
; Equates go here
cr equ 0DH
lf equ 0AH
eom equ "s"

;
include 2000mac.asm
; Assorted MACROS
display macro string
    mov dx,offset string
    mov ah,9
    int 21H
endm

read_kbd_and_echo macro
    mov ah,1
    int 21H
endm

set_dta macro buffer
    mov dx,offset buffer
    mov ah,1AH
    int 21H
endm

search_first macro fcb
    mov dx,offset fcb
    mov ah,11H
    int 21H
endm

search_next macro fcb
    mov dx,offset fcb
    mov ah,12H
    int 21H
endm

delete macro fcb
    mov dx,offset fcb
    mov ah,13H
    int 21H
endm

display_char macro character
    mov dl,character
    mov ah,2
    int 21H
endm

;
0000      cseg      segment para public 'CODE'
;          assume  cs:cseg,ds:data,ss:stack
;
; purg      proc      far                ;ENTRY POINT FROM DOS
0000      push     ds
0001      sub      ax,ax
0003      push     ax
0004      mov      ax,data                ;set up for return to DOS
0007      mov      ds,ax                ;set up data register
0009      pl:      display si            ;prompt for drive
0009      BA 00A4 R
+

```

Listing continued

tures unavailable in other word processors. And WordStar is one of the only word processors currently available for both the 8- and 16-bit computers over a wide spectrum of hardware implementations. This feature alone provides unheralded compatibility and ease of adaptation.

Multiplan

After spending last month on a data base manager (dBase II) and the first part of this column on a word processor (WordStar), I'll round out your software library with an excellent spreadsheet. Multiplan (Microsoft Inc.) is a second generation spreadsheet that features creation of multiple windows, linked spreadsheets, data sorting, and an easy English command structure. Multiplan also contains a powerful Help facility (for a full review of Multiplan, see).

Multiplan requires 128K of memory and permits worksheets to expand to use any extra memory installed in your 2000. Your current worksheet remains in memory at all times and you can link any worksheet to another for external data.

Multiplan provides a worksheet of rows and columns up to 63 columns wide and 255 rows long. Cells (the intersection of a row and a column) can contain numeric values, alphanumeric strings, or formulas. You can format each cell in a number of ways to match your needs.

If you're a VisiCalc user, you can interface all your VisiCalc spreadsheets with Multiplan. When you use the Transfer Options command, Multiplan can load VisiCalc files directly. After reading the file, Multiplan converts the VisiCalc command statements into equivalent Multiplan statements. You can set the transfer option back to normal and save the resulting spreadsheet in Multiplan format. Multiplan automatically compensates for operator precedence, names of functions and order of arguments, and conversion of all cell references to relative references.

You can use all your VisiCalc spreadsheets from another computer with Multiplan on the Model 2000, too. All you need is a communications program for both computers, and a null modem and cabling to connect the RS-232 interfaces. For example, the serial interface cable (Radio Shack

Listing continued

```

000C B4 09      +      mov ah,9
000E CD 21      +      int 21H
                        read_kbd_and_echo      ;get drive
0010 B4 01      +      mov ah,1
0012 CD 21      +      int 21H
0014 3C 61      +      cmp al,"a"
0016 7C 02      JL      p2      ;It's OK, input was upper case
0018 2C 20      sub     al,20H      ;else convert to upper case
001A 2C 40      sub     al,40H      ;Drive "A" = 1, "B" = 2 etc.
001C 3C 01      cmp     al,01H      ;now check if request is valid
001E 74 0D      je      go_ok      ;0 is ok!
0020 3C 02      cmp     al,02H      ;1 is ok! ... but no others
0022 74 09      je      display_sla      ;display error message

0024 BA 00C4 R   +      mov dx,offset sla
0027 B4 09      +      mov ah,9
0029 CD 21      +      int 21H
002B 7A DC      jp      p1
002D A2 0000 R   go_ok: mov     fcb_area,al      ;drive # is first in FCB
0030 B0 3F      mov     al,"?"      ;wildcard file name
0032 BE 0000 R   mov     si,offset fcb_area
0034 46      inc     si      ;point to start of file name
0036 B9 000B R   p3:  mov     cx,11      ;11 characters for file name
0038 8B 04      mov     si,[si],al      ;store "?"
003A 46      inc     si      ;bump index pointer
003C E2 FB      loop    p3      ;do it 11 times
                        set_dta dta_area      ;set up Disk Transfer Address
003E BA 0024 R   +      mov dx,offset dta_area
0041 B4 1A      +      mov ah,1AH
0043 CD 21      +      int 21H
                        search_first fcb_area      ;Get first DIR entry and put to
                                                dta_area
0045 BA 0000 R   +      mov dx,offset fcb_area
0048 B4 11      +      mov ah,11H
004A CD 21      +      int 21H
004C 3C 00      cmp     al,00H      ;check if a file was found
004E 74 09      je      cont      ;go if found
                        display s2      ;else display message
0050 BA 00E5 R   +      mov dx,offset s2
0053 B4 09      +      mov ah,9
0055 CD 21      +      int 21H
0057 7A 31      jp      home      ;and exit
0059 E8 000B R   ; cont: call show_fname      ;Display file name and get
                                                information
005C 3C 59      cmp     al,"y"      ;Delete current file ?
005E 75 14      jne     next      ;go if not
                        delete dta_area      ;else erase current file
0060 BA 0024 R   +      mov dx,offset dta_area
0063 B4 13      +      mov ah,13H
0065 CD 21      +      int 21H
0067 3C 00      cmp     al,00H      ;was it erased ?
0069 74 09      je      next      ;go if it was erased
                        display s3      ;else display error message
006B BA 00F7 R   +      mov dx,offset s3
006E B4 09      +      mov ah,9
0070 CD 21      +      int 21H
0072 7A 16      jp      home      ;and exit on this "system" error
0074 3C 51      cmp     al,"Q"      ;quit program ?
0076 74 0B      je      done      ;yes
                        search_next fcb_area      ;get next file name
0078 BA 0000 R   +      mov dx,offset fcb_area
007B B4 12      +      mov ah,12H
007D CD 21      +      int 21H
007F 3C 00      cmp     al,00H      ;More if 0
0081 74 D6      je      cont
                        ; done: display s4      ;All finished
0083 BA 010A R   +      mov dx,offset s4
0086 B4 09      +      mov ah,9
0088 CD 21      +      int 21H
008A CB      home: ret      ;go home to mama
008B      purg endp
                        ;
008B      show_fname proc near      ;ask user
                        display crlf      ;new line
008B BA 0158 R   +      mov dx,offset crlf
008E B4 09      +      mov ah,9
0090 CD 21      +      int 21H
0092 BE 0024 R   +      mov     si,offset dta_area      ;set up to display file name
0094 46      inc     si      ;point to first file name character
0096 B9 000B R   display: mov     cx,11      ;11 characters to display
0098 8A 04      displ:  mov     al,[si]      ;get character
                        display_char al      ;display it
009B 8A D0      +      mov dl,al
009D B4 02      +      mov ah,2
009F CD 21      +      int 21H
00A1 46      inc     si      ;bump for next
00A2 E2 F5      loop    displ      ;do it 11 times
                        display s5      ;what to do ?
00A4 BA 0126 R   +      mov dx,offset s5
00A7 B4 09      +      mov ah,9
00A9 CD 21      +      int 21H
                        read_kbd_and_echo      ;get response (Y,N,Q)
00AB B4 01      +      mov ah,1
00AD CD 21      +      int 21H
00AF 3C 61      cmp     al,"a"      ;lower case ?
00B1 7C 02      jl      uppercase      ;convert to uppercase
00B3 2C 20      sub     al,20H      ;This is valid
00B5 3C 59      cmp     al,"y"
00B7 74 11      je      ok      ;Also valid
00B9 3C 4E      cmp     al,"N"
00BB 74 0D      je      ok      ;Also valid
00BD 3C 51      cmp     al,"Q"
00BF 74 09      je      display_s6      ;Invalid response handling
00C1 BA 0138 R   +      mov dx,offset s6
00C4 B4 09      +      mov ah,9
00C6 CD 21      +      int 21H
00C8 7A CC      jp      display
00CA C3      ok:  ret
00CB      show_fname endp
00CB      cseg ends
                        ;
00CB      data segment para public 'DATA'
00CB      fcb_area db 36 dup(?)
0000      24 [

```

Listing continued

#26-1408) and null modem (#26-1496) let you connect your Model III/4 to your 2000.

Next, load your communications software on both computers and set the RS-232 interface's protocol to the same values on both computers (baud rate, stop bits, word length, and parity). Follow the instructions for your software and get the Model 2000 in the File Receive mode (download). Then set up the Model III/4 in the File Send mode (upload) and begin transmitting.

Sounds simple, doesn't it? You might have to experiment with the software somewhat, but I find that I can generally transfer text and source files between computers at up to 9,600 baud (Videotex's current limit).

Data Ace

The last software package for this month's column is Data Ace, a powerful, state-of-the-art relational data base manager (Computer Software Design Inc., available from Radio Shack on the Express Order System). Data Ace is available for most of the Radio Shack product line.

Data Ace
Computer Software Design Inc.
1911 Wright Circle
Anaheim, CA 92806
Radio Shack Express Order Software
90-0101
\$645

Microsoft's Multiplan
Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102
26-5311
\$249

Videotex Plus
Tandy/Radio Shack
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Fort Worth, TX 76102
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\$49.95

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MicroPro International Corp.
33 San Pablo Ave.
San Rafael, CA 94903
Radio Shack Express Order Software
90-0105
\$495

Table 2. Model 2000 product index.

Listing continued

```

??
]
0024 80 [ ?? dta_area db 128 dup(?)
]
00A4 45 6E 74 65 72 20 s1 db "Enter drive (letter only) ==> $"
64 72 69 76 65 20
28 6C 65 74 74 65
72 20 6F 6E 6C 79
29 20 3D 3D 3D 3E
20 24
00C4 0D 0A 4F 6E 6C 79 sla db cr,lf,"Only drives A or B are legal",cr,lf,eom
20 64 72 69 76 65
73 20 41 20 6F 72
20 42 20 61 72 65
20 6C 65 67 61 6C
0D 0A 24
00E5 0D 0A 4E 6F 20 66 s2 db cr,lf,"No file found",cr,lf,eom
69 6C 65 20 66 6F
75 68 64 0D 0A 24
00F7 0D 0A 49 6E 74 65 s3 db cr,lf,"Internal error",cr,lf,eom
72 6E 61 6C 20 65
72 72 6F 72 0D 0A
24
010A 0D 0A 50 75 72 67 s4 db cr,lf,"Purge function complete",cr,lf,eom
65 20 66 75 6E 63
74 69 6F 6E 20 63
6F 6D 70 6C 65 74
65 0D 0A 24
0126 20 20 44 65 6C 65 s5 db " Delete (Y,N,Q) $"
74 65 20 28 59 2C
4E 2C 51 29 20 24
0138 0D 0A 49 6E 76 61 s6 db cr,lf,"Invalid response, try again",cr,lf,eom
6C 69 64 20 72 65
73 70 6F 6E 73 65
2C 20 74 72 79 20
61 67 61 69 6E 0D
0A 24
0158 0D 0A 24 crlf db cr,lf,eom
015B data ends
;
; stack segment para stack 'STACK'
0000 80 [ ?? db 128 dup(?)
0000 ]
0000 stack ends
; end purg

```

End

Because it's a second-generation development, Data Ace doesn't suffer from many of dBase II's limitations. For example, Data Ace lets you use up to 12 relations (data bases) at once and has little delay when opening and closing files. dBase II is limited to a primary and one secondary data base and you can experience a significant delay when opening and closing files, particularly if the program writes updated information to the disk. dBase II is limited to 65K records while Data Ace has no limit on the number of records a relation can contain.

Data Ace consists of several parts. First, the data interrogation language (DIL) gives you full use of the data base and is the first active level you encounter. With DIL, you can easily add, delete, change, or list data contained in the data base.

Data Ace's data manipulation language (DML) contains an interpreter and a compiler. DML is block structured and provides facilities for manipulating up to 12 files concurrently. DML is also Data Ace's interface with the outside world.

The data definition language (DDL) establishes the fields, relations, and views stored in the data dictionary. DDL is the heart of the data base management system—this is where you initially set up the structure of the data base and subsequently edit it as needed.

Computer Software Design provides benchmark comparison timing for an application run on three different 16-bit computers, including the Model 2000. This comparison also includes timing for an equivalent task written in dBase II and run on the 2000 (see Table 3). I haven't personally verified these timing comparisons.

Data Ace is a fast, powerful data base management system. However, it has a few significant drawbacks. Personally, I don't like being forced to use only uppercase characters to communicate with Data Ace.

Second, the DML is a structured programming language derived from Forth. Data Ace fully explains the DML and you don't need any prior knowledge of Forth to use the program. However, since the DML has its basis in Forth, it forces the user to program in a similar manner. The most significant aspect of this design is that you must encode all expressions in reverse Polish notation. For example,



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26-1080 Model 4P Portable	\$1499.00	\$1275.00
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you have to encode a simple expression like the Basic statement $((A+B)/C) - ((D+E)/F)/G$ as follows in DML: $A B + C / D E + F / - G /$. From the above example, you can see that reverse Polish notation looks like Greek to most users.

Last, all numeric fields in Data Ace fields are double-precision integers. You're responsible for properly scaling the data through multiplication and division to ensure that the software handles fractional data correctly. In addition to reverse Polish notation, this is extremely confusing.

You must really see this package to make a decision concerning its usefulness. I like Data Ace—it's a strong contender in the data base management field. I wouldn't recommend it as an entry-level system unless you have requirements outside the limits of dBase II.

Express Order System

Since I've used this term twice, I owe you an explanation of the system. As you probably know, Radio Shack

is marketing prominent third-party software for their computer line. Now you can order other packages through the Express Order System (EOS).

EOS software is stocked at the Tandy Electronic Warehouse under product number series 90-XXXX. Radio Shack stores will take orders for this merchandise as for any other store product. The customer must give his

Computer System	Execution Time
IBM PC/XT	27 seconds
Victor 9000 (with hard disk)	23 seconds
Model 2000 (with floppy disks)	20 seconds

The equivalent program written in dBase II executed in one minute and 55 seconds.

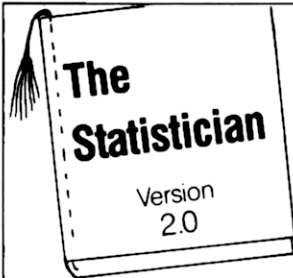
Table 3. Data Ace timing comparisons for the bill of materials reporting program. The marketing support division of Computer Software Design provided the times listed below as a measure of Data Ace's performance. I have not verified them.

name and the full purchase price to the ordering store prior to their placing the order in Fort Worth.

This software is not supported by Radio Shack's Computer Customer Service as are the other software products (product numbers in the series 26-XXXX) sold for the Model 2000. You will receive the phone number for the original vendor and must contact that company if you need product service or information. Radio Shack local store personnel will not contact Fort Worth with questions on this software.

Normal shipment for EOS software is 24 hours. The Store Operating System processes orders for software and transmits them to Fort Worth on a daily basis. EOS products are shipped via UPS ground service and can take two to four days for delivery. ■

Contact John B. Harrell III c/o this column, 80 Micro, 80 Pine St., Peterborough, NH 03458 or via Compu-Serve at 73016,1326.



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Macros:

Name	Length
DELETE	0002
DISPLAY	0002
DISPLAY_CHAR	0002
READ_KBD_AND_ECHO	0001
SEARCH_FIRST	0002
SEARCH_NEXT	0002
SET_DTA	0002

Segments and groups:

Name	Size	align	combine	class
CSEG	00CB	PARA	PUBLIC	'CODE'
DATA	015B	PARA	PUBLIC	'DATA'
STACK	0080	PARA	STACK	'STACK'

Symbols:

Name	Type	Value	Attr
CONT	L NEAR	0059	CSEG
CR	Number	000D	
CRLF	L BYTE	0158	DATA
DISPL	L NEAR	0099	CSEG
DISPLY	L NEAR	0096	CSEG
DONE	L NEAR	0083	CSEG
DTA_AREA	L BYTE	0024	DATA Length = 0080
EOM	Number	0024	
FCB_AREA	L BYTE	0080	DATA Length = 0024
GO_OK	L NEAR	002D	CSEG
HOME	L NEAR	008A	CSEG
LF	Number	000A	
NEXT	L NEAR	0074	CSEG
OK	L NEAR	00CA	CSEG
P1	L NEAR	0009	CSEG
P2	L NEAR	001A	CSEG
P3	L NEAR	0039	CSEG
PURG	F PROC	0000	CSEG Length = 008B
S1	L BYTE	00A4	DATA
S1A	L BYTE	00C4	DATA
S2	L BYTE	00E5	DATA
S3	L BYTE	00F7	DATA
S4	L BYTE	010A	DATA
S5	L BYTE	0126	DATA
S6	L BYTE	0138	DATA
SHOW_FNAME	N PROC	008B	CSEG Length = 0040
UPPERCASE	L NEAR	00B5	CSEG
Warning Severe Errors			
Errors Errors			
0			

Table 4. Macros for the Program Listing.

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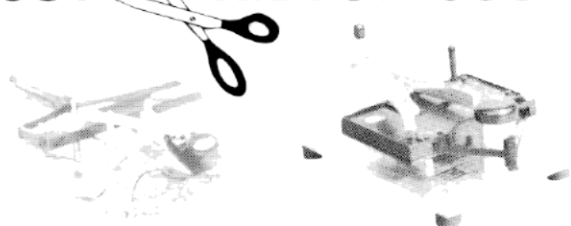
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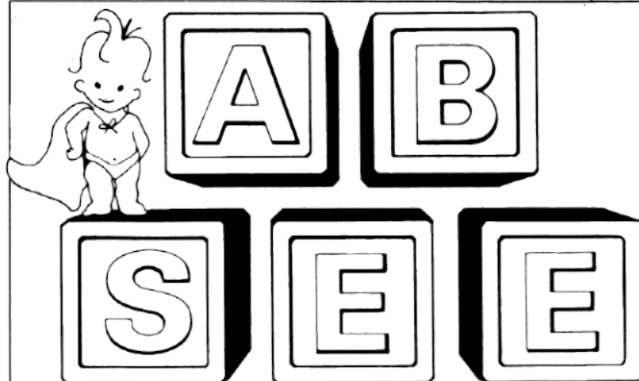
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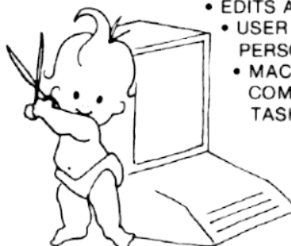


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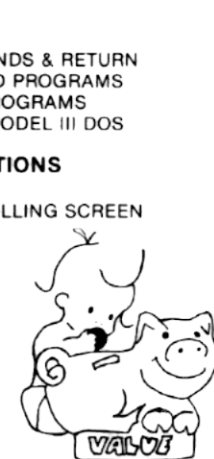
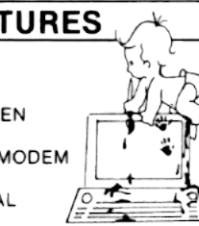
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★ Test Proven

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 retries. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were tallied and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

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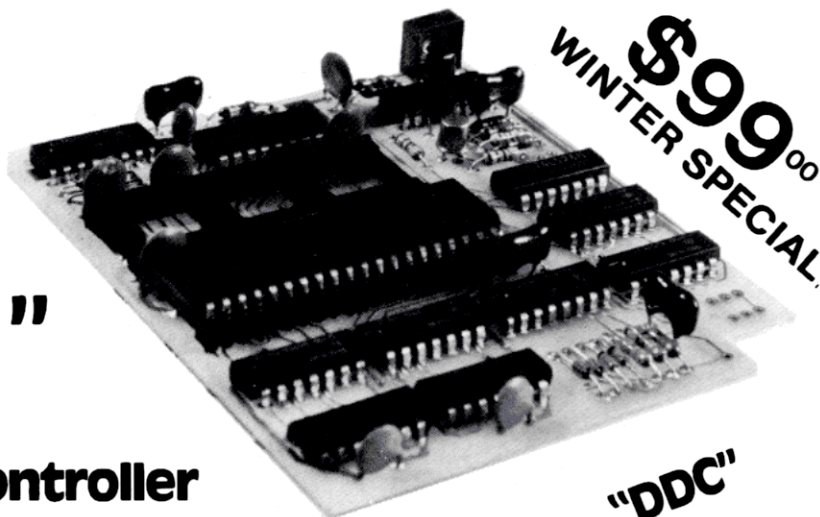
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★ TEST RESULTS ★

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

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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".

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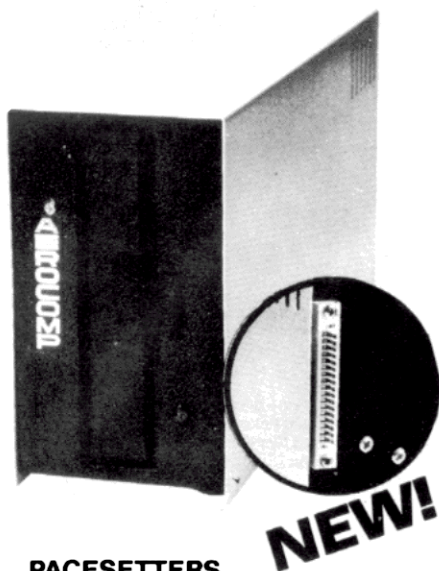
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Rules

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.



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Continued from p. 38

has created and produces either relocatable or absolute files. (A major deficiency in both MisoSys' EDAS editor/assembler and Radio Shack's EDTASM is their inability to produce relocatable files.)

Advanced programmers will recognize the value of an assembler like ALDS that supports macros (see Table 3 for a summary of this and of other assembler features). You'll find macros useful if you need the same source lines several times in your program. Once defined, macros let you refer to the section of code by the label that defines it. You no longer need to insert each instruction within the macro: The assembler automatically inserts the instruction sequence when it recognizes the macro label in the opcode field of your source program. Another useful feature of macros is that you can pass up to 10 dummy parameters to the macro.

The assembler lets you control which portions of the program you print during the assembly listing. ALDS also allows many useful instructions that manipulate the location counter such as ORG, LITORG, RESLOC, SETLOC, and PSECT.

The ALDS assembler can do conditional assemblies that let you assemble portions of a source file or code seg-

ments if a predefined condition is true. When writing a program for both Models III and 4, for example, you may want to assemble a segment of code only for the Model 4. You can include a conditional statement just before the code segment you want to assemble if the condition is true.

Undocumented Z80 Instructions

Have you ever tried to load the lower byte of the IX or IY register with a byte value (LD IX,A or LD IY,A)? These are undocumented Z80 instructions. Since the IX and IY index registers are 16 bits wide (a word) you cannot, in theory, load an 8-bit (1-byte) value directly into the low-order or high-order 8 bits. ALDS supports many of these undocumented opcodes as well as many extended Z80 instructions that are internally defined macros.

An example of an extended instruction is the TZ operand which tests a register pair for zero and sets the Z flag accordingly. TZ BC is expanded to:

```
LD  A,B
OR  C
```

If both the B and C registers contain zero, the Z flag is set. If either register contains a non-zero value, the program resets the Z flag. This instruction also allows you to test the use of the IX and IY registers in a similar fashion. Note that Zilog doesn't support or document such use of the index registers. Although the instructions should assemble properly, they may not work on all processors, so be sure to test them in the target environment.

The macro library extending the Z80's instruction set is a handy feature. Some of the extensions appear like those found on the 8088/86 Intel processors. For example, the command CMPD Op1, Op2,(Length) compares the string pointed to by Op1 to the string beginning at Op2. "Length" specifies the length of the strings. The program decrements the pointers Op1 and Op2 after each Compare instruction and sets the Z flag to reflect the result of the comparison. CMPI performs a similar comparison while incrementing the pointers.

The Linker

The Linker converts a relocatable file into an absolute file. Think of it as

a chain that is incomplete until all its individual links are connected. Similarly, when many modules or relocatable files are linked, they create a complete program.

The Linker directives PSECT, Public, EXTERN, Global, GLINK, and Link instruct the Linker to connect external modules and symbols. Table 4 lists options available through the Linker. The ALDS linker represents a great improvement over EDTASM. According to the documentation, "The Linker links up to 200 external program sections (PSECTs). The Linker Symbol table holds at least 2,000 external symbols...The maximum absolute object file which the Linker creates can be as large as TRSDOS will load."

The Debugger

ALBUG, the ALDS debugger, has all the features of Model III/4 standard Debug as well as added features such as setting permanent breakpoints with pass counts and temporary breakpoints. You can also execute one or more instructions at a time, specify

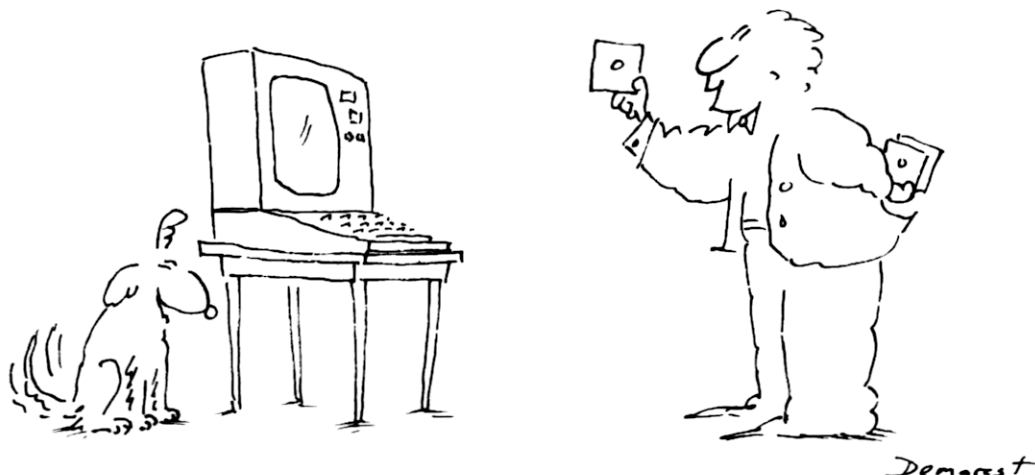
Directive	Function
EXTERN	Signifies that label is defined in another module
PUBLIC	Allows another module to reference label by declaring it EXTERN
PSECT	Marks files as relocatable
DEFB	Defines byte
DEFE	Defines encrypted string
DEFL	Defines label
DEFM	Defines memory
DEFR	Defines Roman numeral string
DEFS	Defines storage
DEFT	Defines string with first byte = length of string
DEFW	Defines word
APUSH	Saves current print status
APOP	Restores print status
MACRO	Begins a section of code that performs a specific function
ENDM	Terminates macro section

Table 2. Directives available with ALDS's assembler.

Command	Description
(Arrow Keys)	Controls cursor
C/string 1/ string 2/n	Changes string 1 to string 2 for a specified number of times
D	Deletes a line or block of lines
E	Edits the current line pointed at by cursor
F/string/n	Finds a string
K	Kills text in buffer
H	Prints all or part of text in buffer
I	Inserts a line
J	Displays text size and amount of free memory in buffer
L filespec (\$C)	Loads a file into buffer; chains file to end of text already in buffer (optional)
W	Writes text buffer to disk
M	Moves block of text from one part of file to another

Table 3. Command features available with ALDS's editor.

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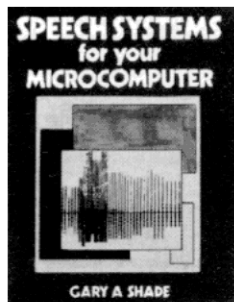
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a memory address as an offset (used when debugging relocatable code), and change the contents of a disk file using the disk zap mode.

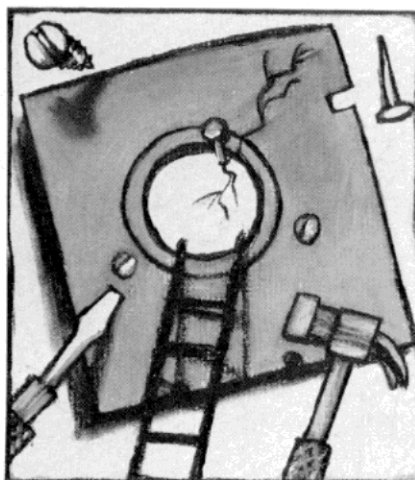
When displaying memory, the program shows all registers along with any breakpoints set. One of the most useful features of the display is that the disassembly of the object code that the program counter points to (the PC register) appears on the screen.

The File Transfer Utility

ALTRAN, the file transfer utility, lets you transfer programs you develop with ALDS to any Z80-based TRS-80 (Models I, II, III, 4, 12, and 16). You don't need a modem to transfer the programs since the communications package works with or without one. You need the Model II ALTRAN package to transfer programs from the Model III or 4 to a Model I, II, 12, or 16. The documentation details the hardware and general setup of each machine you need to make the transfer. You can transfer source files, object files, and data files with ALTRAN. This utility lets you develop software on the Model III or 4 computer for any of the other Tandy Z80 machines and transfer the finished product to the target machine with little difficulty.

Problems

Several bugs in the Linker appeared when I linked 32 modules and some 14,000 bytes of object code. If there are too many undefined external labels (approximately 15), the program



hangs, bombs, reboots, or fills the screen with garbage. While none of my source programs or relocatable files on disk were harmed, it was a nuisance until I found where all the unresolved labels originated, declare them as public, and reassemble the modules.

Another problem surfaced when I used the assembler with the W switch, the Wait-on-Error option. Only odd-numbered errors stopped the assembly. Should your source program contain an error, the first error encountered stops the assembly for your inspection. The next error doesn't stop the assembly, though the error is marked on the listing.

Other than these two significant flaws in the development system, I encountered no other problems. The system handled all small program linkage without hanging up or bombing. (I've used this system to link a 14,000-byte program containing nearly 900 labels.)

Documentation

The 376-page ALDS manual is excellent. Generous examples throughout the text detail sample uses of each directive and of the extended instructions in the package. The standard Z80 instruction set in chapter 9, the same as that found in EDTASM or Radio Shack's Series I Editor/Assembler, is similarly excellent. The documentation is not a tutorial, though; while it clearly presents how to use each portion of the ALDS package, it assumes that you're already familiar with Assembly language.

Conclusion

If you're a casual or a novice Assembly-language programmer, ALDS

isn't for you; I recommend you buy EDTASM and some good books on Z80 programming instead. But if you're serious about programming and want a development package that represents the state of the art, ALDS isn't only a must: At \$149, it's a bargain. ■

Disk-Zapping On the Model 4/4P

by Terry Kepner

Every Model 4/4P owner should own a copy of Super Utility 4/4P, a streamlined version of Powersoft's disk-zap utility adapted to the unique all-RAM environment of the Model 4/4P. Super Utility will pay for itself as soon as you recover one important file.

Super Utility Plus users will find Super Utility 4/4P to be almost identical in capabilities, though some of the procedures in the 4/4P version are different. (For a comprehensive review of Super Utility Plus 3.1a, see *80 Micro*, October 1983, p. 110.) You still have the Zap, Purge, Format, Back-up, Repair, Memory, File, and Configuration utilities. In addition, Super Utility 4/4P offers other functions (see Table 5).

The only significant differences between Super Utility Plus and Super Utility 4/4P are increased buffer space (by about 16K), faster operation

Directive	Function
Map	Produces each PSECT name, start address, the program's start, end, and transfer addresses
XREF	Cross-references alphabetically each symbol declared Public or External, the absolute address of the label, and all addresses referencing the label
SYM	Prints alphabetical listing of each Public or External symbol
Disk	Saves listings produced by SYM, XREF, or Map to disk
PRT	Directs output to printer

Table 4. Options available through ALDS's linker.

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(thanks to the 4/4P's 4 MHz system clock), removal of the cassette input/output capability, a simplified system configuration screen, support of the TRSDOS 6.X disk format in addition to all the other TRS-80 formats, and removal of the Jump-to-Memory and Memory-to-Track routines (increasing the buffer space, although you can still perform memory-to-disk and disk-to-memory transfers).

But if, like me, you were hoping that Super Utility could help you fix your blown CP/M disks, you'll be disappointed: Unlike the Model 4/4P itself, Super Utility 4/4P does not support CP/M. Lack of standardization in the 5¼-inch CP/M disk formats makes it impractical to support them and all the TRS-80 formats. The 512-byte sectors that some CP/M computer manufacturers use would require redesigning many of the Super Utility 4/4P displays.

Another surprise was that Super Utility 4/4P's screen display is like that of a Model I/III's—64 characters

wide by 16 lines long. Of course, the advantage to keeping the display the same size as that on the Model I/III is that Powersoft could use much of Super Utility Plus's code, making only minor revisions in the documentation, and thus releasing the 4/4P version so quickly. ■

Command	Function
F1	Returns you to the main menu
F2	Toggles the sound function to beep whenever a prompt appears
F3	Takes you to the configuration screen
Clear-A	Toggles the small graphics characters in and out of motion
Clear-V	Displays the program's version number
Clear-S	Displays the program's serial number
Clear-W	Displays the program's author credits

Table 5. Additional commands available with Super Utility 4/4P.

Tune In, Log On With Videotex Plus

by M.J. Batham

If Videotex Plus were the only Model 4 communications software on the market, I'd certainly buy it. But even though its price is reasonable, I can't recommend the package to the first-time user who would have to learn hexadecimal codes in order to operate it.

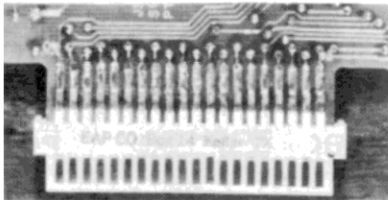
Videotex Plus uses the Model 4's full 80-column by 24-line screen display. It comes with one free hour of non-prime-time use, an ID number, and passwords for the Dow Jones News/Retrieval Service and for CompuServe. The package also includes instruction manuals for the communications program, for CompuServe, and for Dow Jones.

In addition to the software, you need a modem for telecommunications. Videotex Plus supports an auto-answer/auto-dial modem; 110, 150,

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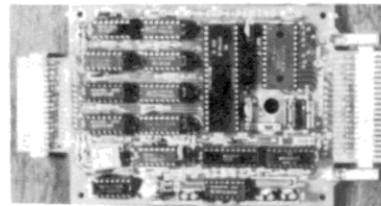


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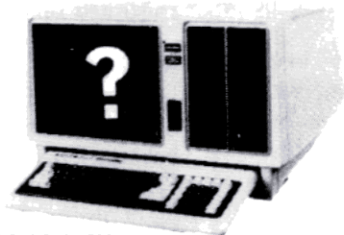
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300, 600, 1200, 2400, 4800, and 9600 baud speeds; and both full- and half-duplex communications. I tested the program using the Modem I (which is limited to 300 baud speed and has no auto-dial/auto-answer capability), and the Rixon 212A modem (which offers 300/1200 speed and auto-dial/answer features). The software worked well with both.

Special Features

An essential feature in a communications package is flexibility in setting communications parameters. Three hundred and 1200 baud speeds are the most common, as are 8-bit word length, no parity, and 1 stop bit, or, for CompuServe, 7-bit length, even parity, and 1 stop bit. The program defaults to the 8-bit length, no parity, 1 stop bit setting used by most bulletin boards, MCI mail, and Dow Jones. You can select any of the 12 UART (Universal Asynchronous Receiver Transmitter) configurations for telecommunications.

Videotex Plus supports dialing from the keyboard and auto-dial and auto log-on settings—features important to Modem II or Hayes/Rixon modem owners.

You can prerecord strings of information—a password, user ID, or other information needed to access another computer or an information service. You can define up to 10 keys with clear-F. After creating each key string, you can save the key function to disk and create different file names for other sets of 10 keys. Or you may pre-

fer to have the same 10 keys appear each time you load the program by calling the file name vidtex.

While running Videotex Plus, you can turn the printer on by pressing either the clear or control key and then the R key, or off using the same sequence with the T key.

You can upload and download files created off-line while on-line with the host computer, saving dollars of connection time fees. The Videotex Plus program also supports XMODEM protocol—a technique for verifying file transmissions from one computer to another.

The most significant difference between Videotex and Videotex Plus is the latter's capture buffer feature. Using the Meta keys (from the Greek, meaning "to change"), you can manipulate the RAM buffer in various ways (see Table 6).

The manual warns that a full, edited buffer may be too large to reload into Videotex, and suggests that you use clear-S only with a word processing program that can capture a long file. It suggests using clear-A (abort) when prompted for a file name to cancel the save operation, though this defeats the purpose of the capture buffer itself.

The program has some nice features with the auto log-on techniques. You can create as many log-on files as you have room for on the disk, or specify which disk contains the log-on file, if you have a two-drive computer.

Separate communication settings can be set up for each file. You can set pauses in dialing or delays in the auto log-on commands. If it doesn't establish the connection with the host computer right away, the program keeps trying the phone number until the host answers.

You can change full- to half-duplex operation easily, and the program supports the XON/XOFF functions (non-visible characters that one computer sends to another to tell it to resume or stop transmitting, respectively).

VIDTEX S is another feature in the software package that allows you to load a program, select a menu choice, log on to a store-and-forward information service, and receive and save up to 48 pages of text.

The VIDEDT portion of the program is menu-driven and sets up auto-dial and auto log-on files, prints them out, and saves them to disk.

Documentation

Videotex Plus's documentation isn't designed for the first-time user. If I had just purchased a Model 4, unpacked it from the box, and attempted to use Videotex, I would have become frustrated very quickly.

The 43-page manual has plenty of blank spaces. Rather than referring me back to the complicated Model 4 owner's manual, the author should have included a paragraph explaining how to format and back up the program disk.

The VIDEDT portion of the program (to create auto log-on and auto-dial files) requires some technical expertise: You must set up the files in hexadecimal code!

To make matters worse, there were bugs in the manual especially confusing for a new user. The first line of a sample log-on file on page 10, for example, reads "[WC||P2]"—meaning "Wait for carrier tone detect and pause two seconds." But the step-by-step instructions show "<control>

Videotex Plus



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Command Function

Clear-O	Opens buffer to capture data (instead of displaying, then losing information)
Clear-S	Saves edited version of buffer information to disk
Clear-U	Saves file to disk exactly as received (useful for graphics pages)
Clear-C	Closes buffer
Clear-Z	Clears buffer (after you save file to disk)
Clear-D	Displays buffer contents (control-S stops, control-Q continues, and clear-A aborts display)
Clear-G	Saves copy of screen in memory without opening up buffer
Clear-L	Loads a saved file from disk (error message displayed for a file too large)
Clear-V	Transmits file just loaded to the host computer (saves connect time since you create file at any time, and send it quickly while being charged for connection fees)
Clear-Y	Lets you upload buffer contents one line at a time
Clear-P	Prints RAM buffer contents (after either clear-R or control-R has turned printer on)

Table 6. Videotex Plus's Meta keys manipulate the RAM buffer.

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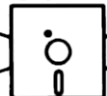
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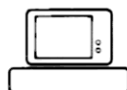
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<|> WN<|> <control><|>WC<|>” —meaning “Don’t wait for the carrier tone.” The sample on this page appears in both upper- and lowercase type. When I typed in the hexadecimal codes in lowercase, I kept getting error messages until I realized that hex codes require uppercase.

Pages 14-21 illustrate three methods of using an auto log-on file for communications. Method A, the most difficult and confusing, appears first, with B and C, the easier methods, shown after I wasted time learning method A. Why doesn’t the most efficient method appear first?

There are good illustrations and instructions using the Meta keys and the control keys needed to edit files. But the patch addresses for Meta-Q are most confusing and no examples were given.

The manual needs a short glossary to define esoteric terminology, as well as an index.

Drawbacks

Other communications packages such as Microterm (Micro Systems Software) set up files using “1200” for speed or “8” for word length or “E” for parity. I find this much easier to use than the Videotex system of [77] for 1200 baud, or [E4] for 8-bit length and even parity.

Another problem with the definition of the Meta keys is that clear-P or control-P turns the printer on. In CompuServe, I frequently use the control-P to politely break a scrolling message and return to the main menu. A control-C is a rude way of stopping the program, and sometimes takes me out of the special interest group and back to CompuServe’s main menu.

You also can’t go into DOS from Videotex Plus and then return. If, for instance, you want to upload a file while on-line, but have forgotten the file name’s exact spelling, you have to log off, exit the program, get the directory, reload the program, and redial the host computer.

You also can’t use the Model 4’s built-in clock to generate a message later on. CompuServe is busiest between 7 p.m. and 10 p.m. weeknights. But with Videotex Plus you can’t upload or download E-mail at 3 a.m. as you can with other communications software.

Three other minor features this program lacks are: a translation table (to send ASCII codes your Model 4 may not have), generation of a true Break signal (as opposed to a control-C), and the ability to add a line feed or a carriage return in case the host computer doesn’t send one. ■

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Spider-like Drut monsters have stolen the city’s fuel supply. As Hunting Harry, you get eight chances to explore the Drut’s volcano and retrieve the stolen fuel cells. Harry must evade the monsters and other obstacles before he can return the cells to the basements of the city’s buildings and win the game.

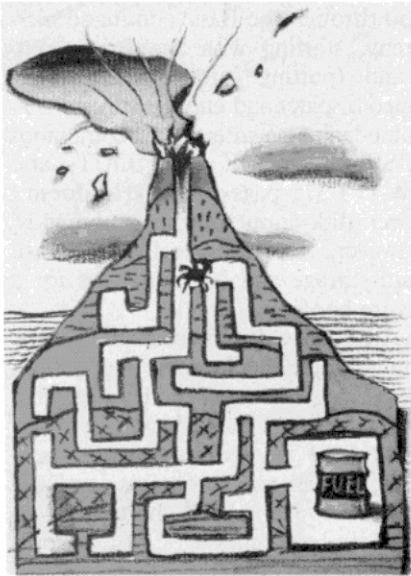
This is the scenario for Volcano Hunter, an ingenious machine-language, arcade-style adventure game. While Volcano Hunter doesn’t require fast reflexes, it’s notable for the 200 graphics screens that comprise the giant maze through which you travel. You control the game with the arrow keys and space bar or a joystick. The time bombs you drop by pressing the space bar blow up Druts but can kill Harry too, if you don’t drop the bombs strategically.

Volcano Hunter



Lap Video Entertainment
P.O. Box 1736
Mississippi State University
Mississippi State, MS 39762
Models I and III
16K RAM cassette, \$19.95
32K RAM disk, \$22.95

Good graphics?	★★★★☆
Good docs?	★★★☆☆
Fast?	★★★★☆
Challenging?	★★★★★



Overcoming Obstacles

As you guide Harry through the maze, you encounter new obstacles with each new screen. You don't see adjoining screens until Harry enters them, so remembering obstacles becomes a key skill to successful play.

Conveyor belts, water, and the volcano itself are all obstacles for Hunting Harry. The conveyor belts move him from one part of the maze to another, but they become an obstacle when they take Harry in the wrong direction.

Other obstacles that Harry must avoid are the drop-offs. Sometimes the drop-offs are on the next screen which is unseen. Harry must jump just before entering that screen in order to be safe.

The Druts have filled some of the maze with water. Harry's air supply, the level of which is displayed at the top of the screen, lets him travel through water, but when his air runs out you lose one of your men. Similarly, another gauge on screen measures body heat: If Harry remains near the vein of hot lava that flows through the active volcano, his body heat rises to a fatal level.

The Druts themselves are the most serious obstacles. They kill Harry on contact and appear just about anywhere. Some areas in the maze are safe from Druts: They can't get inside the buildings though they might appear on top of or beside them. Druts can't enter designated peace zones nor can you drop bombs there. But the Druts can appear in groups and surround

you. Sometimes they don't attack right away, waiting until you make a mistake and walk into them. If you're patient, they can go to sleep and you can walk right past them.

How to Score Points

You garner the most points by bringing back the fuel cells—worth 2,000 points each—to the city's basements. Transporting fuel cells successfully is the only way to get a high score. Getting fuel without returning it to the basement nets you only 50 points. You can collect all the fuel you want before returning to the basement, so you only have to make one return trip. Knowing your skill limitations is important since many of the same obstacles are present on the return trip.

Getting the gold that the Druts mine in the volcano gives you 200 points. A beamer (you'll know it when you see it) gives you 100–200 points. For every screen explored you get 20 points. Killing a Drut monster gives you from five to 45 points. A direct hit with your bombs scores more points than an indirect hit.

Documentation, Sound, and High Scores

The instructions provided with the game are minimal. For one thing, the documentation doesn't explain the pause feature. After much trial and error, I discovered that pressing the P key pauses the action, while pressing the C key continues the game.

The sound effects available through the cassette port are nice but not necessary for play.

My final criticism of Volcano Hunter is that you can't save high scores, something you routinely expect in a game of this quality. ■

Model 4/4P Basic For Neophytes

by Terry Kepner

As a Model 4/4P owner, you've discovered that the Basic manual that came with your machine is intended only as a reference tool. If you already know how to program in Basic, that's not a problem. But if the Model 4/4P is your first computer and you know nothing about Basic programming, then you need David A.

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by William Fink

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Lien's *Learning TRS-80 Model 4/4P Basic*.

Lien's prose is marked by the same style that won him awards for his manual *Learning Level I BASIC*: plain English explanations, humorous

Learning TRS-80 Model 4/4P Basic



CompuSoft Publishing
525 Broadway
El Cajon, CA 92021
483 pp.
\$19.95

Well written? ★★★★★
Organized? ★★★★★
Thorough? ★★★★★
Readable? ★★★★★

Overall, the book is well written and thoroughly researched, though it does have a few problems.

asides, important notes and suggestions set off from the rest of the text in graphic sidebars, cartoons to break the monotony, and simple examples to illustrate the point under discussion.

Course of a Course

Lien assumes you have a full-featured Model 4, with dual disk drives and 64K of memory, and that you have absolutely no idea of what you're doing. He starts off with the computer plugged in and sitting on your desk. From that point on, he tells you everything you need to do, including formatting and making a back-up of your system disk, and how to get into Basic.

Once you're in Basic, Lien takes

you through the Basic command hierarchy, starting with the Print command (putting information on the video display) and ending with the machine-language interfacing commands (USR, VARPTR, INP, OUT, and SWAP) 375 pages later. (He doesn't cover disk input/output commands, however, reserving the topic of disk data storage and its techniques for a future book.)

After these Basic commands come four chapters on flowcharting, debugging, chasing bugs, and identifying programming errors. Next are chapters on the answers to program exercises, special user programs, and the appendices (an ASCII chart, reserved word list, error messages, system commands, and a hexadecimal-to-decimal conversion chart).

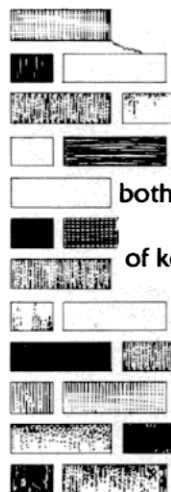
Lien divides his tutorial into eight main sections: getting started; elementary Basic; strings; variable precision and math; display formatting; arrays; miscellaneous information on graphics, PEEKs and POKEs; and program control. Each chapter introduces several new commands, gives several exercises to practice them, and summarizes the commands and concepts covered. Lien provides an answer key, along with explanations, at the end of the book.

Overall, the book is well written and thoroughly researched, though it does have a few problems. Lien fails to explain some details. For example, he mentions that bulk-erasing disks "wakes up" the iron oxide granules, without explaining what they are or what they do.

Some references to the programming exercises don't match up with the actual programs listed in the answer section. For example, he says line 20 in exercise 7-1 has an exclamation point at the end of the line when there isn't one in the entire exercise program. Perhaps the most serious error is Lien's suggestion that it's all right to break out of a For...Next loop without properly terminating it. It isn't: Doing so leaves garbage on the Basic stack pointer, which will crash a program with a "Next without For Error" and confuse the novice programmer.

Fortunately, these errors are few and far between. As a Basic self-teaching manual, David Lien's book is the best. ■

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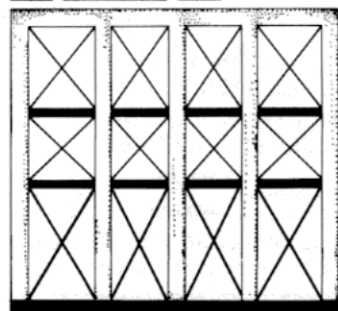
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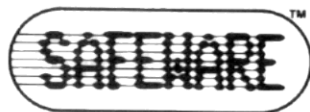
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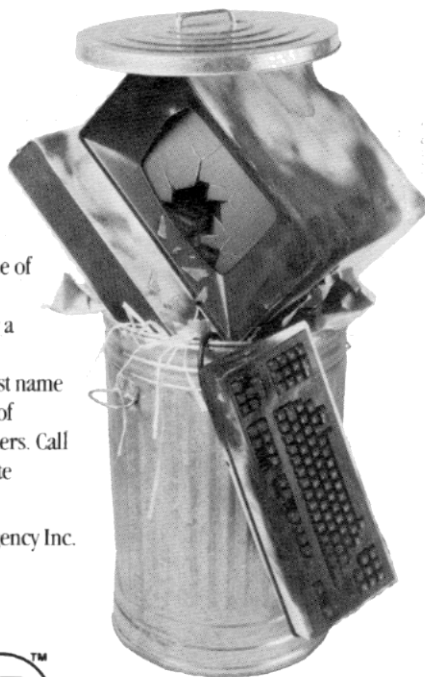
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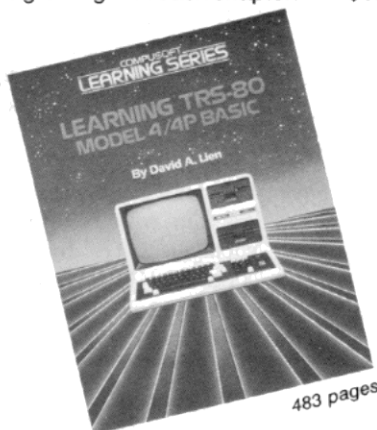
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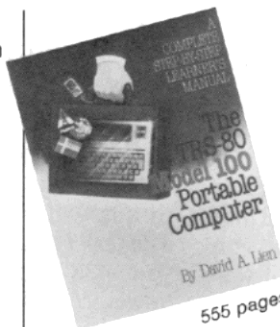
By **David A. Lien**

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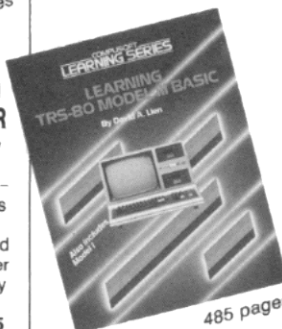
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THE TRS-80 MODEL 100 PORTABLE COMPUTER

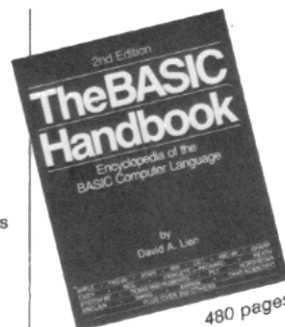
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PC Comptroller is the Institute for Scientific Analysis Inc.'s fully integrated, menu-driven business accounting system for the Models I and III. The package handles all business accounting functions, including general ledger, accounts payable, accounts receivable, and payroll, and updates all files automatically.

The program costs \$695, comes with three manuals and three disks, and runs in 48K of memory. For more information contact the Institute for Scientific Analysis at 36 E. Baltimore Pike, Media, PA 19063, 215-566-0801 (800-441-7680 for orders).

Reader Service ✓ 554

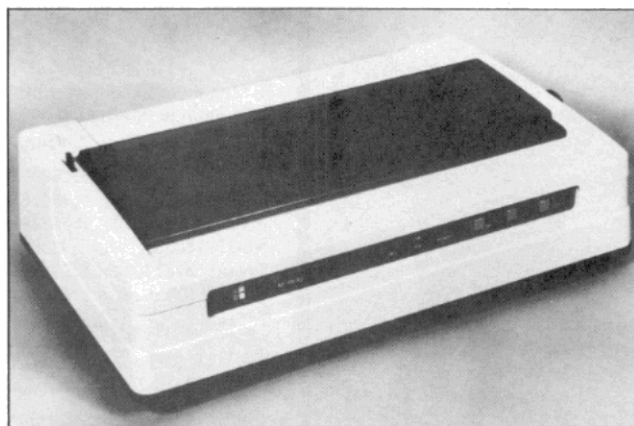
Learning About the Bulls and the Bears

Your kids know their ABCs and they've learned math; now you can teach them how to put their skills to practical use. Computer Stocks and Bonds teaches children ages 12 and up investment strategy while they play the stock market.

The game requires that players master the concepts of modern capital investments to become successful in securities, and provides insights into the forces that affect the economy.

Players develop an understanding of bull and bear markets, the importance of performance histories in planning an investment strategy, and influences on the stock market.

Computer Stocks and Bonds is available on disk



The C.Itoh 1570 Color Dot Matrix Printer converts daisy-wheel software and prints in seven colors.

(\$25) or cassette (\$20) for the Models I, III, and 4 with 32K RAM. For more information contact Intelligent Quest Software, 4517 Harford Road, Baltimore, MD 21214, 301-254-5300.

Reader Service ✓ 563

A Dot-Matrix Printer Shows Its Colors

C.Itoh's newest printers give you printouts in color or in black and white. The Model 1570 multi-mode, color dot-matrix printer prints seven colors and converts daisy-wheel software to dot-matrix code.

It features a 24-wire print head, 24K memory buffer, and prints at 130 cps in letter-quality mode and 180 cps in draft mode. It also has a built-in graphics mode, accepts friction or tractor feed, and loads from the top, rear, or bottom.

The A-10 daisy-wheel printer runs at 30 cps and uses 100-character plastic print wheels that maintain print quality over wheel life. It accepts friction or bidirectional paper feed.

RS-232C or parallel port interfaces are available for both models. The Model 1570 is \$2,000 and the A-10 is \$795 from C.Itoh Electronics Inc., 5301 Beethoven St., Los Angeles, CA 90066, 213-306-6700.

Reader Service ✓ 573

Computer-Aided Ancestry

Trying to draw your family tree becomes a paper nightmare as you go back through the generations. The task is ideally suited for your 48K Model III or 4, however, with the help of Mimar Inc.'s Genealogy Program (\$49.95).

The program files 350 records by name. Information on each relative includes name, date and place of birth, place of death, spouse's name, date and place of marriage, names of mother and father, names of children, and 90 spaces for additional information.

You can generate printouts of your family tree, paternal line, maternal line, and a descendant line to

prove direct lineage. The program includes a 20-page manual.

For more information contact Mimar Inc. at 116 Baywood Drive, Biloxi, MS 39532, 601-388-8033.

Reader Service ✓ 574

Disk Terminal Program

The Disk Term menu-driven disk terminal program automatically transmits large numbers of files over telephone lines. In addition, Disk Term's Auto File feature automatically engages the transmit mode.

Disk Term contains a print buffer, and automatically sets the RS-232 parameters (except for baud rate) to meet its needs. Other features include auto redial, automatic phone disconnect, automatic data transfer from buffer to disk, and eight user-defined macro keys.

Disk Term runs under TRSDOS, LDOS, and DOSPLUS on the Models I, III, and 4 and supports the Hayes Smart Modem, Radio Shack auto-dialer modems, and all manual modems.

Contact Indiana Software Development Co. (723 Franklin Square, Suite 502, Michigan City, IN 46360, 219-870-2941) for more information.

Reader Service ✓ 572

Reading Levels

What reads well to an adult can be frustratingly difficult for students learning to read. Readability Analysis helps teachers de-



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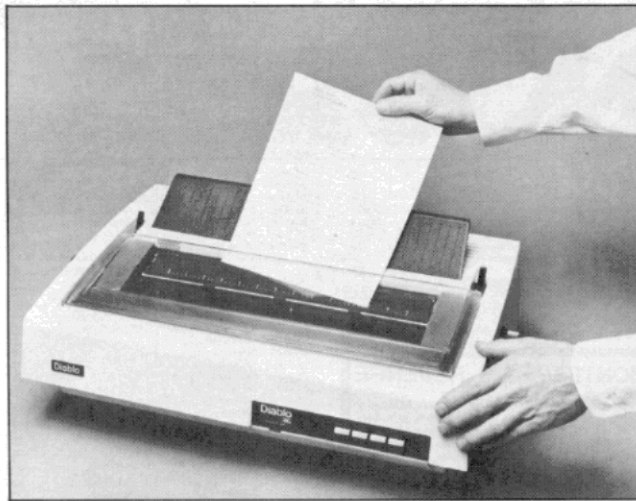
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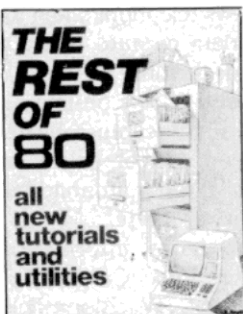
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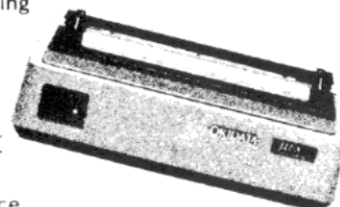
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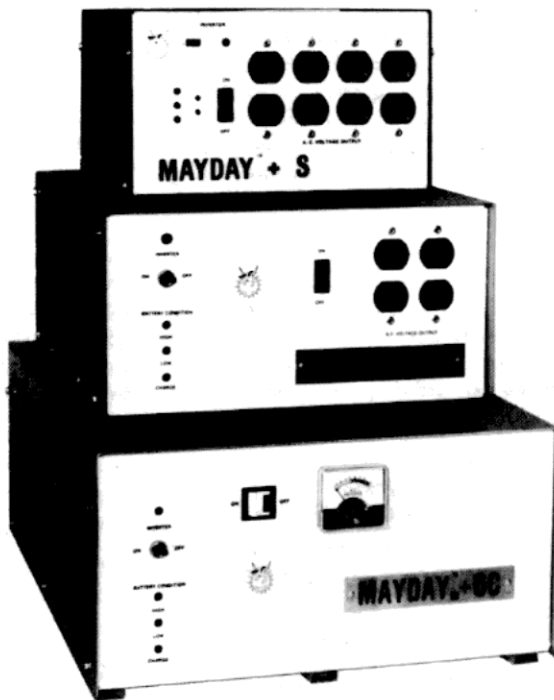
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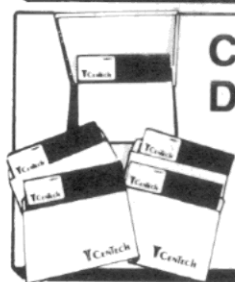
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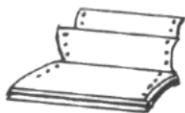
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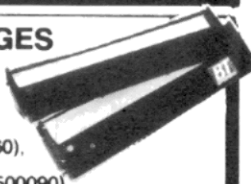
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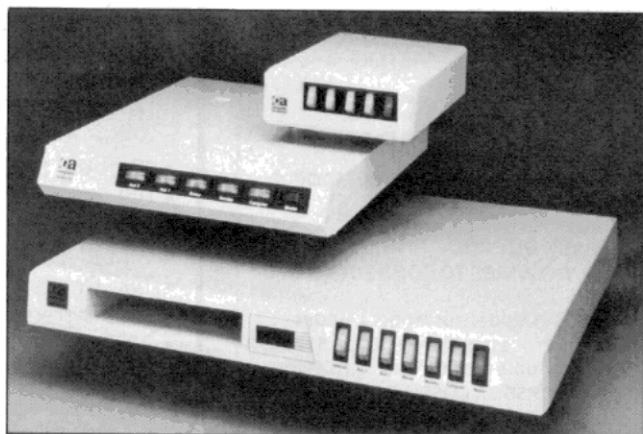
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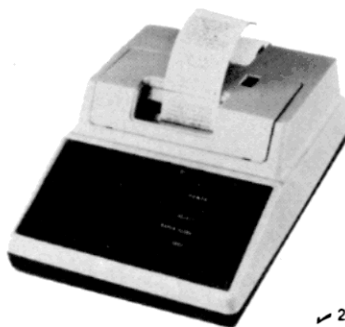
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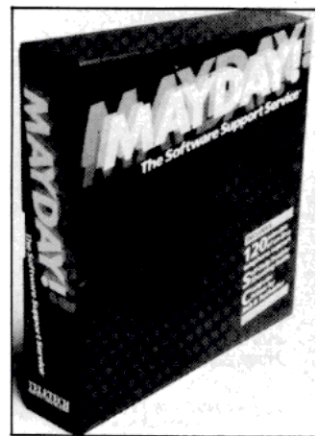
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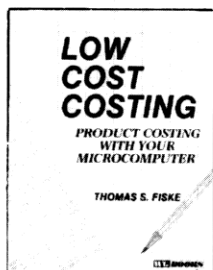
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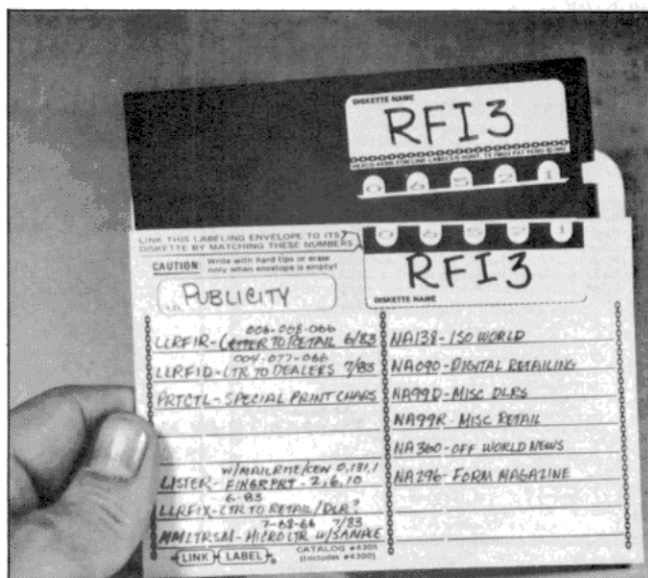
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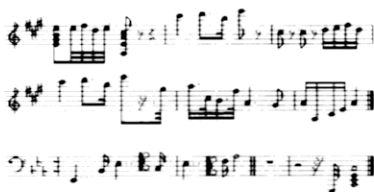
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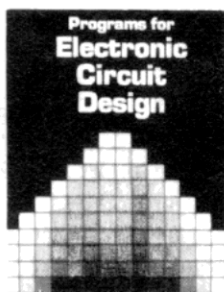
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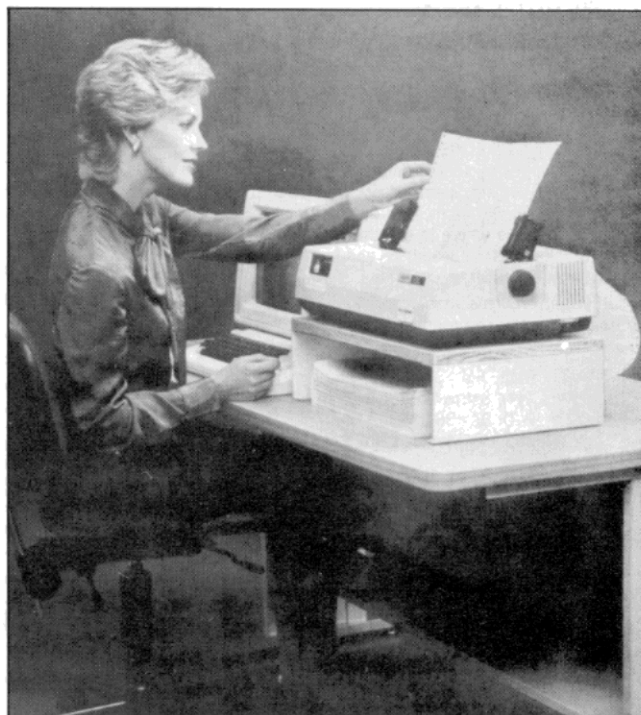
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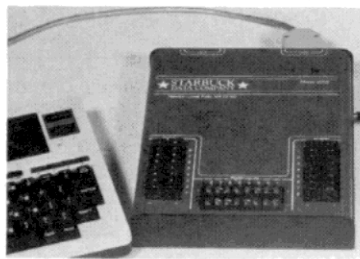
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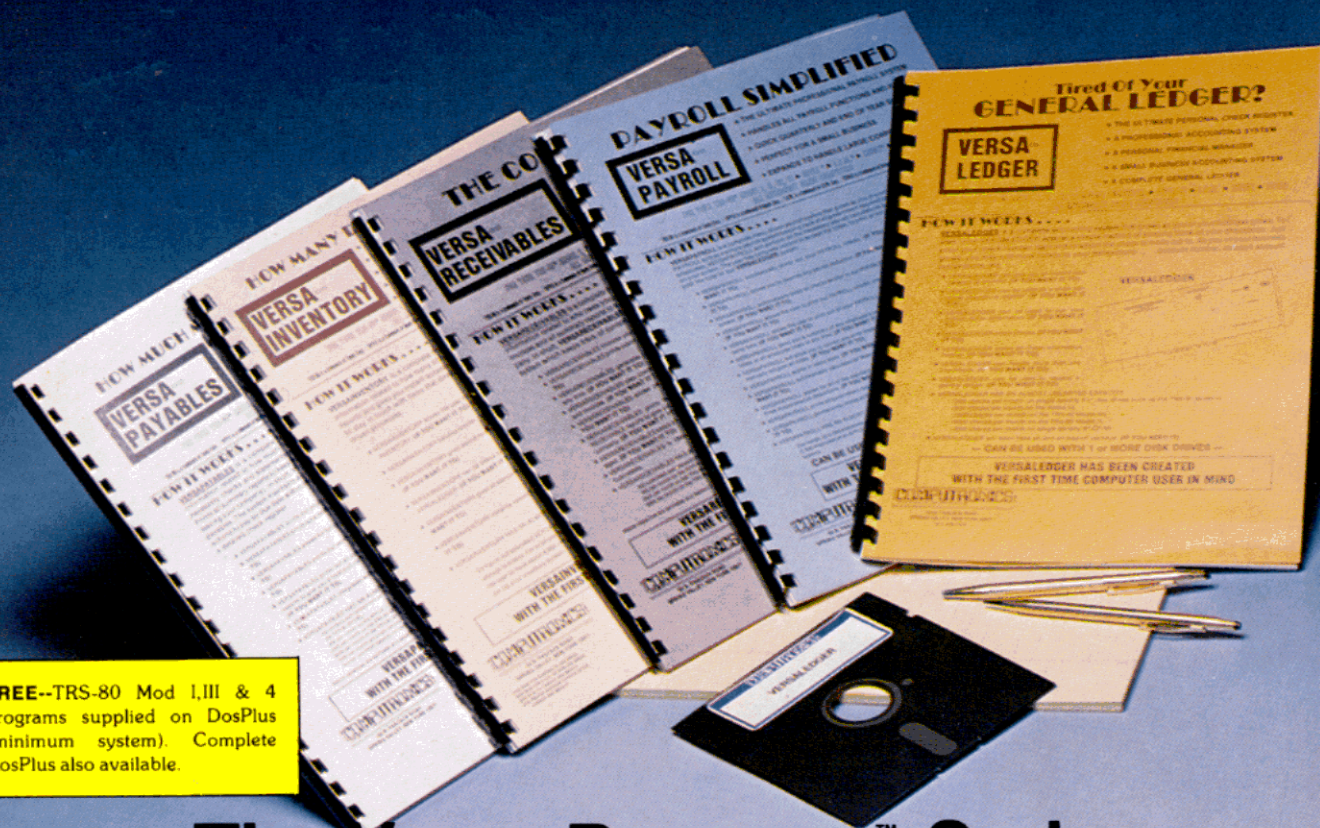
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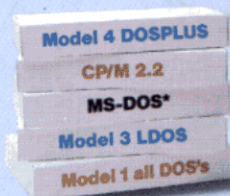
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