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On the Cover

42. **Drive Ways** by Vincent E. Meyer
   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
   You, too, can directly access the Model 4 screen and keyboard. (Model 4; Load 80)

Reviews

33. **Assembly Language Tutor**

36. **microMERLIN**

38. **Assembly Language Development System (ALDS)**

166. **Super Utility 4/4P**

168. **Videotex Plus**

172. **Volcano Hunter**

174. **Learning TRS-80 Model 4/4P Basic**

Departments

6. **Load 80 Directory**

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   by Eric Maloney

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14. **Feedback Loop**
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21. **Pulse Train**
   edited by Bradford N. Dixon

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138. **Pascal Calculations**
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    by Hardin Brothers

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    by John B. Harrell III

176. **New Products**
    edited by Robert Mitchell
LOAD 80

Load 80 gather 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/assembly. 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 TRS-80 system disk according to simple on-screen directions. If you own a Model 4, you must convert the programs from Model III TRS-80 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 TRS-80 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 programs 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), TIME3R/ CMD (object code).
Model 4: TIME4B/SRC (source code), TIME4/ CMD (object code).
Source code requires EDITASM.
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
System: Model 4, 64K RAM Language: Basic
Access the Model 4 screen and keyboard without using PRINT statements or TRS-80 D:0.0 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 program 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 EDITASM.

LOAD 80
Bit by bit, Star’s Gemini-10X printer will grow with you.

“Having a quickly growing marketing business means more and more paperwork. And the way I type, I knew early on that I needed a printer.

“I chose the Gemini-10X dot matrix printer because I wanted a printer that could do it all.

“First, the Gemini type is excellent. Actually good enough for letters. And I can also create my own type. For example, I designed “SteveScript.” It’s a combination of two different type styles and it makes my letters really stand out.

“Plus, my Gemini can do all sorts of advanced graphics, which a daisywheel can’t.

“And it’s much faster. No more time wasted typing. It was a pleasure to throw the whiteout away.”

Steven Clarke—San Francisco, California

With Star’s Gemini-10X printer you get 120 characters per second of clean, crisp type, multi-function versatility and steady, dependable service. All at a price that works.

It’s everything you need in one printer.
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 be made available to customers commercial programs and documentation for hands-on examination. 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 were 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 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:


Try sorting that list with CMD "O".

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ALLWRITE! is an advanced Word Processor for the TRS-80 Models I, III, 4, and 4P. It is fast, safe, and easy to use. You can write all kinds of documents with it, from simple letters to customized Form Letters and large books. Then, at the touch of a key, you can print them on any of the dozens of printers ALLWRITE controls for you. Right-justified proportional printing is just one of the hundreds of standard, built-in features available for your use.

ALLWRITE! is easy to learn and use because its two-key commands are based on the English language. Writing a letter is simple with ALLWRITE, because it has pre-defined "Soft Keys" for common functions such as "paragraph" and "center." Writing a term paper or a text book is straightforward with ALLWRITE, because it can develop a Table of Contents, an index, and Footnotes; and can easily process several diskettes as a single document.

ALLWRITE! has an on-line "HELP" library with over fifty subjects available at the touch of a key, and a Quick Reference Cue Card that fits right on your keyboard. This 350-page book includes a 40-page introductory tutorial to help you get started.

Whether your writing needs are simple or complex, you now have the one Word Processor that does it all—ALLWRITE!

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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 SuperScripsit.

When you use EW with SuperScripsit, 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 Mansfield
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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—Frank J. Deffler, Jr. 4/84

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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 Salsbury
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. Kutter
La Jolla, CA

I’d like to clarify some specific issues Kutter raises. First, I reject Kutter’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 Kutter 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.
ANSWERS QUESTIONS YET TO BE ASKED!

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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/CM. It modifies the TRS3 DOS clock to operate at 50 Hz instead of 60 Hz. TRS3 DOS 1.3 works without the modification, as does LDOS and NEWDOS. The clock loses time on each disk access, so HZ50/CM 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 reseat 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 a 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
New clock-80 $69.95
The right time at the right price! Keep the time and date with quartz accuracy, even when your computer is off. The backup lithium battery (included) will last for over 2 years. Software on tape or disk, please specify. Use “TIMESET” once to set the clock. Use “SETCLOCK” to set your computer’s internal clock (at power up) or use “STSTRING” so that the “T McGill” function reads the New clock.
Connection: Model I plugs into the keyboard or expansion interface. Model II plugs into the 50-pin I/O bus. Compatible with all operating systems.

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 II 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 manual. (Up to 8 interfacer’s 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!

Special Cables
Disk drive extender cable (8’)...$160:S9.95
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...$162:32 4-drive...$163:45
Extension cable, 4 foot: For printer and drive (34-pin)...$165:S22
- For Mod I bus (40-pin)...$167:S24 For Mod 3 & 4 bus (50-pin)...$169:S28
Keyboard to E/I (40-pin, 8’)...$161:S21
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.

Does anyone else have any suggestions?

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 TRS-DOS. 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 TRS-DOS 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 word of caution: You can’t use the last 2 bytes at the top of memory (HFFFE 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.

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, I 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)

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-
GIVE YOUR COMPUTER A

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FEEDBACK LOOP

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. Malcom E. Baird, USN, Cape Canaveral, FL)

A: First, you can mix and match most 5 1/4-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 40-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 disks 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's not 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.

ITG Inc., 1953 W. 11th St., Upland, CA 91786, 714-946-5805. Publisher of TRS-80 Disk and Other Mysteries ($25.50), 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-80 2.3 Decoded and Other Mysteries (Model II) ($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 synthe-
sizer.

■ 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 synthe-
sizers. One is to use a limited look-up dictio-
nary. 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?

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 documenta-
tion 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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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 Russian ambassadors Anatoliy Dobrynin and Oleg Troyanowsky. 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 Tymshare 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

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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 Houston, 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 hampered 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 clarmor 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 inhouse 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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80 Micro, September 1984 • 23
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 competitor 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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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 TIMES 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(I): 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
I'm looking for a copy of version 4.0 of The Postman Deluxe Mass Mailing System (Model I DD). I'm also interested in upgrading to the hard drive version of Postman.

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

Jerel Peterson's letter in the June 1984 RAM Files (p. 168) caught my attention. He had trouble sending a file from a Model 100 to a Model III. I've had problems sending a file from a Model II to a Model III. I'm using a null modem cable with Terminal on the Model II and Modem80 on the Model III. It works in the other direction. Why can't I send to the Model III? Is something wrong with the RS-232 on the Model III?

R. Lee Stockman
10748 100th St.
Alto, MI 48302

Error Trap

I'd like to point out two errors in the published version of my terminal program ("Smart Talk," May 1984, p. 54).

The DEFM in line 3310 is missing three characters. The assembled opcode addressing, however, is correct. The corrected line is:

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

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

7380 PMH DEFM ' .

Again, the assembled opcode addressing is correct.

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

The photo in my article on the 80186 microprocessor ("Moving Up To 16 Bits," June 1984, p. 44) shows the 80186 die (enlarged), not the Model 2000 communications board as indicated.

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

If you had trouble finding Karl Sar-now's "Molecular Matters" in order to make the corrections listed in the May 1984 Debug (p. 31), you aren't alone. We referred readers back to the February 1984 80 Micro, when in fact the article appears on p. 100 of the October 1983 issue.

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 programs that are not on the tape. They are JULYLS, D, E, and CONV. For a correct list, see the Load 80 directory in the July issue of 80 Micro.

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

New User's Groups

Olympian Computer Club
Hellenikon Air Base
Athens, Greece
C/O Paul Mullens
Box 4277
APO NY 09223

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's Group
1226 Daniel Court
Quincy, IL 62301
Contact: L. Moeller

New Bulletin Board System

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

DEBUG

Here's a final correction to my program Sunfinder ("Catching Rays," October 1983, p. 256 and Debug, March 1984, p. 40). The program calls for a positive value for west magnetic deviation, when in fact it's commonly assigned a negative value. Therefore, please change the prompt near the end of line 510 to read:

(XX.X DEGREES, -- IF W)

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 certain conditions. You can correct this by revising the original line 310 as follows:

310 A = A*RD/IF A<0 AND C>0 AND C<3.14159 OR A>0 AND C<0 OR A<0 AND C>3.14159 THEN A = 180 + A ELSE IF A<0 AND C<0 OR A<0 AND C>3.14159 THEN A = 360 + A

Smith Harris
Route 4 Box 59
Gray, GA 31022

I've discovered a bug in my Munchies program ("Sneak a PEEK, Invoke a POKE," March 1984, p. 152). The program works normally for a while and then freezes for no apparent reason. The problem lies in the loop in line 230; it's supposed to loop whether or not "MPS + MA>V1 AND MPS + MA<V2" is met, but it doesn't. You can fix this by adding "ELSE 40" to the end of the line. The new line should read:

230 IF MPS + MA>V1 AND MPS + MA<V2 THEN POKE MPS,Q;MPS = MPS + MA: Q = PEEK(MPS);POKE(MPS,MC:GOTO40 ELSE 40

Tad Kershner
10579 Rainbow Ridge
Grass Valley, CA 95945

30 • 80 Micro, September 1984
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Learning the Language: An Assembly Tutor

by Hardin Brothers

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/assembly/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 subroutines 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/assembly, 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 memory. When you run an assemble 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><X><RET> or <Z><X><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 editors/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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**STATUS**

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| B4B9 | DD | 21 | 07 | 00 | 06 | 04 | 07 | 76 | DD | 06 | 08 | 77 | 28 | DD | 28 |
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**MODE=EDIT SPEED=9800 FREE MEMORY=18896 BP 0 FFFF, FFFF, FFFF, FFFF**

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**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 0B480 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.)

---

**microMERLIN**

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Does the job? ★★★★★

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 ASIM86 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 index 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 TRS80 DOS 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, 5½-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 SuperUtility 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, MPPFORMAT.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 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.
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 rehosting 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, 5½-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 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:>, 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

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.

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Tandy's New Precedent

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The system runs on the Models II and 12 (hard disk recommended) and features automatic accounts updating, integrated time and billing, and general ledger and cash disbursements accounting. It tracks billing hours for 50 clients.

The program manual includes a tutorial to get first-time users started. The Precedent comes with eight billing formats and prepares reports on unbillable inventory, attorney performance, monthly accounts receivable, trust deposits, client advances, and client matters.

For more information contact Tandy Corporation/Radio Shack at 1800

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<td>NEWDOS80/VERS. 2</td>
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Hey, Pop! How come my disk drive sounds like a garbage disposal?!

Kajong  Kajonk  Skreek  Kazit

Poing  Spween!

3 HOURS LATER

Are you sure you can fix my computer, Pop?!

3 DAYS LATER

I thought you were gonna fix my computer, Pop!
A professional technician tells you how to cope with disk drive disaster.

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, Siemans, 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.

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**Table. Necessary tools for disk-drive maintenance.**

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<thead>
<tr>
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<tr>
<td>Alcohol</td>
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<td>Alignment disk and software</td>
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<tr>
<td>Allen wrench set</td>
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<tr>
<td>Bath towel</td>
</tr>
<tr>
<td>Blank disks</td>
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<tr>
<td>Cotton swabs</td>
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<tr>
<td>Small flashlight</td>
</tr>
<tr>
<td>Flat-head screw driver, ¼-inch wide blade, at least 4 inches long</td>
</tr>
<tr>
<td>Small hand mirror</td>
</tr>
<tr>
<td>Oil (Chem-oil or Marvel oil; not WD-40)</td>
</tr>
<tr>
<td>Oscilloscope (optional with the J &amp; M Systems diagnostic package)</td>
</tr>
<tr>
<td>Paper</td>
</tr>
<tr>
<td>Pencil</td>
</tr>
</tbody>
</table>

*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 control 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, 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.
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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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 carries 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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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 ½ 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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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 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 screwdriver 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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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 suck 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**

Dykan Corp.
5201 Patrick Henry Dr.
Santa Clara, CA 95050

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

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

J & M Systems
137 Utah NE
Albuquerque, NM 87108

Percom Data Corp.
11220 Pagemill Road
Dallas, TX 75243

Shugart Assoc.
475 Oakmead Pkwy.
Sunnyvale, CA 94086

Siemens Communications Systems Inc.

Micro Data Supplies
2295 Euclid Ave.
Euclid, OH 44117

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

Data Communications Division
186 Wood Ave. S.
Iselin, NJ 08830

Tandon
9333 Osso Ave.
Chatsworth, CA 91311

TEAC Corp. of America
7733 Telegraph Road
Montebello, CA 90640

Texas Peripherals
1010 E. 8th St.
Odessa, TX 79761

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HAVE A refreshing Editor/Assembler

EDTASM  ZEN  MZAL
SERIES I  ZEUS  EDAS IV
INTASM  ALE  ALDS
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 nonalphabetic 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 nondocumented 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 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 pre-assembled 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 program 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 system 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.

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**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.)**

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Description</th>
<th>Price</th>
<th>Distributor</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDTASM</td>
<td>(Included as part of NEWDOS80 2.0 for the Model I/III.)</td>
<td>Apparat Inc.</td>
<td>4401 S. Tamarac Parkway</td>
</tr>
<tr>
<td>Series 1 Editor/Assembler</td>
<td>($34.95; Model I and III versions included in one package.)</td>
<td>Tandy/Radio Shack</td>
<td>One Tandy Center</td>
</tr>
<tr>
<td>Instant Assembler (INTASM) 2.1</td>
<td>($49.95; available for the Model I/III. Model 4 version available soon.)</td>
<td>Munford Micro Systems</td>
<td>P.O. Box 400</td>
</tr>
<tr>
<td>Zen 4.3</td>
<td>($59.95; one package supports Model I/III/4.)</td>
<td>The Alternate Source</td>
<td>704 N. Pennsylvania</td>
</tr>
<tr>
<td>Zeus</td>
<td>($59.95; runs on Models I and III.)</td>
<td>Cosmopolitan Electronics Corp.</td>
<td>5700 Plymouth Road</td>
</tr>
<tr>
<td>ALE 1.5</td>
<td>($49.95; runs on Models I and III.)</td>
<td>The Alternate Source</td>
<td>704 N. Pennsylvania</td>
</tr>
<tr>
<td>M-ZAL release 3</td>
<td>($99.95; available for Models I, III, and 4. Model 4 version not reviewed.)</td>
<td>Computer Applications Unlimited</td>
<td>P.O. Box 214</td>
</tr>
<tr>
<td>EDAS IV and Pro-Create</td>
<td>($100; EDAS IV runs on Models I and III with LDOS. Pro-Create runs on Model 4 with TRSDOS 6.X.)</td>
<td>Micosys</td>
<td>P.O. Box 4848</td>
</tr>
<tr>
<td>Assembly Language Development System (ALDS)</td>
<td>($149; Model III/TRSDOS 1.3 and Model 4/TRSDOS 6.X versions included in one package.)</td>
<td>Tandy/Radio Shack</td>
<td>One Tandy Center</td>
</tr>
</tbody>
</table>
The most friendly user interface utilizing a set of menus. Runs utilities, wordprocessors, games and applications directly from menus. Can be easily modified and customized.

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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The System is compatible with TRS-80 mod 1/III (min 2 drive 48k) LDOS, NEWSOS/80, DOSPLUS and MULTIDOS

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NY, NY 10121 (212) 781-7254
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 usable editor/Assembler for a novice, but would limit a serious programmer.

While most of the more complex 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 assembled 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.

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Table 2. Auxiliary programs available with editor/assemblers.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Zen</td>
<td>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-disassembler.</td>
</tr>
<tr>
<td>Zeus</td>
<td>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.</td>
</tr>
<tr>
<td>ALE</td>
<td>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, and a utility to change keyboard defaults, and the source code (two sides of a separate disk) for a monitor/debugger/disassembler.</td>
</tr>
</tbody>
</table>

**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 routines 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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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>
<thead>
<tr>
<th>Pseudo-op</th>
<th>EDTASM</th>
<th>Series I</th>
<th>INTASM</th>
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<th>Zeus</th>
<th>ALE</th>
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64 • 80 Micro, September 1984
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.

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

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 repetitive 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).
- LITORC 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.
- NLOAD 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 0FFFs 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 temporally 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.
- DEFI 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.
- DEFN 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 .SLL.
- 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/asmblers:
  - .HIGH. or .MSB. returns the high order byte of a value.
  - .LOW. or .LSB. returns the low order byte of a value.
  - .BIT.
  - .LOW. or .LSB.

** or A

**.R. and .RI.

ABS.

.GO. or >

.GE.

.LT. or <

.LE.

.RES.

.SGN.

.UGT.

.UGE.

.ULT.

.ULE.

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 assemblies 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.
- IFF assembles if expression is negative (minus).
- IFNE assembles conditional block only if two values or labels 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.

ALDS includes several unique printer pseudo-ops:

- 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.

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 5 bytes of object code generated by each line (e.g., DEFM 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.

(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 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/dep-
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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 AIE has the best editor, with ALDS and M-ZAL a close 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 ED-TASM, 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

---

The Key Box

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

---

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 CND EQU 8F0H
00145 SEL EQU 8F1H
00150 RCLC EQU #1C9H
00160 RDSP EQU #033H
00170 RDISP EQU #021H
00180 REXIT EQU 4020H
00190 RRD EQU #002H
00200 RXEY EQU #049H
00210 SPAUSE EQU #060H
00220 COUNT DEFL 12
00230 CURSOR EQU 4023H
00240 VID EQU 3C0H
00250 GRO EQU 520H
00260 ;
00270 ; Main Program Loop
00280 ;
00290 MAIN CALL RCLS
00300 LD BL,VID
00310 LD (HL),188

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 Micosy'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 0D8 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.

80 Micro, September 1984 • 73
#1420 LD (CURSOR), HL ;Update the cursor.
#1430 LD HL, MESG$18 ;HL=Message pointer.
#1440 CALL RDSPLY ;Display it.
#1450 MAIN5 CALL RXBD ;Scan the keyboard.
#1460 OR A ;Key pressed?
#1470 JR NS, MAIN1 ;Jump if a key was pressed.
#1480 LD A, (CURPOF) ;Get the new cursor offset.
#1490 CALL GETSTEP ;Get the old cursor offset.
#1500 CP C ;Are the offsets the same?
#1510 JR NZ, MAIN5 ;Loop if they are.
#1520 PUSH BC ;Save the new cursor offset.
#1530 LD C, A ;BC=Old cursor offset.
#1540 CALL HL, SID$576 ;HL=Video line pointer.
#1550 ADD HL, BC ;HL=Video memory location.
#1560 LD (HL), 32 ;Erase the indicator.
#1570 POP BC ;Restore the new cursor offset.
#1580 LD A, C ;A=New cursor offset.
#1590 LD (CURPOF), A ;Save it.
#1600 LD HL, SID$576 ;HL=Video line pointer.
#1610 ADD HL, BC ;HL=Video memory location.
#1620 CALL RXBD ;Display the indicator.
#1630 JR MAIN5 ;Loop.
#1640 JR MAIN6 ;Clear the screen.
#1650 JP REXIT ;Return to DGS.
#1660 ;Display Graphic Line Routines
#1670 DISGPR LD (HL), A ;Display a character.
#1780 INC HL ;Jump the video memory pointer.
#1790 DJNZ DISGPR ;Loop till done.
#1800 RET ;Return.
#1810 ;Clear Menu Portion of the Screen Routine
#1820 CLRAMK LD HL, VID$713 ;HL=Video memory pointer.
#1830 D=Number of lines to clear.
#1840 CLRAMK PUSH HL ;Save the video memory pointer.
#1850 LD B, 54 ;B=Number of characters to display.
#1860 LD A, 32 ;A=Character to be displayed.
#1870 CALL DISGPR ;Display the line.
#1880 POP HL ;Restore the video memory pointer.
#1890 LD BC, 64 ;BC=Offset to the next line.
#1900 ADD HL, BC ;Update the video memory pointer.
#1910 DEC D ;All lines done?
#1920 JR NZ, CLRAMK ;Loop if not.
#1930 JR N, REXIT ;Return.
#1940 ;Update Cursor and Display Message Routine
#1950 DISMES LD E, (HL) ;E=LSB of the new cursor position.
#1960 INC HL ;Jump the message pointer.
#1970 LD D, (HL) ;D=MSB of the new cursor position.
#1980 INC HL ;Jump the message pointer.
#1990 LD (CURSOR), DE ;Update the cursor.
#2000 JP RDSPLY ;Display the message.
#2010 ;Select Drive and Get Status Routine
#2020 SELECT LD C, A ;C=Drive number.
#2030 LD B, 8 ;B=Drive number.
#2040 LD HL, DSVTAB ;HL=Drive select mask pointer.
#2050 ADD HL, BC ;HL=Drive select mask pointer.
#2060 LD A, (HL) ;A=Drive select mask.
#2070 LD (DRVSEL), A ;Save it.
#2080 SELECT IN A, (CMD) ;A=Disk status.
#2090 PUSH AF ;Save the status.
#2100 LD A, (DRVSEL) ;A=Drive select mask.
#2110 POP AF ;Select the drive.
#2120 POP AF ;Get the status.
#2130 RLCA ;Were the drives already selected?
#2140 JR NC, SELECT1 ;Jump if they were.
#2150 LD BC, 1999H ;BC=Delay counter.
#2160 CALL RPMASE ;Delay till drives get up to speed.
#2170 #2160 SELCT1 LD A, (DRVSEL) ;A=Drive select mask.
#2180 #2170 OUT (SEL), A ;Select the drive.
#2190 #2180 OUT (CMD), A ;Reset the FDC.
#2200 #2190 LD D, 16 ;D=Delay counter.
#2210 #21A0 #2120 #21C0 #21D0 #21E0 #21F0 #2200 #2210 #2220 #2230 #2240 #2250 #2260 #2270 #2280 #2290 #2300 #2310 #2320 #2330 #2340 #2350 #2360 #2370 #2380 #2390 #2400 #2410 #2420 #2430 #2440 #2450 #2460 #2470 #2480 #2490 #2500 #2510 #2520 #2530 #2540 #2550 #2560 #2570 #2580 #2590 #2600 #2610 #2620 #2630 #2640 #2650 #2660 #2670 #2680 #2690 #2700 #2710 #2720 #2730 #2740 #2750 #2760 #2770 #2780 #2790 #2800 #2810 #2820 #2830 #2840 #2850 ;Variables, Tables, and Messages
#2860 #2870 ;DRIVE DEFB 0
#2880 #2890 #2900 #2910 #2920 #2930 #2940 #2950 ;Display the drive, ;Reset the FDC command.
#2220 #2230 #2240 ;Delay till FDC is ready.
#2250 #2260 #2270 ;BC=Loop counter.
#2280 #2290 #2300 ;Index hole?
#2310 #2320 ;Loop if not.
#2330 #2340 ;Flag drive ready.
#2350 #2360 #2370 #2380 ;Flag drive error.
#2390 #2400 #2410 ;Set flag for index hole status.
#2420 #2430 ;Tone the Drive and Figure Cursor Position Routine
#2440 #2450 ;Disable the interrupts.
#2460 #2470 ;Re-select the drive.
#2480 #2490 ;Reset the FDC.
#2500 #2510 ;Reset the FDC.
#2520 ;Delay till FDC is ready.
#2530 #2540 #2550 #2560 #2570 #2580 ;Index hole?
#2590 #2600 #2610 ;Set flag for index hole status.
#2620 #2630 #2640 #2650 ;Enable the interrupts.
#2660 #2670 #2680 #2690 ;Compare it with the speed value.
#2700 #2710 #2720 ;Jump if the MSDs don't match.
#2730 #2740 ;Compare it with the speed value.
#2750 #2760 #2770 ;Compare it with the speed value.
#2780 #2790 ;Compare it with the speed value.
#2800 ;Jump if it's the correct position.
#2810 #2820 ;BC=New video memory offset.
#2830 #2840 #2850 #2860 #2870 #2880 #2890
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<td>TRS-80 Models I, II</td>
<td>32K memory</td>
<td>$95.00</td>
</tr>
<tr>
<td>TRS-80 Model II</td>
<td>32K memory</td>
<td>$95.00</td>
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80 • 80 Micro, September 1984
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<tr>
<th>NAME</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>RULE78</td>
<td>Interest Apportionment by Rule of the 78's</td>
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<tr>
<td>ANNU1</td>
<td>Annuity computation program</td>
</tr>
<tr>
<td>DATE</td>
<td>Time between dates</td>
</tr>
<tr>
<td>DAY YEAR</td>
<td>Day of year a particular date falls on</td>
</tr>
<tr>
<td>LEASE DT</td>
<td>Interest rate on lease</td>
</tr>
<tr>
<td>BREAK EVN</td>
<td>Break-even analysis</td>
</tr>
<tr>
<td>DEPR</td>
<td>Straightline depreciation</td>
</tr>
<tr>
<td>DEPSY</td>
<td>Sum of the digits depreciation</td>
</tr>
<tr>
<td>DEPR DB</td>
<td>Declining balance depreciation</td>
</tr>
<tr>
<td>DEPR DBB</td>
<td>Double declining balance depreciation</td>
</tr>
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<td>In memory inventory control system</td>
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80 Micro, September 1984 • 83
; Select Drive and Get Status Routine

0190 ; Select Drive and Get Status Routine
0191 ; \n0192 ; 0190: SELECT LD C,A ;Drive number.
0193 ; \n0194 ; 0190: SELECT LD B,0 ;Drive number.
0195 ; \n0196 ; 0190: SELECT LD HL,DRVTAB ;Drive count mask table pointer.
0197 ; \n0198 ; 0190: SELECT ADD HL,BC ;HL=Drive select mask pointer.
0199 ; \n0200 ; 0190: SELECT LD A,(HL) ;A=Drive select mask.
0201 ; \n0202 ; 0190: SELECT LD (DRVSEL),A ;Save it.
0203 ; \n0204 ; 0190: SELECT2 IN A,(CND) ;A=Disk status.
0205 ; \n0206 ; 0190: SELECT2 LD A,(DRVSEL) ;A=Drive select mask.
0207 ; \n0208 ; 0190: SELECT2 OUT (SEL),A ;Select the drive.
0209 ; \n0210 ; 0190: SELECT2 POP AF ;Get the status.
0211 ; \n0212 ; 0190: SELECT2 RLCA ;Were the drives already selected?
0213 ; \n0214 ; 0190: SELECT2 JNC SELECT1 ;Jump if they were.
0215 ; \n0216 ; 0190: SELECT2 LD BC,B ;BC=Dual counter.
0217 ; \n0218 ; 0190: SELECT2 SVC @PAUSE ;Delay till drives get up to speed.
0219 ; \n0220 ; 0190: SELECT2 JR SELECTB ;Loop.
0221 ; \n0222 ; 0190: SELECT2 LD A,(DRVSEL) ;A=Drive select mask.
0223 ; \n0224 ; 0190: SELECT2 OUT (SEL),A ;Reset the drive.
0225 ; \n0226 ; 0190: SELECT2 LD B,18 ;Reset the FDC.
0227 ; \n0228 ; 0190: SELECT2 DJNZ SELECT2 ;Delay till FDC is ready.
0229 ; \n0230 ; 0190: SELECT3 CALL SELECT5 ;Index hole?
0231 ; \n0232 ; 0190: SELECT4 JR NS,SELECT3 ;Loop if it is.
0233 ; \n0234 ; 0190: SELECT4 CALL INDEX ;Index hole?
0235 ; \n0236 ; 0190: SELECT4 JR Z,SELECT4 ;Loop if not.
0237 ; \n0238 ; 0190: SELECT4 XOR A ;Flag drive ready.
0239 ; \n0240 ; 0190: SELECT4 RET ;Return.
0241 ; \n0242 ; 0190: SELECTS PUSH AF ;Save the flags.
0243 ; \n0244 ; 0190: SELECTS DEC BC ;Decrement the loop counter.
0245 ; \n0246 ; 0190: SELECTS LD A,(HY-12) ;A=Port IECH image.
0247 ; \n0248 ; 0190: SELECTS RES 6,A ;Reset bit for 2.8275 MHz clock.
0249 ; \n0250 ; 0190: SELECTS OUT (IECH),A ;Set the clock for 2.8275 MHz.
0251 ; \n0252 ; 0190: SELECTS LD HL,R ;HL=Time counter.
0253 ; \n0254 ; 0190: SELECTS LD A,(DRVSEL) ;A=Drive select mask.
0255 ; \n0256 ; 0190: SELECTS OUT (SEL),A ;Reset the drive.
0257 ; \n0258 ; ; Time the Drive and Figure Cursor Position Routine
0259 ; \n0260 ; 0259: GETSF DI ;Disable the interrupts.
0261 ; \n0262 ; 0259: GETSF LD A,(HY-12) ;A=Port IECH image.
0263 ; \n0264 ; 0259: GETSF RES 6,A ;Reset bit for 2.8275 MHz clock.
0265 ; \n0266 ; 0259: GETSF OUT (IECH),A ;Set the clock for 2.8275 MHz.
0267 ; \n0268 ; 0259: GETSF LD HL,R ;HL=Time counter.
0269 ; \n0270 ; 0259: GETSF LD A,(DRVSEL) ;A=Drive select mask.
0271 ; \n0272 ; 0259: GETSF OUT (SEL),A ;Reset the drive.
0273 ;
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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 VALUES TO ORIGINAL INVESTMENTS.

STOCKVALUE ALSO TRACKS 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, 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 IT'S 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-
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80 Micro, September 1984 • 87
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 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 FMS, 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.

---

**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),total cost
5020 DATA"Security name",no. of shares,date purchased(mmddyy),total 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"

0000 DATAdate1(mmddyy),price this date of security one,price of two,price of three,etc until a price is entered for all securities.
6010 DATAdate2(mmddyy),price this date of security one,price of two,price of three,etc until a price is entered for all securities.
Continue entering date and prices as desired. Prices on any date should be entered only for securities held on that date
7999 DATA999

---

**Program Listings begin on p. 90**

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305
DMP420
735
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Gemini 10X
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Gemini 15X
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305
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<table>
<thead>
<tr>
<th>#</th>
<th>SECONDS DELAY</th>
<th>PERCENT</th>
<th>STRING</th>
<th>NORMAL TRASHMAN IMPROVEMENT</th>
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<tbody>
<tr>
<td>10</td>
<td>1.1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>11.9</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>14.8</td>
<td>1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>179.5</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>713.2</td>
<td>7.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: For use with The Home Accountant.*

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M ary Lynch Portfolio Valuation

<table>
<thead>
<tr>
<th>Shares</th>
<th>Date Purch</th>
<th>Price Value</th>
<th>Share Price Value</th>
<th>Price Value</th>
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<tbody>
<tr>
<td>37 Fid Trend Multiple</td>
<td>731</td>
<td>22.19</td>
<td>741</td>
<td>29.03</td>
</tr>
<tr>
<td>48 Simplicity 4/17/81</td>
<td>12.23</td>
<td>590</td>
<td>31.38</td>
<td>540</td>
</tr>
<tr>
<td>65 Greyhound 1/5/81</td>
<td>14.13</td>
<td>410</td>
<td>58.63</td>
<td>886</td>
</tr>
<tr>
<td>100 Good Year 1/5/81</td>
<td>15.65</td>
<td>605</td>
<td>57.58</td>
<td>360</td>
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<tr>
<td>112 Ogil Multiple</td>
<td>1455</td>
<td>0.08</td>
<td>12.08</td>
<td>18.05</td>
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<tr>
<td>54 Houston IntMultiple</td>
<td>1800</td>
<td>0.08</td>
<td>13.08</td>
<td>21.08</td>
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<tr>
<td>50 GM 1/16/81</td>
<td>3128</td>
<td>0.08</td>
<td>598.80</td>
<td>520.80</td>
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<tr>
<td>8 GM Mar 13/82</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>180 Gillett 12/9/82</td>
<td>1466</td>
<td>0.08</td>
<td>0.00</td>
<td>16.75</td>
</tr>
</tbody>
</table>

**Total** | 2948 | 2358 | 14852

**Detail of Multiple Purchases**

<table>
<thead>
<tr>
<th>Fid Trend Shares</th>
<th>DatePurch Cost/sh Cum/sh Price-3/31/83-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>22,000</td>
<td>6/1/75</td>
</tr>
<tr>
<td>0.000</td>
<td>12/5/77</td>
</tr>
<tr>
<td>3.324</td>
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<tr>
<td>1.053</td>
<td>1/8/82</td>
</tr>
<tr>
<td>0.046</td>
<td>1/4/83</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17.91</td>
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</table>

**Closed Transactions**

<table>
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<tr>
<th>Shares Security</th>
<th>DatePurch Cost</th>
<th>Date Sold</th>
<th>Sales Price Gain (Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100 GM Mar 13/82</td>
<td>12/82</td>
<td>-79</td>
<td>3/15/83</td>
</tr>
<tr>
<td>-100 G year Apr 35</td>
<td>11/9/82</td>
<td>-190</td>
<td>2/15/83</td>
</tr>
</tbody>
</table>

**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, 7172 Pebble Park West Bloomfield, MI 48033
30 CLS: CLEAR1580:DEPINTA-C:F-Y
40 READMAHAS-NAS-NAS' PORTFOLIO VALUATION:PRINTTAB(6)N
50 PORTFORDER:READA:IFAS="S","I=1:PRINT:READD,DELSEERADD,D,A:
60 IFAS="I"N:"1=1:+"1:COUNT SALES AND REPLACES
70 IFAS="E"N:"NEXT:PRINT"END NOT READ IN DATA STATEMENTS:ST DCP
80 FORD="BC3896:READA:IFAS=999THEN100"CHARGE 30 TO A GREATER NUMBER
90 FORD="TC11-1:READD:IFP=999THENR=r+1:GOTO000ELSEIFP=1000THEN
100 ELSEPRINT:PRINT"999 NOT READ AT END OF PRICE ENTRIES.
PROGRAM SET FOR A MAXIMUM OF 30 VALUATIONS, CHANGE LINE 70 TO ALLOW MORE":
110 STOP:RESTORE:PRINT148,STOCKS:PRINTUSING"***":I=1:PRINT230,2
120 "REPEAT PURCHASES:"PRINTUSING"***":I=1:PRINT263,1:CLOSED TRANSACTIONS:"PRINTUSING"***":FPRINT330,1:PRINTS"DATE TIME:
130 PRINT#0:"READA:PRINT146"TOTAL ITEMS:"PRINTUSING"***":4+1*R+I(1)+2*F
140 "DIMAS(1),DP(I),DI(1),DA(R),DG(I),Z(I),RI(I),RI(1),RI(2),R3(I),R4(R),R5(R),R6(R),F(I)
150 "MO1:PS=OFF:RD=R:FLS="STOCKVAL"N,M="Multiple":L=STRINGS(6
160 SAVEA:READA:PRINT146"READING ITEM 1":A=3
170 PRINT"GORM=TOTALA=A=A+4:PRINT603,A
190 DP(I):TAGAS:IFAS="N":N=0:N=S:SAVEA:DATEPUNCH="C"
200 IFAS="B"N:"READA:PRINT148"N=0:SAVEA:DATEPUNCH="C"
210 PRINT"GORM=TOTALA=A=A+4:PRINT603,A
220 PRINT863,1:PRINTA:READA:"READ A:PRINTEND FROM999
230 PRINT170"RETURN:RA+A=A+1:PRINT603,A
240 PRINTA:READD(X):X=DATE
250 PRINTA:READD(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)=1000-LR(X)
260 PRINT170"RETURN:RA+A=A+4:PRINT603,A

Listing continued
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<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>.dOrder</td>
<td>Sales Order Processing</td>
<td>$195</td>
</tr>
<tr>
<td>.dInvoice</td>
<td>Billing/Inventory</td>
<td>$195</td>
</tr>
<tr>
<td>.dStatement</td>
<td>Accounts Receivable</td>
<td>$ 95</td>
</tr>
<tr>
<td>.dPurchase</td>
<td>Purchase Order Processing</td>
<td>$195</td>
</tr>
<tr>
<td>.dPayable</td>
<td>Accounts Payable</td>
<td>$295</td>
</tr>
<tr>
<td>.dPayroll</td>
<td>Payroll/Labor Accounting</td>
<td>$395</td>
</tr>
<tr>
<td>.dLedger</td>
<td>General Ledger/Finance</td>
<td>$395</td>
</tr>
<tr>
<td>.dAssets</td>
<td>Asset/Depreciation</td>
<td>$195</td>
</tr>
<tr>
<td>.dProject</td>
<td>Project/Job Accounting</td>
<td>$345</td>
</tr>
</tbody>
</table>

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7. List/Key Backup
8. List/Key Restore
9. List/Key Help
0. Exit

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80 Micro, September 1984 • 95
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 TRS80 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, because 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 TRS80 6.0 stores certain drive-handling pointers in the memory that the screen uses.

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

Figure 1. Keyboard memory map for Models III and 4 modes.
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<thead>
<tr>
<th>Montezuma Micro</th>
<th>Radio Shack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient Program Area (TPA)</td>
<td>55K</td>
</tr>
<tr>
<td>Bytes Free in MBASIC</td>
<td>30,776</td>
</tr>
<tr>
<td>Bytes Free on Formatted Disk</td>
<td>166.5K</td>
</tr>
<tr>
<td>(Not including reserved tracks)</td>
<td>YES</td>
</tr>
<tr>
<td>64K Memory Drive</td>
<td>YES</td>
</tr>
<tr>
<td>Double-Side Drive Support</td>
<td>YES</td>
</tr>
<tr>
<td>Format, Read/Write Other CP/M Formats</td>
<td>YES</td>
</tr>
<tr>
<td>Communication Program Included</td>
<td>YES</td>
</tr>
<tr>
<td>Time To Boot</td>
<td>3.6 sec.</td>
</tr>
</tbody>
</table>

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

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 TRS-DOS 6.1.2. If you don’t set memory size with this version, Basic will hang. TRS-DOS 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 rundown:

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 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 the 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 TRS-DOS.

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 problem: Simply load the A register with the value you want and invoke an Out 132 command with A. However, TRS-DOS 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 (DI) to eliminate this problem as long as you don’t use TRS-DOS 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 TRS-DOS 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 MS, which is dimensioned into the number of fields you want. The program points each field into screen memory so that printing an element of MS 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 resits 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 columns.
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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<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>1-10 Pkgs.</th>
<th>11-24 Pkgs.</th>
<th>25-40 Pkgs.</th>
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<tr>
<td>#626</td>
<td>5½&quot; SS, DD</td>
<td>$17.00/pk.</td>
<td>$16.00/pk.</td>
<td>$15.00/pk.</td>
</tr>
<tr>
<td>#627</td>
<td>5½&quot; DS, DD</td>
<td>22.00/pk.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(EACH PKG CONTAINS 10 DISKETTES)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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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 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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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

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal Name</th>
<th>Direction*</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Data Strobe</td>
<td>To</td>
<td>Synchronizes data to the printer</td>
</tr>
<tr>
<td>2-9</td>
<td>DATA1-DATA8</td>
<td>To</td>
<td>Printer data bits</td>
</tr>
<tr>
<td>10</td>
<td>Acknowledge</td>
<td>From</td>
<td>High to low = completion of data input</td>
</tr>
<tr>
<td>11</td>
<td>Busy</td>
<td>From</td>
<td>High = data cannot be received, low = OK to receive data</td>
</tr>
<tr>
<td>12</td>
<td>Paper End</td>
<td>From</td>
<td>High = out of paper</td>
</tr>
<tr>
<td>13</td>
<td>Select</td>
<td>From</td>
<td>High = printer selected</td>
</tr>
<tr>
<td>14, 16, 33</td>
<td>GND</td>
<td></td>
<td>Signal ground</td>
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<tr>
<td>17</td>
<td>Chassis GND</td>
<td></td>
<td>Chassis ground</td>
</tr>
<tr>
<td>18</td>
<td>+5 V</td>
<td>From</td>
<td>Low current supply</td>
</tr>
<tr>
<td>19-30</td>
<td>GND</td>
<td></td>
<td>Signal returns for 1-11</td>
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<tr>
<td>31</td>
<td>Input Prime</td>
<td>To</td>
<td>Printer reset</td>
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<tr>
<td>32</td>
<td>Fault</td>
<td>From</td>
<td>Low = printer fault</td>
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<tr>
<td>15, 34, 35, 36</td>
<td>unused</td>
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</table>

*Direction to or from printer

Table 1. Centronics connector pinout.

DATA LINES
DATA1-DATA8

DATA STROBE

ACKNOWLEDGE

BUSY

Figure 1. Parallel printer interface timing requirements.
PROJECT 80

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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 (IFB—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 (IFB—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 “oneshot” (74LS161) to generate a low pulse of approximately 1.6 microseconds (µs). 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 PCO (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-
PROJECT 80

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

---

Table 2. IC power pins.

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<td>U6</td>
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<td>U5, U10, U23-U31</td>
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<td></td>
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<tr>
<td>U9, U11, U12, U13</td>
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<tr>
<td>U14-U21</td>
<td>16</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

---

Figure 2. Block diagram of the Intel 8255A parallel printer interface (PPI).

Figure 3. Functional block diagram of printer buffer.
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<td>22 µF/16V capacitor</td>
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<td>.1&quot; perfboard (4½&quot; × 6&quot;)</td>
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*You can use either a 2716 or a 2732A EPROM.

†Except for C12, the 0.1 µF capacitors can be monolithic instead of ceramic.

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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Force Electronics, 343 S. Hindry Ave., Englewood, CA 90301, 1-800-421-5880. Orders will be shipped C.O.D. and tax added, where appropriate.

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, deseleced, 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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If you want to add fancier features to your buffer, the 2732A ROM capability may be advantageous.

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.

![Diagram of RAM block select operation]

**Figure 4. The RAM block select operation.**
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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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Figure 5c. Schematic of the printer buffer: Part 3 (P.3).

Figure 5d. Schematic of the printer buffer: Part 4 (P.4).
PROJECT 80

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 jumper 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 5c. Schematic of the printer buffer: Part 5 (P.5).

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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 μF 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 requirements. 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.](image-url)
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.

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 ceramic 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 204, Ann Arbor, MI 48106.

---

Figure 7. Proper cable construction for parallel printer buffer.
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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18. 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. DEF DERS is now supported.
23. Disk file access is opened simultaneously, randomly, sequential, or mixed.
24. LINE INPUT. is now supported.
25. Invoke the compiler by simply hitting these two keys: "- A".
26. NEW 80 PAGE MANUAL WITH DESCRIPTIONS AND EXAMPLES.
27. ZBASIC 2.2 Comes with CMD FILE CMD program from MISOSYS to allow appending or merging compiled programs and machine language programs from tape or disk.

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1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation (However, subroutine in the manual for these functions.)
2. ERRO, ON ERROR GOTO, ERL, ERR RESUME
3. No direct commands like AUTO, EDIT, LIST, LIST ETC. although these commands may be used when writing programs.
4. Others NOT supported: CDL, CINT, CSNG, DEFFN, FIX, FRED
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 you find out 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 subroutine package. Program shown exactly as compiled and run in BASIC and ZBASIC.]
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, TRS-DOS 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, TRS-DOS 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 SDS 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), SDS, the system drive, is set to drive zero and DDS, 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.

<table>
<thead>
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<th>Field: System/BBS Lines 190-210</th>
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<tr>
<td><strong>SL$</strong></td>
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<td><strong>HS$</strong></td>
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<td><strong>SN$</strong></td>
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<tr>
<td><strong>VS$</strong></td>
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<td><strong>SF$</strong></td>
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<td><strong>NM$</strong></td>
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<tr>
<th>File: Messages/BBS Lines 220-230</th>
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<tr>
<td><strong>TIS$</strong></td>
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<td><strong>FIS$</strong></td>
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<td><strong>SIS$</strong></td>
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<td><strong>T2S</strong></td>
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<th>File: XASPACE/BBS Lines 260-270</th>
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<td><strong>NIS$</strong></td>
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<td><strong>PIS$</strong></td>
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<td><strong>DIS$</strong></td>
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<td><strong>XAS$</strong></td>
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<td><strong>XLS$</strong></td>
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<td><strong>LPS$</strong></td>
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<td><strong>RPS$</strong></td>
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<th>File: Members/BBS Lines 240-250</th>
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<tr>
<td><strong>AIS$</strong></td>
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<td><strong>CIS$</strong></td>
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<td><strong>RPS$</strong></td>
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<tr>
<th>File: User: BBS Lines 280-290</th>
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<tr>
<td><strong>U1S$</strong></td>
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<tr>
<td><strong>U2S</strong></td>
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<td><strong>U3S</strong></td>
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<td><strong>U4S</strong></td>
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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 MSG100/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 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.
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 ASCII(“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 lowercase 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 ASCII(“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 ASCII 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
```
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**THE BOTTOM LINE**

80 Micro, September 1984
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 LEFTS, RIGHTS, And MIDS Statements

LEFTS, RIGHTS, and MIDS are the most powerful string commands. Although they’re simple by definition, their uses are complex.

Type in A$ = “ROBERT” and then PRINT LEFTS(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 LEFTS(“HARMONICA”,6) returns the same answer.

The RIGHTS command, as you’ve probably guessed, is similar to the LEFTS command, but works from the right side of the string. Try typing in and running the following lines:

100 PRINT RIGHTS(“HANDSOME”,4)
110 PRINT RIGHTS(“CARAVAN”,3)

The computer responds by displaying the words SOME and VAN.

The program below uses LEFTS and RIGHTS.

100 REM * FRANKLY, MY DEAR
110 CLS
120 A$ = “I REALLY DON’T CARE”
130 PRINT “I SAY , ” A$ “ BUT INSIDE ” LEFTS(A$,9);RIGHTS(A$,4)
140 END

The MIDS command lets you pull out characters from the middle of a string. Type in PRINT MIDS(“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 MIDS(“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 STRS, VAL, and STRINGS Statements

The STRS 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 STRS 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$, the computer simply shoved the strings together: 10050. This isn't a mathematically correct answer. But you can use strings in arithmetic equations. Type in A = VAL(A$), 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 STR$ command with STRS$. STRS$ returns a string made of a stated number of the same character.

Type in PRINT STRS$(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 STRS$(10, 42).

You can't mix characters in a STRS$ command, but you can print one or more groups of characters in a row, as in PRINT STRS$(10, 42); STRS$(10, 43); STRS$(44).

You can also compress a STRS$ value into a letter variable. Type in A$ = STRS$(32, "*" ). If this is in a program, you can print a line of dashes anytime you include the line PRINT A$.

If you experiment with the STRS$ 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 STRS$(64, 153) and press the enter key (Model 100 users, try PRINT STRS$(40, 252) instead).

STRS$ 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 1, 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 1, 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 * LUCKY TICKET/ MODEL 100 ONLY*
110CLS
120 LUCKY$ = "324 567 444 678"
130 LOSER$ = "SORRY. YOU DIDN'T WIN."
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You can't mix characters in a **STRING$** command.

A string, by values found within a For...Next loop. In this case, the loop goes from 1 to 255, and the program adds each **CHRS** value and then prints the result.

```
100 CLS
110 CLEAR 1000
120 FOR X = 1 TO 255
130 GS = GS + **CHRS**(X)
140 NEXT X
150 PRINT GS
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 7s 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 a GO SUB: 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 **MIDS** statement in this line recognizes 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 **INKEYS** command in line 140 waits for you to tap a key to give **A$** a value.

Line 150 contains GO SUB to line 200 to test the key you tapped, and in line 160, **B$** is @ or the last correct key.
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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 INKEYS input.

Line 160 makes INKEYS (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.

---

BASIC TAKES

```
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$=STRINGS(30,32)
140 A$=A$+INKEYS
150 B$=RIGHT$(A$,1)
155 IF B$="C" THEN A$="": CLS: C=0: GOTO 140
160 IF B$="." THEN A$="": 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$;
180 PRINT @ 128,"NUMBER:";"A$:
185 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
250 PRINT @ 896,"DIVISION BY ZERO IMPOSSIBLE"
260 FOR T=1 TO 1000
270 NEXT T
280 PRINT @ 996,S$;
290 RETURN
300 END
305 REM * FOR MODEL 100 MAKE FOLLOWING CHANGES:
310 REM * 175 PRINT @ 41,"TOTAL:";C$;S$;
315 REM * 177 PRINT @ 88,"NUMBER:";"A$;
320 REM * 236 PRINT @ 48,S$;
325 REM * 1000 PRINT @ 240,"DIVISION BY ZERO IMPOSSIBLE";
330 REM * 1030 PRINT @ 240,S$;
335 REM END
```

Program Listing 5. Calculator.

---

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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:

```pascal
type
color = (red, orange, blue, black);
var
ScreenColor, flowerColor, carHue: color;
```

To use the variables, you can indicate the allowed values directly:

```pascal
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:

```pascal
var
a: array [1..10] of real;
b: array [1..11] of char;
c: array [5..50] of integer;
```

Array “a” has 10 elements; each is a real number. An index of 1-10 refers to one 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 (Newscript’s editor and Alcor’s Blaise Text Editor have brackets), use periods instead of the brackets. So, b[1..11] is the same as b[1].

You can also define an array type in a TYPE statement:

```pascal
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;
```

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 the first, simply use the statement:

```
cList[2] := 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;
var
  inputs: vector array [1..100] of integers;
begin
  inputs := readln;
end;
```

```
program sample;
var
  cList: array [1..100] of cRec;
begin
  for i := 1 to 100 do
    begin
      cList[i].id := i;
      cList[i].name := 'Jane Doe';
      cList[i].amountDue := 14.37;
    end;
end;
```

```
program sample;
var
  cRec = record
    id: integer;
    name: string;
    address: string;
    amountDue: real;
  end;

begin
  var
    customer: cRec;

  begin
    with customer do begin
      id := 1;
      name := 'Jane Doe';
      address := '123 Main Street';
      amountDue := 14.37;
    end;
  end;
end;
```

```
program sample;
var
  cRec = record
    id: integer;
    name: string;
    address: string;
    amountDue: real;
  end;

begin
  var
    customer: cRec;

  begin
    customer.id := 1;
    customer.name := 'Jane Doe';
    customer.address := '123 Main Street';
    customer.amountDue := 14.37;
  end;
end;
```

```
program sample;
var
  cRec = record
    id: integer;
    name: string;
    address: string;
    amountDue: real;
  end;

begin
  var
    cList[1].id := 1;
    cList[1].name := 'Jane Doe';
    cList[1].amountDue := 14.37;
    cList[2].id := cList[1].id;
end.
```

Program Listing 1. Using arrays to compute the average value of a group of reals.

Program Listing 2. Declaring the record type.

Program Listing 3. Using the With statement when declaring record types.

Program Listing 4. Using the record type to list customer variables.
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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 require-
ments at the expense of increasing ac-
cess time to those data items. In Alcor
Pascal, the key word Packed has no ef-
fet; 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 un-
signedByte can contain only values
0–255, and the type signedByte can contain values –128 to 127:

\[
\begin{align*}
type & \quad \text{unsignedByte} = 0..255; \\
& \quad \text{signedByte} = -128..127; \\
var & \quad a : \text{unsignedByte}; \\
& \quad b : \text{signedByte};
\end{align*}
\]

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 peri-
dods between the lower and upper bound-
daries on the subrange mean "and all
values in between."

You can use subrange types with other
types. For example:

\[
\begin{align*}
type & \quad \text{lowerCase} = 'a'..'z'; \\
& \quad \text{uppercase} = 'A'..'Z'; \\
& \quad \text{allLetters} = 'A'..'z'; \\
var & \quad a : \text{lowerCase}; \\
& \quad b : \text{uppercase}; \\
& \quad c : \text{allLetters};
\end{align*}
\]

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 val-
ues; variable \( a \) can only have the val-
ues \( a-z \).

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 per-
mitted values of January–December:

\[
\begin{align*}
type & \quad \text{month} = \text{January}, \text{February}, \text{March}, \\
& \quad \text{April}, \text{May}, \text{June}, \text{July}, \text{August}, \\
& \quad \text{September}, \text{October}, \text{November}, \text{December}; \\
& \quad \text{summer} = \text{June..August}; \\
var & \quad \text{currentMonth} : \text{month}; \\
& \quad \text{birthMonth} : \text{summer}; \\
begin & \quad \text{currentMonth} : = \text{November}; \\
& \quad \text{birthMonth} : = \text{June}
end.
\end{align*}
\]

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 vari-
able 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:

\[
\text{readin(currentDate.month)};
\]

because currentDate.month is not a
simple data type. There are two ap-
proaches 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 vari-
able 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 mon-
thNow 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 val-
ue of 5 for monthNumber, the While
statement loops until ORD(month

\[
\begin{align*}
\text{program sample;} \\
& \quad [ \text{date declared as before} ] \\
& \quad \text{var} \\
& \quad \text{currentDate} : \text{date}; \\
& \quad \text{monthNumber} : 5..11; \\
& \quad \text{monthNow} : \text{month}; \\
& \quad \text{begin} \\
& \quad \text{write}('Enter month number (5..11): '); \\
& \quad \text{readin(monthNumber)}; \\
& \quad \text{monthNow} := \text{January}; \\
& \quad \text{while} \text{ORD(monthNow)} < \text{monthNumber} \text{ do} \\
& \quad \text{monthNow} := \text{succ(monthNow)}; \\
& \quad \text{if} \text{monthNow} = \text{monthNumber} \text{ then} \\
& \quad \text{currentDate.month} := \text{monthNow}; \\
& \quad \text{end};
end.
\end{align*}
\]

Program Listing 5. Building a date type from
enumerated types.

\[
\begin{align*}
\text{program text;} \\
& \quad \text{type} \\
& \quad \text{monthType} = \text{January, February, March}, \\
& \quad \text{April}, \text{May}, \text{June}, \text{July}, \text{August}, \\
& \quad \text{September}, \text{October}, \text{November}, \text{December}; \\
& \quad \text{dayOfTheMonth} = 1..31; \\
& \quad \text{date} = \text{record} \\
& \quad \text{month} : \text{monthType}; \\
& \quad \text{day} : \text{dayOfTheMonth}; \\
& \quad \text{year} : \text{yearType}; \\
& \quad \text{end}; \\
& \quad \text{var} \\
& \quad \text{currentDate} : \text{date}; \\
& \quad \text{begin} \\
& \quad \text{currentDate} : = \text{November}; \\
& \quad \text{currentDate} : .\text{day} : = 12; \\
& \quad \text{currentDate} : .\text{year} : = 1984; \\
& \quad \text{end}.
\end{align*}
\]

Program Listing 6. Using the ORD function
to enter a month from the keyboard.

\[
\begin{align*}
\text{program test;} \\
& \quad \text{type} \\
& \quad \text{monthType} = \text{January, February, March}, \\
& \quad \text{April}, \text{May}, \text{June}, \text{July}, \text{August}, \\
& \quad \text{September}, \text{October}, \text{November}, \text{December}; \\
& \quad \text{month} = \text{record} \\
& \quad \text{case} \text{ of} \\
& \quad \text{true: (name: monthType);} \\
& \quad \text{false: (name: number);} \\
& \quad \text{end}; \\
& \quad \text{var} \\
& \quad \text{currentMonth} : \text{month}; \\
& \quad \text{begin} \\
& \quad \text{write}('Enter month number (0..11): '); \\
& \quad \text{readin} \text{ (currentMonth.number);} \\
& \quad \text{currentMonth} : = \text{succ(monthNow)}; \\
& \quad \text{if currentMonth.name is now set to the} \\
& \quad \text{proper month} \\
& \quad \text{writeln(currentMonth.number);} \\
& \quad \text{end}.
\end{align*}
\]

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 rec-
ords. 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 vari-
ant 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(205,203),(674,821)
is strongly typed, so you can't just set
currentMonth: = 5; Pascal checks
types for assignment statements. Buty using variant records, you can set
currentMonth.number: = 5, meaning
that currentMonth.name is now June.

It's important to note that the vari-
ant 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 gen-
eral, 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 sub-
range of the same size as the user-de-
defined field, so you know they occupy
the same space.

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Pack Your Editor/Assembler With Some Powerful Extras

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, II, III, and IV.

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-compati-ble 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 value 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 following 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
THE NEXT STEP

would decide if the source and destination blocks would overlap, would choose whether to use an LD 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 repetitive code over and over, but also because they let you move your Assembly-language code 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 definition 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 (CHR$(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 single 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 ADTB1 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  ADTB1 MACRO #P1,#P2,#P3
00070  PUSH AF
00080  PUSH BC
00090  PUSH HL
00100  LD HL,#P1  ;HL=#table
00110  LD BC,#P2  ;BC=table length
00120  ADTB?? 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 MB of counter
00180  OR C  ;Merge with LSB
00190  JR NZ,ADTB??  ;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  !ADTB1 B000H,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  ;Save registers
00152  PUSH BC
00153  PUSH HL
00154  LD HL,B000H  ;HL=>table
00155  LD BC,400H  ;BC=table length
00156  ADTB3 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 MB of counter
00162  OR C  ;Merge with LSB
00163  JR NZ,ADTB3  ;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 ADTB?? has been replaced by ADTB3 both times it was used. The # 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 expanded.
5 ' Inspired by the ZEN editor/assembler, but all code is original.
6 ' Written by Hardin Brothers
7 ' 8 ' 9 ' 10 'Variable definitions:
11 ' MNS ......... Name of Macro Library File
12 ' ISS ......... Name of original source file
13 ' OS$ ......... Name of new output source file with
14 ' expanded macros
15 ' MP$(100) .... Names of macro definitions (maximum of 100)
16 ' PS$(9) ...... Parameters from source file
17 ' P .......... Highest parameter number in macro file
18 ' LA ........ Number of macros expanded
19 ' LAS ....... LA in string form for '??' substitution in local
20 ' LC ........ Line number counter for output file
21 ' LCG ....... Line number in string form (length = 5)
22 ' M$ ......... Macro name
23 ' M$I$ ....... Input line from macro (MNS) file
24 ' SIG ....... Input line from source (ISS) file
25 ' SOS ....... Output line to expanded (OS$) file
26 ' S$ ....... Temporary SIG form during processing
27 ' TBS ....... Holds TAB value (CHR$(9))
28 ' Z,ZZ ...... Loop counters
29 ' ZS ....... Temporary string for output file header
30 ' File format (EDTASM source files)
31 ' Each line of source code contains
32 ' 1. 5-digit line number (including leading 0s)
33 ' 2. with high bit of each digit set
34 ' 3. A single space (20H)
35 ' 4. An optional label field
36 ' 5. An op-code field
37 ' 6. An optional operand field
38 ' All fields are separated by tab characters (9BH)
39 ' The file contains a 7-byte header before
40 ' the first line number consisting of a $BDH byte
41 ' and the first six characters (without extension)
42 ' of the source file name, left justified.
43 ' The end of the file is marked by a single byte
44 ' of LAH.
45 ' SERIES 1 (Radio Shack's Editor-Assembler) files
46 ' are identical except that the file starts with
47 ' the first line number. The $BDH and 6-byte
48 ' header are absent.
49 ' To modify this program to work with the SERIES 1
50 ' Editor-Assembler, delete lines 3030 to 3100.
51 ' 58 ' Initialize variables and arrays
52 ' CLEAR 5000
53 ' DEFINT A-Z
54 ' DIM MNS,ISS,OS$,P,L,LA,LC,LCS,M5,M$I$,S1$,SOS$,S$
55 ' DIM Z,ZZ,ZS
56 ' DIM M$(100),MP$(100)
57 ' 99 ' Program outline
58 ' 60 ' GOSUB 1000 .... 'Get file names
59 ' 110 GOSUB 2000 .... 'Read macros
60 ' 120 GOSUB 3000 .... 'Read source and process macros
61 ' 130 ' 140 CLOSE: END .... 'End of program
62 ' 150 ' 999 ' Get file names for all three files
63 ' 1000 CLS:PRINT"Macro Instruction Pre-processor"

Listing 1 continued

Readers who subscribe to CompuServe can ask questions or take part in discussions on topics covered by “The Next Step.” Go PCS-117 to the Software and Authors’ Special-Interest Group (SASIG) and leave your questions addressed to Hardin Brothers on section zero of the message board. Feel free to join in discussions started by others.
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1010 PRINT: PRINT: PRINT
1020 LINEINPUT "File name of Macro Library" => "$MNS"
1030 LINEINPUT "File name of original source code" => "$ISS"
1040 LINEINPUT "File name of expanded source code" => "$OSS"
1050 CLS
1060 PRINT "Macro Library File" => "$MNS"
1070 PRINT "Original Source Code" => "$ISS"
1080 PRINT "Expanded Source Code" => "$OSS"
1090 PRINT: INPUT "Okay" => "$S$
1100 IF RIGHT$("$S",1) <> "y" AND RIGHT$("$S",1) <> "y" THEN GOTO 1000
1110 RETURN
1120 ·
1999 ' Read macro file, collect macro names in $M$ and
save the position of each in $MP$
2000 OPEN "I",1,$MNS
2010 MC = $M$: MP = 1 'Initialize macro
counter and line
pointer
2020 CLS: PRINT"Macro definitions found:"
2030 PRINT
2034 LINEINPUT"1", $ISS
2040 IF INSTR($ISS,"MACRO") = 0 OR
(INSTR($ISS,"MACRO") - INSTR($ISS,"TBS")) < 1
THEN GOTO 2890
2050 MC = MC + 1 'Inc. Macro counter
2060 $M$(MC) = MIDS($ISS,7,INSTR($ISS,CHR$(9)) - 7)
'Macro name in $M$
2070 PRINT $M$(MC)
2080 $MP$(MC) = $M$
2090 $MP$(MP) = $M$ 'Copy line # into $MP$
2100 IF EOF(1) THEN CLOSE: RETURN
2110 GOTO 2830
2120 ·
2129 ' Main Processing Routine
3000 OPEN "I",1,$ISS
3010 OPEN "O",2,$OSS
3020 LC = 1 'initialize line count
3030 ' Process last source line (may not contain a macro call)
3040 LINEINPUT1, $ISS
3050 GOSUB 4000
3060 $Z$ = STRINGS(6," ") 'Get lc in string form
3070 LET $Z$ = LEF$(OSS,INSTR(OSS,"/")) - 1
3080 SOS = $Z$ + LC$ + MIDS($ISS,13)
3090 PRINT SOS
3100 PRINT $Z$, CHR$(43) + SOS
3110 ' Now loop to process all the rest
3119 ' If $ISS$ = CHR$(81) THEN
3120 PRINT$2,CHR$(43) + SOS
3129 ' '1AH marks end of file
3130 $ISS$ = MIDS($ISS,7)
3140 'strip leading line
3150 IF INSTR($ISS,"!")) <> 0 AND
INSTR($ISS,"!")) - INSTR($ISS,$TBS) = 1
THEN GOSUB 5000: GOTO 3200 'Look for macro call
3160 LC = LC + 1: GOSUB 4000 'and expand if found
3170 PRINT "$ISS$" 'update line # and make
3180 'build output string
3190 PRINT$2, SOS
3200 GOTO 3120 'string to output file
3210 'for next line
3219 ' 3999 ' Change line count (LC) into 5 char. string (LC$)
4000 LC$ = MIDS($STR$(LC),2)
4010 IF LEN(LC$) = 5 THEN GOTO 4040 'must be 5 char. long
4020 LC$ = "0" + LC$: GOTO 4010
4030 ' Set high bit of each character
4040 FOR I = 1 TO 5
4050 MIDS(LC$,$Z) = CHR$(ASC(MIDS(LC$,$Z,1)) OR $&H80)
4060 NEXT Z
4070 RETURN
4080 ·
4099 ' Process and expand a macro definition
5000 $SS$ = MIDS($ISS,INSTR($ISS,"!")) + 1 'Strip source line to
5010 IF INSTR($ISS,$TBS) = 0 THEN $SS$ = $SS$ ELSE $SS$ = LEF$(SS,INSTR($ISS,$TBS)) - 1
5020 FOR I = 1 TO $SS$ 'Find name in list
5030 IF $MP$(I) = $SS$ THEN GOTO 5070 'macro name to $MP$
5040 NEXT Z
5050 PRINT"Macro ";$ISS$" not found.
5060 'stop if macro not found in list
5060 ' 5069 OPEN "I",3,$ISS
5070 OPEN "O",2,$OSS
5080 FOR ZZ = 1 TO $MP$(1) 'Read macro defn.
5090 LINEINPUT1, $ISS$ 'Strip comment and its
5100 NEXT ZZ
5110 ·
5119 ' Find # of parameters expected by macro
5140 IF LEN($ISS$) = LEN($ISS$) + 7 THEN GOTO 5260 'no macros
5159 IF INSTR($ISS$,"\") <> 0 THEN $MP$(I) = LEF$(ISS,INSTR($ISS$,"\")) - 2 'Strip comment and its
5160 IF RIGHT$(ISS,1) = CHR$(9) 'leading tab
5169 THEN $MP$(I) = LEF$(ISS,LEN($ISS$)) - 1 'strip trailing tab
5170 P = VAL(RIGHTS($ISS,1)) 'get highest parameter #
5180 IF P = 0 THEN GOTO 5260 'go if no parameters
5190 ·
Listing 1 continued
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**THE NEXT STEP**

**Listing 1 continued**

```plaintext
5200 IF INSTR(SS,THS)=0
5220 THEN P$="\""
5250 ELSE SS=MIDS(SS,INSTR(SS,THS)+1) "strip to #1
5280 THEN P$=LEFTS(SS,INSTR(SS,THS)-1)
5300 "strip everything after
5350 last parameter
5390
5400 FOR Z=1 TO P
5450 THEN PSZ()=LEFTS(SS,INSTR(SS,THS,"\""))+1
5500 ELSE PSZ()=SS: SS="\"

5550 "Read source parameters
5600 into P$(
5650
5700 NEXT Z
5750"

5800 LA = LA + 1: LA$ = MIDS(STR$(LA),2)
5900 "New label exten.
5950 IF LEN(LA$)<2 THEN LA$ = "#" + LA$
6000 "strip leading space
6050 5000 line input$, MIS
6100 IF INSTR(MIS,END$)<>0
6150 THEN CLOSE 3: RETURN
6200 "Check for end
6250 StrIP Line $ & space
6300 MIS = MIDS(MIS,7)
6350 IF INSTR(MIS,???)<>0 THEN
6400 MIDS(MIS,INSTR(MIS,???) = LA$
6450 "Make label local
6500 IF INSTR(MIS,???) = 0 THEN GOTO 5380
6550 "Go if no params.
6600 MS = LEFTS(MIS,INSTR(MIS,"\""",1)-1)
6650 +PS(VAL(MIDS(MIS,INSTR(MIS,"\""",1)+2,1)))
6700 "build output line
6750 5340 IF LEN(MS) > INSTR(MIS,"\""",2)
6800 THEN MS = MS + MIDS(MIS,INSTR(MIS,"\""",3)+3)
6850 "add rest of line
6900 Copy output line
to $M$
6950 5360 GOTO 5320
7000 Prepare MIS for output
7050 5370 LC = LC + 1: GOSUB 4800
7100 "Get line #
7150 5390 MIS = LCS + " + MIS
7200 "Put in file
7250 PRINT MIS
7300 5410 PRINT MIS
7350 5420 GOTO 5280
```

**Program Listing 2. General-purpose macros.**

```plaintext
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 ;ILD MACRO #P1,#P2,#P3
00200 PUSH IX ;Save IX
00210 PUSH #P1 ;Transfer pointer
00220 POP IX ;to IX
00230 LD #P2,(IX-0) ;LSB to #P2
00240 LD #P3,(IX+1) ;MSB to #P3
00250 POP IX ;Restore IX Listing 2 continued
```
THE NEXT STEP

Listing 2 continued

00260 NC
00270 ;
00280 ;FILL -- fill any block of memory (including
00290 ; video memory) with any value.
002A0 ;#P1 = address of block
002B0 ;#P2 = length of block
002C0 ;#P3 = fill byte
002D0 FILL MACRO #P1,#P2,#P3
002E0 #P150 PUSH AF
002F0 #P510 PUSH BC
00320 ;Save registers
00330 #P370 LD HL,#P1
00340 ;HL = beg. of block
00350 #P180 LD BC,#P2
00360 ;BC = byte count
00370 #P190 FILL??
00380 LD DL,HL,#P3
00390 ;Set one address
003A0 #P400 INC HL
003B0 ;Jump pointer
003C0 #P410 DEC BC
003D0 ;Decrement counter
003E0 #P420 LD A,$FF
003F0 ;Get MSB of count
00400 #P430 OR C
00410 ;Merge LSB
00420 #P440 JR NW,$FILL??
00430 ;Loop until done
00440 #P450 POP HL
00450 ;Restore registers
00460 #P180 POP AF
00470 #P180 POP BC
00480 #P180 POP DE
00490 #P180 POP HL
004A0 POP AF
004B0 ;
004C0 ;
004D0 ;SNAP -- exchanges the values of any two register pairs
004E0 ;#P1 & #P2 are the names of the pairs
004F0 #P120 SNAP MACRO #P1,#P2
00500 #P530 PUSH #P1
00510 ;Place both on stack
00520 #P540 PUSH #P2
00530 ;Pop off stack in reverse order
00540 #P550 POP #P1
00550 #P560 POP #P2
00560 #P150 ENDM
00570 #P150
00580 ;
00590 #P190 ADDB16 -- Adds an 8-bit value to a 16-bit register pair
005A0 #P600 #P1 is the 16-bit register pair
005B0 #P610 is an 8-bit value or register
005C0 #P620 ADDB16 MACRO #P1,#P2
005D0 #P630 PUSH AF
005E0 ;Save registers
005F0 #P640 PUSH HL
00600 ;
00610 #P650 PUSH #P1
00620 ;Transfer 16-bit value
00630 POP HL
00640 ;to HL
00650 #P660 LD A,$FF
00660 ;Get MSB of reg. pair
00670 #P680 ADD A,#P2
00690 ;Add 8-bit value or reg.
006A0 #P730 JR NC,AD2??
006B0 ;Skip if no carry
006C0 #P720 INC HL
006D0 ;Increment HL
006E0 #P720 AD2?? PUSH HL
006F0 ;Transfer 16-bit value
00700 #P730 POP #P1
00710 ;back where it came from
00720 #P730 POP HL
00730 ;Restore registers
00740 #P750 POP AF
00760 ;
00770 ;PSHAL -- Saves all non-prime registers on stack
00780 #P790 no parameters
00790 #P7A0 PSHAL MACRO
007B0 #P810 PUSH AF
007C0 #P820 PUSH BC
007D0 #P830 PUSH DE
007E0 #P840 PUSH HL
007F0 #P850 PUSH IX
00800 #P860 PUSH IY
00810 #P870 ENDM
00820 #P880
00830 ;POPAL -- Pops all non-prime registers from stack
00840 #P890 no parameters
00850 #P8A0 POPAL MACRO
00860 #P8B0 POP AF
008C0 #P8D0 POP BC
008D0 #P8E0 POP DE
008E0 #P8F0 POP HL
008F0 #P900 POP IX
00900 #P910 POP IY
00920 #P920 ENDM
00930 ;
00940 #P940 ;CP16 -- Compares two 16-bit register pairs, #P1 & #P2
00950 #P960 ;Changes AF register pair.
00970 #P980 ;Status flags after compare:
00990 #P9A0 #P1 > #P2 X
009B0 ;
009C0 #P9D0 #P1 < #P2 C
009E0 ;
009F0 #P9F0 #P1 = #P2 Z
00A10 ;
00A20 #P100 #P16 MACRO #P1,#P2
00A30 #P100 PUSH DE
00A40 #P100 PUSH HL
00A50 #P100 PUSH BF
00A60 #P100 PUSH IX
00A70 #P100 PUSH IY
00A80 #P100 POP DE
00A90 #P100 POP HL
00AA0 #P100 POP BF
00AB0 #P100 POP IX
00AC0 #P100 POP IY
00AD0 #P100 ENDM
00AE0 #P100
00AF0 ;
00B00 ;
00B10 ;
00B20 ;
00B30 ;
00B40 ;
00B50 ;
00B60 ;
00B70 ;
00B80 ;
00B90 ;
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00C90 ;
00CA0 ;
00CB0 ;
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00CD0 ;
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00CF0 ;
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00DB0 ;
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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 (Micropro 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-

<table>
<thead>
<tr>
<th>Command</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEBUG</td>
<td>Invoke the MS-DOS dynamic debugging environment to allow patching the BIOS.</td>
</tr>
<tr>
<td>E40:DA</td>
<td>Display the byte located at segment 0040, address 00DA (absolute address 004DA hex).</td>
</tr>
<tr>
<td>00</td>
<td>If it is OFF hex, then line feed filtering is enabled and you must change the byte to 00 hex to disable line feeds.</td>
</tr>
<tr>
<td>Q</td>
<td>The patch is installed and entering Q tells Debug to exit and return to MS-DOS.</td>
</tr>
</tbody>
</table>

Table 1. Patch to disable line feed filtering. You must terminate all entries in the command column by pressing the enter key.
# Nocona Electronics

## Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<tbody>
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<tr>
<td>16K Model</td>
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</tr>
<tr>
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<td>4 2 DR RS 232</td>
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<tr>
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</tr>
<tr>
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<td>12 1 DR</td>
<td>2189.00</td>
</tr>
<tr>
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<td>12 2 DR</td>
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<td>16 2 DR</td>
<td>3639.00</td>
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<tr>
<td>256K Model</td>
<td>16 1 DR with HD</td>
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</tr>
<tr>
<td>8K Model</td>
<td>100 PORTABLE</td>
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</tr>
<tr>
<td>24K Model</td>
<td>100 PORTABLE</td>
<td>579.00</td>
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<tr>
<td>15 MEG HD</td>
<td>MOD 12/16</td>
<td>2369.00</td>
</tr>
<tr>
<td>5 MEG HD</td>
<td>MODEL III/4</td>
<td>1549.00</td>
</tr>
<tr>
<td>1 DR EXP</td>
<td>MOD 12/16</td>
<td>1019.00</td>
</tr>
<tr>
<td>Model 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOD 2000 W/MONO MONITOR</td>
<td>2299.00</td>
<td></td>
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<tr>
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<td></td>
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<tr>
<td>DMP 200 PRINTER</td>
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<td>479.00</td>
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<tr>
<td>DMP 420 PRINTER</td>
<td></td>
<td>699.00</td>
</tr>
<tr>
<td>DMP 500 PRINTER</td>
<td></td>
<td>999.00</td>
</tr>
<tr>
<td>DMP 2100 PRINTER</td>
<td></td>
<td>1499.00</td>
</tr>
<tr>
<td>DWP II DAISY WHEEL</td>
<td></td>
<td>1069.00</td>
</tr>
<tr>
<td>DWP 210 DAISY WHEEL</td>
<td></td>
<td>559.00</td>
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<td>DWP 410 DAISY WHEEL</td>
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<tr>
<td>DWP 210 TRACTOR FEED</td>
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<td>110.00</td>
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<tr>
<td>DWP 410 TRACTOR FEED</td>
<td></td>
<td>129.00</td>
</tr>
<tr>
<td>DWP II TRACTOR FEED</td>
<td></td>
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<tr>
<td>PARALLEL PRINTER SWITCH</td>
<td></td>
<td>96.00</td>
</tr>
<tr>
<td>64K PRINTER CONTROLLER</td>
<td></td>
<td>199.00</td>
</tr>
</tbody>
</table>

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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 Executable 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 58,132
Name: PURGE
Title: Purge utility, prompts with filenames

; Equates go here
FF equ $B9
D1 equ $AF
equ $1F

; Include 8088.mac

; Assorted MACROS
; display macro string
mov dx,offset string
mov ah,0
int 21h
ends

; read_kbd_and_echo macro
mov ah,1
int 21h
ends

; set_data macro buffer
mov dx,offset buffer
mov ah,11h
int 21h
ends

; search_first macro fcb
mov dx,offset fcb
mov ah,11h
int 21h
ends

; search_next macro fcb
mov dx,offset fcb
mov ah,12h
int 21h
ends

; delete macro fcb
mov dx,offset fcb
mov ah,12h
int 21h
ends

; display_char macro character
mov dx,character
mov ah,2
int 21h
ends

; proc purg far
; ENTRY POINT FROM DOS
push dx
sub ax,ax
push ax
; set up for return to DOS
mov ax,data
; set up data register
mov dx,ax
push dx
; pl: display nl
mov dx,offset nl
```

Listing continued

---

Features 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
#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 database 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

One Tandy Center

Fort Worth, TX 76102

26-5260

$49.95

WordStar 3.31

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.
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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MODEL 4 COMPUTERS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>LIST PRICE</th>
<th>OUR PRICE</th>
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<tr>
<td>26-1007 Model 4 16K Computer</td>
<td>$899.00</td>
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<td>26-1008 Model 4 64K 1 Drive Computer</td>
<td>$1299.00</td>
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<td>26-1009 Model 4 64K 2 Drive Computer</td>
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<td>26-1080 Model 4 Portable</td>
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<tr>
<td>26-1122 64K Memory Expansion</td>
<td>$79.95</td>
<td>$70.00</td>
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<tr>
<td>26-1127 0 Drive Model 4 Computer</td>
<td>$499.95</td>
<td>$425.00</td>
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<tr>
<td>26-1134 Model 4CP/M Plus Model 4</td>
<td>$199.95</td>
<td>$169.00</td>
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<td>26-2216 CP/M Plus Model 4</td>
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MODEL 100 COMPUTERS

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<tr>
<td>26-3801 8K Model 100 Computer</td>
<td>$599.00</td>
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<tr>
<td>26-3802 24K Model 100 Computer</td>
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<td>26-3804 4K Adaptor</td>
<td>$5.95</td>
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<tr>
<td>26-3805 Accoustic Coupler</td>
<td>$39.95</td>
<td>$34.00</td>
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<td>26-3816 6K Memory Expansion</td>
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<tr>
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<td>$12.70</td>
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<tr>
<td>26-1410 Modern Cable</td>
<td>$19.95</td>
<td>$17.00</td>
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<tr>
<td>26-3809 Briefcase</td>
<td>$49.95</td>
<td>$42.50</td>
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<td>26-1183 Bar Code Reader</td>
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MODEL 100 COMPUTERS

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<th>OUR PRICE</th>
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<td>26-3202 Color II Extended Basic</td>
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<td>26-3203 1.2.3, Color Drives</td>
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<td>26-3209 Drive Color Computer II</td>
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<td>26-3030 OSI-9 With Editor Assembler</td>
<td>$69.95</td>
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<td>26-3036 Basic 09</td>
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RADIO SHACK PRINTERS

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<td>26-1252 DMP 500 Dot Matrix Printer</td>
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<td>26-1257 DWP 210 Daisy Wheel Printer</td>
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<td>26-1158 DII Daisy Wheel Printer</td>
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<td>26-1267 DMP 420 Dot Matrix Printer</td>
<td>$999.00</td>
<td>$740.00</td>
</tr>
<tr>
<td>26-1271 DMP 110 Dot Matrix Printer</td>
<td>$399.00</td>
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OTHER MAJOR BRANDS

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<td>$Call</td>
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<td>Star (Geminii)</td>
</tr>
<tr>
<td>Software</td>
<td>$Call</td>
<td>Hayes Moderns</td>
</tr>
</tbody>
</table>

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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 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 CompuServe at 73016,1326.

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### 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.

<table>
<thead>
<tr>
<th>Computer System</th>
<th>Execution Time</th>
</tr>
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<tbody>
<tr>
<td>IBM PC/XT</td>
<td>27 seconds</td>
</tr>
<tr>
<td>Victor 9000 (hard disk)</td>
<td>23 seconds</td>
</tr>
<tr>
<td>Model 2000 (floppy disk)</td>
<td>20 seconds</td>
</tr>
</tbody>
</table>

The equivalent program written in dBase II executed in one minute and 55 seconds.

---

### Table 4. Macros for the Program Listing.

<table>
<thead>
<tr>
<th>Name</th>
<th>Length</th>
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<td>CONVERT</td>
<td>L HUNT #55 CSGB</td>
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</tr>
<tr>
<td>CR</td>
<td>L HUNT #00D</td>
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<td>CRFL</td>
<td>L BYTE #159 DATA</td>
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<td>EOK</td>
<td>L BYTE #024 DATA</td>
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<td>GO_DBE</td>
<td>L BYTE #020 DATA</td>
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158 • 80 Micro, September 1984
**NEWDOS/80™ Users**

Four NEW Utilities for NEWDOS/80

Versions 2.0 and 2.5

DIRSORT — Alphabetize a disk's directory ON THE DISK!
Make searching through a large "DIR" listing a breeze!

UN KILL — Restore a KILLed file, automatically! A long
awaited and much needed utility. A lifesaver!

DFLIST — Display a listing of a disk's KILLed files. These are
the candidates for the UN KILL utility.

RAMSPool — Put printing in the background. Use the
computer's memory as a printer buffer. A real timesaver!

*Each of the utilities is fully Model I/II
and Hard Disk compatible.*

$49.95

(please add $2 per order for shipping and handling)

California residents add 6% sales tax

To order, send check, money order, or charge card information (MasterCard or Visa) to:

SOFTWARE SUCCESS

P.O. Box 1048 • Windsor, CA 95492

These utilities are written and produced by NEWSOFT Products
and Software Success with the knowledge and cooperation of
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Versions 2.0 and 2.5. Support and update services are solely the
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Re-ink most fabric ribbons with only one machine

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without fuss! Without mess!

The manual E-Zee Inker is only $39.50. For higher
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• INSTANT HELP SCREENS

• EDITS ANY FILE

• USER DEFINED

• PERSONALITY

• MACROS FOR

• COMPLEX

• TASKS

• SCREEN SNAPSHOT (GRAPHS)

• COLUMN EDITING FEATURES

• RANGES, VETOS & STRINGS

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**ON SCREEN WORD PROCESSING**

• PROPORTIONAL SPACING

• PAGE NUMBERING (ANYWHERE)

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• PARTIAL DOCUMENT PRINTING

• MODEL III GRAPHICS

• ODD/EVEN TOP & BOTTOM TITLES

• WORD WRAP - AUTO TABS

**ADDITIONAL FEATURES**

FREEBEE PROGRAMS (Source Files Included)

• DRAW: HOR/VERT SCROLLING SCREEN

• GRAPHICS EDITOR

• CONNECT: SUPPORT HAYES SMARTMODEM FEATURES

• HELP: FRAME ORIENTED RELATIONAL QUERY DATA BASE

• LPRINT: SCREEN IMAGES ON EPSON, PROWRITER, AND OKIDATA (IO)

**DOS SHELL**

• EXEC DOS COMMANDS & RETURN

• EXEC BASIC & /CMD PROGRAMS

• USE MACROS IN PROGRAMS

• SUPPORTS MOST MODEL III DOS

**TELECOMMUNICATIONS**

• UP TO 1200 BAUD

• HORIZONTAL SCROLLING SCREEN

• MACROS HANDSHAKE WITH HOST

• EXTREMELY FAST SCREEN DISPLAY

**EXCELLENT DOCUMENTATION**

• OVER 200 PAGES

• PROGRAMMED TUTORIAL

• CLEARLY WRITTEN

• EASY TO USE

**SUPER POWER**

PERFORMANCE FOR MODEL (III)

OR MODEL IV IN III MODE

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COMPUGENTS INC.

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PHONE 208-529-2492 (9-5 Mtn)

REQUIRES 48K - 2 DISK DRIVES

IDaho residents add sales tax

Master Charge or VISA Welcome

5% shipping & handling charge

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See List of Advertisers on Page 162

80 Micro, September 1984 • 159
Aerocomp's Proven Best-By Test! The "DDC" Double Density Controller

★ Technical Superiority

At last! A double density controller for Model I with HIGHER PROBABILITY OF DATA RECOVERY THAN WITH ANY OTHER DOUBLE DENSITY CONTROLLER ON THE MARKET TODAY! The "DDC" from Aerocomp. No need to worry about the problems that keep cropping up on existing products. AEROCOMP'S new analog design phase lock loop data separator has a wider capture window than the digital types currently on the market. This allows high resolution data centering. The finest resolution available with digital circuitry is 125 ns (nanoseconds). The "DDC" analog circuit allows infinitely variable tuning. Attack and settling times are optimum for 5-1/4 inch diskettes. The units presently on the market use a write precompensation circuit that is very "sloppy." Board to board tolerance is extremely wide - in the order of ± 100 ns. The "DDC" is accurate to within ± 20 ns. The bottomline is state of the art reliability!

★ 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, 48K with TRS80 Expansion Interface and a Percom FD100* 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 one - no retry. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were totalled and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

★ Features

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

SUMMER SPECIAL $99.00
for the Best DD Controller on the market.

"DDC" and LDOS $169.95
"DDC" and Newdos 80 $179.95

Data Separators

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

★ Has your original manufacturer left you holding the bag?

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

<table>
<thead>
<tr>
<th>MFR. &amp; PRODUCT</th>
<th>SECTORS LOCKED OUT</th>
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Note: Same test procedures as "DDC".

★ "DDS" $49.95
(Use 1791 chip from your DD controller)

★ "DDS" with disk controller chip included $79.95

★ "Disk controller chip $34.95

Plugs directly into your existing Double Density Controller.

Do you need a Single Density Data Separator?

The internal data separator in the WD1771 chip (85 Expansion Interface) is NOT recommended by WD for reliable data transfer. Do you have any of these problems: lost data, tracks locked out, CRC errors, disk retry? YOU NEED ONE!

★ "SDS" $29.95
(For Mod. I; shipping $2.00)

See opposite page

160 • 80 Micro, September 1984
Aerocomp leads the way to the BEST value in disk drives and related peripheral products on the market today. Sound engineering, high performance, quality construction, no-risk free trial, outstanding warranty service and a reputation for doing the right thing make your decision to buy Aerocomp the correct one. Please look over our offerings and make your selection. When you have made your choice call one of our toll-free numbers and place your order. If you need assistance in making your selection, please call our information number. It's listed in the box below along with the technical assistance number for those of you who want to get to the nitty-gritty. Thanks, we all appreciate your business and will do our very best to support you.

**NEW!**

**DISK DRIVES**

**40 & 80 TRACK**

**SINGLE & DOUBLE SIDED**

**as low as $169**

**PERSONAL CHECKS WELCOME**

We'll be happy to accept your personal check with any mail order without any shipping delay.

**FREE TRIAL OFFER**

Use your Aerocomp hardware product for up to 14 days. If you are not satisfied for ANY REASON (except misuse or improper handling), return it in the original shipping container for a full purchase price refund. Sorry, this offer does not apply to software. Defective software will be replaced only. Any hardware/software specials will be prorated and the software will be charged at the regular unbound price. We have confidence in our products and we know you will be satisfied.

**WARRANTY**

We offer a one year warranty on parts and labor against defects in materials and workmanship. In the event service becomes necessary for any reason you will find our service department fast, friendly and cooperative. Our goal is 48 hour turnaround on all repairs.

**100% BURN-IN and TEST**

All our products are burn-in and fully tested prior to shipment. We want you to receive an item ready-to-go.

**AEROCOMP means reliability!**

**ORDER NOW!**

Call one of our toll-free numbers and place your order. Have your Mastercharge or Visa number ready. We will not charge your card until the day we ship your order. You may order by mail using your credit card, check or money order. Personal and company checks are welcome and cause no shipping delay as long as they are bank printed and the signature exactly agrees with the name printed on the check. We will ship surface COD with no deposit but all COD's require cash or a cashier's check on delivery. Texas residents add 6% State Sales Tax for hardware only. No tax collected on out of state shipments. Canadians add $20 to your orders if over $500 for customs documentation.

**ORDERS ONLY CALL TOLL-FREE**

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Redbird Airport, Bldg. 8
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**DISK CONTROLLER and DRIVE KITS**

Convert your cassette Model III or 4 disk drive operation with one of our complete kits. You receive our own advanced disk controller board with gold plated circuit contacts capable of 4-drive operation; our own power supply; mounting towers complete with EMI shield plus all the cables and hardware necessary. Detailed instructions are included. Complete kits come with 40 track single-side Tandem drives (TM100-1) or order just the components you need from the list below.

**FULL CONTROLLER KIT (less drives) $195**

**ONE DRIVE SYSTEM $359**

**TWO DRIVE SYSTEM $399**

Shipping & handling $8.00 per system

**DISK CONTROLLER ONLY** $119

No mounting kit, power supply or drives. $2.00 S & H

**MOUNTING KIT & POWER SUPPLY** $99

No controller or drives. $4.00 S & H

**Our Famous Model I Starter Package**

If you have a Model I and an Expansion Interface this is what you need to get started with disks. Included is one 40 track single-side disk drive complete with matching silver case and power supply, a 2-drive cable, a TRS80 CP 2.3 disk operating system and TRS80 manual plus all insurance and delivery charges to your door (lower 48 states).

Yours for only $239

We also have the LNW Model I Expansion Interface available. This unit comes with 32K RAM (the maximum), a built-in RS-232C and a one year factory warranty. We have discounted the price of this nationally known unit to only $399 delivered.

You can add our renown "DDC" double density controller to either the Radio Shack or the LNW E/F for 80% more storage capacity on your drive. Go ahead, you deserve increased density. See the opposite page for details.

**COMPLETE DRIVES**

Includes disk drive, power supply, extender cable and enclosure. Please specify silver or beige color enclosure. Shipping and handling $5.00 per drive. One year warranty includes parts, labor and return postage (surface).

- 40k Single Side full size (Tandem) $199
- 40k Single Side full size (Tandem) $199
- 40k single size full size, "Flipper" (MIP) $249
- 80k single side full size (Tandem) $269
- 80k single side full size (Tandem) $269
- 80k single side full size (Tandem) $269
- 140k single side full size (Tandem) $279
- 240k single side full size (Tandem) $279
- 240k single side full size (Tandem) $279
- 240k single side full size (Tandem) $279
- 320k single size full size (Tandem) $279
- 880k single side full size (Tandem) $399
- 2.8" 5.25" 8mm drives in dual case $999
- 2.8" 5.25" 8mm drives in dual case $999
- 2.8" 5.25" 8mm drives in dual case $999
- 2.8" 5.25" 8mm drives in dual case $999

**BARE DRIVES**

- 40k single size Tandem (TM110-1) $169
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- 40k single size Tandem (TM110-1) $169
- 80k single size Tandem (TM110-1) $199
- 80k single size Tandem (TM110-1) $199
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- 80k single size Tandem (TM110-1) $199
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**MISCELLANEOUS GOODIES**

- Model I TRS80 CP 2.3 disk & manual $25
- Model I TRS80 CP 2.3 disk & manual $25
- UXOS (specify Mod I or II) $69
- NEWOS 80 2.0 (specify Mod I or III) $139
- 10 diskettes in library box $23
- 5.25" drive power supply & enclosure $59
- 8" drive power supply & enclosure $150
- 5.25" 2-drive cable $24
- 5.25" 4-drive cable $34
- 5.25" extender cable with gold contacts $13

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<td>General Interface Corp.</td>
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<td>Generic Inc.</td>
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<td>379</td>
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<td>Good Software Corp.</td>
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<td>Good Software Corp.</td>
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<td>H &amp; E Computeronics Inc.</td>
<td>79, 81, 83</td>
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<td>* H &amp; E</td>
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<td>Harmon Hardware &amp; Supply</td>
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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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- Model 4
- Model 4 P

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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 segments 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. CMP1 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 TRS80 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

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Arrow Keys)</td>
<td>Controls cursor</td>
</tr>
<tr>
<td>C/(string 1/ string 2/n)</td>
<td>Changes string 1 to string 2 for a specified number of times</td>
</tr>
<tr>
<td>D</td>
<td>Deletes a line or block of lines</td>
</tr>
<tr>
<td>E</td>
<td>Edits the current line pointed at by cursor</td>
</tr>
<tr>
<td>F/(string/n)</td>
<td>Finds a string</td>
</tr>
<tr>
<td>K</td>
<td>Kills text in buffer</td>
</tr>
<tr>
<td>H</td>
<td>Prints all or part of text in buffer</td>
</tr>
<tr>
<td>I</td>
<td>Inserts a line</td>
</tr>
<tr>
<td>J</td>
<td>Displays text size and amount of free memory in buffer</td>
</tr>
<tr>
<td>L filespec(SC)</td>
<td>Loads a file into buffer; chains file to end of text already in buffer (optional)</td>
</tr>
<tr>
<td>W</td>
<td>Writes text buffer to disk</td>
</tr>
<tr>
<td>M</td>
<td>Moves block of text from one part of file to another</td>
</tr>
</tbody>
</table>

Table 2. Directives available with ALDS's assembler.

Table 3. Command features available with ALDS's editor.
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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 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.
(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 1/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 1/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.

### Table 5. Additional commands available with Super Utility 4/4P

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Returns you to the main menu</td>
</tr>
<tr>
<td>F2</td>
<td>Toggles the sound function to beep whenever a prompt appears</td>
</tr>
<tr>
<td>F3</td>
<td>Takes you to the configuration screen</td>
</tr>
<tr>
<td>Clear-A</td>
<td>Toggles the small graphics characters in and out of motion</td>
</tr>
<tr>
<td>Clear-V</td>
<td>Displays the program’s version number</td>
</tr>
<tr>
<td>Clear-S</td>
<td>Displays the program’s serial number</td>
</tr>
<tr>
<td>Clear-W</td>
<td>Displays the program’s author credits</td>
</tr>
</tbody>
</table>

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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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/auto-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 Compuserserve, 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 prefer 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 (nonvisible 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 automatic 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 autodial files) requires some technical expertise: You must set up the files in hexadecimal code.

To make matters worse, there were bugs in the manual specifically confusing for a new user. The first line of a sample log-on file on page 10, for example, reads ""[\[P2]\]""—meaning ""Wait for carrier tone detect and pause two seconds."" But the step-by-step instructions show ""<controle>

---

**Table 6. Videotex Plus's Meta keys manipulate the RAM buffer.**

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear-O</td>
<td>Opens buffer to capture data (instead of displaying, then losing information)</td>
</tr>
<tr>
<td>Clear-S</td>
<td>Saves edited version of buffer information to disk</td>
</tr>
<tr>
<td>Clear-U</td>
<td>Saves file to disk exactly as received (useful for graphics pages)</td>
</tr>
<tr>
<td>Clear-C</td>
<td>Closes buffer</td>
</tr>
<tr>
<td>Clear-Z</td>
<td>Clears buffer (after you save file to disk)</td>
</tr>
<tr>
<td>Clear-D</td>
<td>Displays buffer contents (control-S stops, control-Q continues, and clear-A aborts display)</td>
</tr>
<tr>
<td>Clear-G</td>
<td>Saves copy of screen in memory without opening up buffer</td>
</tr>
<tr>
<td>Clear-L</td>
<td>Loads a saved file from disk (error message displayed for a file too large)</td>
</tr>
<tr>
<td>Clear-V</td>
<td>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)</td>
</tr>
<tr>
<td>Clear-Y</td>
<td>Lets you upload buffer contents one line at a time</td>
</tr>
<tr>
<td>Clear-P</td>
<td>Prints RAM buffer contents (after either clear-R or control-R has turned printer on)</td>
</tr>
</tbody>
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**Reviews**

<> WN<> <controlo<>WCI>—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 reedit 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.

**Amazing Adventures East of Java**

by Thomas L. Quinody

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.
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

A s 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.
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 sidebar, 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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PC Comptroller is the Institute for Scientific Analysis Inc.'s fully integrated, menu-driven business accounting system for the Models I and II. 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, 215-366-0801 (800-441-7680 for orders).

Reader Service 554

Learning About the Bulls and the Bears
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Computer Stocks and Bonds is available on disk ($25) or cassette ($20) for the Models I, III, and 4 with 32K RAM. For more information contact Intelligent Quest Software, 4517 Hartford 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 Mimir 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 Mimir Inc. at 116 Baywood Drive, Biloxi, MS 37532, 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 DOPLUS on the Models I, III, and 4 and supports the Hayes Smart Modem, Radio Shack automatic modem, 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
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Reader Service 568

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The Diablo P101 ($499) uses a dot-matrix font that produces type similar to that of daisy-wheel printers and runs at 80 cps. Its bidirectional, logic-seeking features let you mix text and graphics on the same line or page.

With the C150 Ink Jet Printer ($1,250), you don’t need a color monitor to generate more than 150 colors for text and graphics. It uses a water-based ink that dries in under one second and prints text and graphics at 20 cps.

A medium-duty, bidirectional dot-matrix printer, the P120CP ($699) produces draft-quality copy at 150 cps and correspondence-quality documents at 60 cps. It also features line, mosaic, and bit-mapped graphics.

The Diablo 36 daisy-wheel printer from Xerox.

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<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>FREE NEWS-NET Subscription</td>
<td>Value $50.00</td>
</tr>
<tr>
<td>FREE M-TERM™ Software</td>
<td>Value $79.00</td>
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<tr>
<td>FREE Dialer™ Software</td>
<td>Value $49.00</td>
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**AUXILIARY RS232C FEATURES**

- Drivers for Auxiliary RS232C
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80 Micro, September 1984 • 179
Contact Xerox Corp. at Xerox Square 006, Rochester, NY 14644, 716-423-5078 for more information.
Reader Service 555

**Do-It-Yourself Gaming**

You’re an adventure gamer and you’re always ready for the next challenge. The ultimate challenge, however, is not to play someone else’s adventure game, but to make up your own.

*Creating Adventure Games on Your Computer* by Tim Hartnell ($9.95) tells you everything you need to write your own Basic adventure game. The book describes programming for four games ranging from simple to complex.

He also discusses how to construct worlds and maps, creating computerized labirints, magic spells, and daring heroes, tracking player movements, and designing battles with monsters.

For more information contact Ballantine Books, 201 E. 50th St., New York, NY 10022, 212-572-2392.
Reader Service 565

**More Modem For the Money**

The Intec 300 300-baud auto-dial/auto-answer modem ($189) is a ready-to-run package for your Model III or 4.

It includes software, interface cabling, and documentation, features a 255-number auto-dialing directory, auto log-on support, modem/telephone hang up, and data capture direct to disk or memory buffer.

It also allows on-line display of the capture buffer, lets you add or delete line feeds, and has an unattended answer mode.

For more information, contact Intec Corp., P.O. Box 5164, W. Bloomfield, MI 48033, 313-851-5491.
Reader Service 560

**Get It Straight From Day One**

Designed for the first-time computer user or business executive with data management needs, the Day One relational data base management system for the Model 2000 ($695) lets you sort, manipulate,
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See List of Advertisers on Page 162
and retrieve data from multiple files.

A built-in applications generator lets you design your own database to meet your needs. Day One is menu driven and includes a report generator, help screens, and 13 utilities for rebuilding and restructuring files.

Two optional vertical software packages, Mailing List Management ($149) and Inventory Management ($395) are available. The Inventory Management program includes fields for part numbers, descriptions, quantities on hand, quantities on order, and reorder quantities.

Other Day One features include a multi-tiered security system that protects data, and a toll-free support line.

For more information, contact Challenge Marketing, Goshen Professional Center, Suite 214, Falcon Bldg., 1,240 West Chester Pike, West Chester, PA 19390, 215-436-0465.

Reader Service 562

Speed Reading

The E-Z-Reader high-accuracy bar code reader from Percon (2190 W. 11th St., Eugene, OR 97402, 503-344-1189) reads low-density bar codes from dot-matrix printers or the finely printed high-density bar codes common on grocery products. E-Z-Reader reads Codabar, Code 3 of 9, and Interleaved 2 of 5 and connects to any Radio Shack computer.

E-Z-Reader ($495) includes an operation and installation manual. The manual is also available separately for $20.

Reader Service 562

Getting the Full Picture

FullVu 100 saves 50 or more screen displays in your 24K or 32K RAM Model 100 during on-line connections with Compuserve, MCI Mail, and other information services.

This machine-language program lets you use the arrow keys to redisplay previous screens while maintain-

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Graphics Solutions
High-Resolution Software and Hardware

Radio Shack Model 4/4P/III hi-res board owners: GBR8C 3.0. This enhanced version of Graphics Basic provides an equivalent for all of the Radio Shack commands as well as adding many important new ones. The hi-res screen can be printed on any of 20 popular printers or saved or loaded to disk without leaving Basic. The software works with TRSDOS, LDOS, NEUDOS80, and DOSPLUS and uses 1400 bytes less memory. The disk comes with over 40 graphics related programs and a detailed manual which includes entry addresses for interfacing to assembly language. GBR8C 3.0 is required in order to run any of the following programs. $49.95.

The following eight programs run on a Model 4/4P/III equipped with a Micro-Labs or Radio Shack graphics board:

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80-GRAFIX. Plug-in, clip-on board upgrades any Model III/1 to provide 128 user-definable characters. Comes with over 20 programs/files. $99.95.

JOY-ROUSE. Allows a Radio Shack Color Computer joystick and mouse to be connected to any Model 4/4P/III. Hardware provides X, Y position values from 0 to 255. A built-in speaker produces sound from the cassette port. $99.95.

G.I.N.R. Software program for the Model 4/4P/III/1 which uses the standard block graphics screen to display a window to a larger 65536 x 65536 dot tablet. The arrow keys are used to draw two or three-dimensional figures. The display can be scaled, shifted, or rotated in any dimension. The final picture is printed in hi-res on Radio Shack, Epson, NEC 8023, or Prowrite printers. $98.00.

Please specify your exact system configuration when ordering or requesting information. Payment may be by check, COD, or Visa/MC. Domestic shipping is free on pre-paid or COD orders. (Texas residents add 5% sales tax.)

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902 Pinecrest, Richardson, Texas 75080

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182 • 80 Micro, September 1984
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<th>SOFTWARE</th>
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<tr>
<td>SuperCRIPIPIT</td>
<td>Insert pg. Mod 3 expands training manual. Combines ref. manual into Inc. chart. $16.00</td>
</tr>
<tr>
<td>Mod IV Plus</td>
<td>108 insert pg. Mod for Mod manual. repl. examples. $21.02 flow charts. $16.00</td>
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<tr>
<td>WALL CHARTS showing all command used &amp; explanations for the following programs. (All are 192 x 25, 2-color, easy to read — $5.00 each)</td>
<td></td>
</tr>
<tr>
<td>SuperCRIPIPIT, MOD I, Profile III, VisCalc, General Ledger, Mod 3, Basic Mod 3, Basic Mod 4.</td>
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<tr>
<td>MOD 4 BY JACK</td>
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<tr>
<td>MOD 4 BASIC CHART</td>
<td>2-color wall chart shows most BASIC + DOS 6.2 operations with examples. $5.00</td>
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<tr>
<td>INDEXES</td>
<td>Detailed indexes, on heavy stock, punched 3 holes, for the manuals of Profile III. MOD 4 30K, 35K OWNERS MANUAL, SuperCRIPIPIT III (each) $5.00</td>
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<tr>
<td>MONTHLY NEWSLETTER</td>
<td>Dealt mainly with word processing data base on Mod. 4 30K. Mailed: 1st class with wide range of topics for non-hackers. $24.00 yr.</td>
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80 Micro, September 1984 • 185
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If it's worth remembering, it's worth 3M diskettes. 3M diskettes are designed and manufactured to give you years of reliable, error-free performance. So put your data where it will stay put: buy 3M diskettes. Available in all standard 8" and 5 1/4" diskette formats.

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The Power Director line conditioners are a power control center for your computer system.

One Tandy Center, Fort Worth, TX 76102, 817-390-3300. Reader Service 559

When Power Is Not Enough

Getting power to your computer is only half the battle: Clean signals and organized peripheral power lines and connections make the difference between smooth computing and computerized chaos.

To get your system going, the Power Director line conditioning and power control centers from Computer Accessories Corp. (7696 Formula Place, San Diego, CA 92121, 619-695-3773) monitor and control power, allow for outlet expansion, and protect your system from spikes and overloads in one neat package.

The Model P22 ($99) has four outlets and fits in easily with your disk drives or modem. The Model P2 ($129) fits under a CRT or monitor and has five outlets. The Model P12 ($199) contains six outlets plus a digital clock and disk storage area.

The Data Directors switch one port to three peripherals or one peripheral to three ports. The Q13 connects RS-232 ports and the Q15 connects Centronics parallel ports. Both units are $189. Reader Service 567

Double-Duty Disk System

You've got a Model 100 with limited storage space and a desktop computer with disk drives. Instead of buying a separate disk system for your Model 100, you can use the drives in your desktop computer.

Portable Computer Support Group's (PCSG) menu-driven Disk + program ($69.95) lets you turn your desktop computer into an instant disk system. Disk + works with a Model 100 and a Model II, III, 4, or 2000 and lets you transfer files by pressing a function key.

Files transfer directly at 19,200 baud or through a modem at 300 baud. Disk + features a file transfer utility that converts text files from your desktop computer to the Model 100 or from the Model 100 to your desktop machine.

Disk + is available on disk or cassette and includes a manual. The disk version uses 4.5K of memory and requires an additional 4.5K of RAM for operation. A connecting cable is $40, or...
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PARALLEL 8 BIT INPUT & OUTPUT • MODEL I

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   • Select type
   • Select multiple lines
   • Outline page numbering
   • Outline page numbering
   • Outline page numbering
   • Insert type
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   • Print double width headings.
   • Insert non-printing characters.
   • Insert open and close double lines.
   • Insert other characters.
   • Clear file together.

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FOR TRS-80 MODELS 1, 3 & 4
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For additional information see New Product section p. 220

MODEL I SPEED UP

The SK-2 is a hardware modification for the Model I that allows CPU speeds to be increased by 50% or 100%. Speeds may be varied by a toggle switch (not included) or on software command: it can also be configured to return to normal speed any time a disk is active. It mounts inside the keyboard unit with only 1 necessary connection and is easily removed for the computer if the user needs to service the SK-2 has been field proven by 3 years of use, and comes fully assembled with socketed IC's.

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NEW PRODUCTS

Link Labels make identifying disk contents easy.

The program runs on all TRS-80 operating systems, requires no line numbers, and adds commands such as Do/While, Do/Until, Select/Case, and If/End/If constructs to Basic.

Alternate Basic can translate itself, and includes a library of routines that you can access with the Copy command (additional libraries are available).

The package includes an on-line help file, sample programs, five support utilities, Alternate Basic source code, and a manual for $69.95.

Reader Service 5 556

Disk Listing

Small disk labels are fine when a disk contains one or two programs, but they’re inadequate when you have a dozen or more files on one disk.

Link Labels are color-coded disk labels and storage envelopes that hold up to 26 file names per disk. Numbered, two-part disk labels visually link the disk and envelope.

Each envelope contains spaces on front and back to list the contents of the disk, and has a hanger to display the label near its corresponding disk drive. The stickers have spaces for disk name and application.

Link Labels are available in five colors, and you can order special numbering or custom printing on the stickers. They cost 36 cents each and come in quantities of 12. Quantity discounts are available.

For more information contact Hexco Inc., P.O. Box 199002, Hunt, TX 78024, 512-238-4404.

Reader Service 5 571

Prophet from Your TRS-80

Followers of the I Ching believe that the forces of Yin and Yang drive the world. A new software translation of this 3,000-year-old concept, called Oracle, lets you consult the I Ching through your Model III.

Instead of throwing sticks or coins to confer with the I Ching, Oracle lets you seek guidance with the touch of your keyboard. A random-number generator creates the chance element; by de-
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Use your microcomputer and *Programs for Electronic Circuit Design* to help you select the correct value for each component in an electronic circuit. The programs are adaptable to most microcomputer systems and are also available on disk for the Apple, IBM PC and TRS-80. The thirteen programs can be used individually, or they can be combined, using a master menu, as explained in the book.

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*Programs for Electronic Circuit Design*

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Book and Disk Packages $24.97
IBM PC CC740012, ISBN 0-88006-080-8

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NEW PRODUCTS

The Wilson Jones desk top printer stand lets you load checks and other forms into bottom-feed printers.

ciding when to press the activating key, you add the personal factor.
Oracle is available on Model III disk for $69.95 (add 5% sales tax in MA).
A companion book is also available. Contact Kerson Huang, P.O. Box 1083, Marblehead, MA 01945, 617-631-5985 for more information.

Reader Service  553

Printer Helper

Running a bottom-feed printer on your desk top is not always the best arrangement. Paper often catches in the printer, and running labels or checks is awkward at best.

To keep your printer feeder organized, Wilson Jones offers a desk top printer stand. Available in 14-inch ($35) and 21-inch ($45) models, the stand elevates the printer for easy feeding of checks, invoices, and other continuous forms.

The stand is constructed of steel, with a choice of an oak- or walnut-finish top. Nonskid pads prevent slippage or marking on the desk surface.

For more information contact Wilson Jones at 6150 Touhy Ave., Chicago, IL 60648, 312-774-7700.

Reader Service  575

Learning At Home

At Home with Basics (30th St. and Remington Ave., Baltimore, MD 21211, 301-325-4009) has 25 educational programs to help children develop basic reading and language skills. Program subjects include word analysis, vocabulary skills, reading comprehension, and study skills.

The programs, for the Models I, III, and 4, include a disk and 20-page workbook for children ages 10 and up. The program modules are available separately for $19.95 each.

Reader Service  552

Wayne Green Books, Peterborough, NH 03458  34988P
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