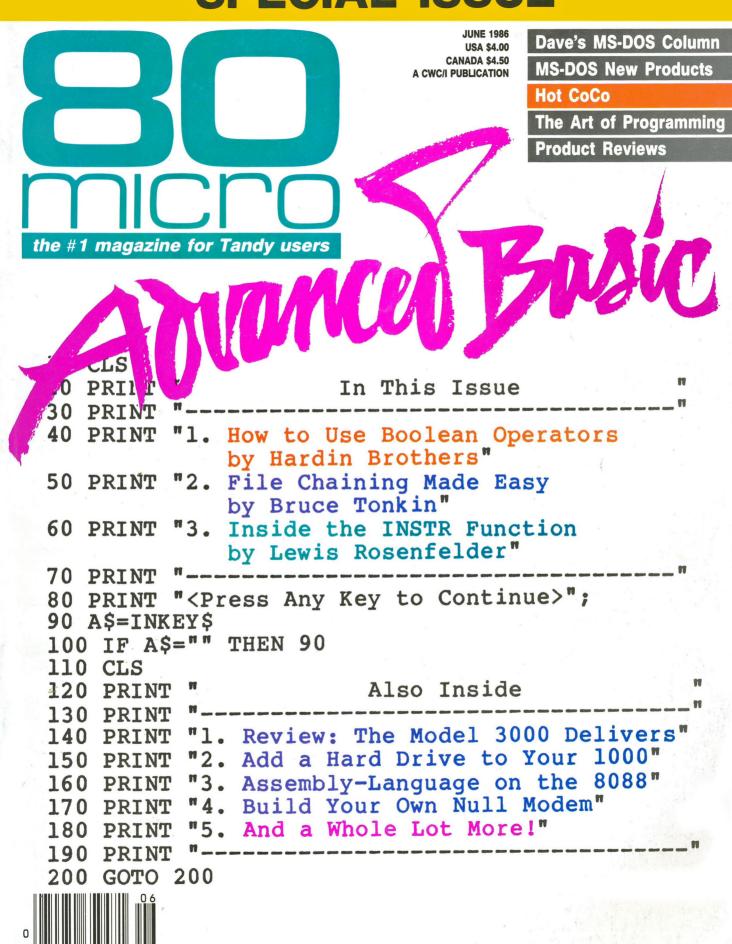
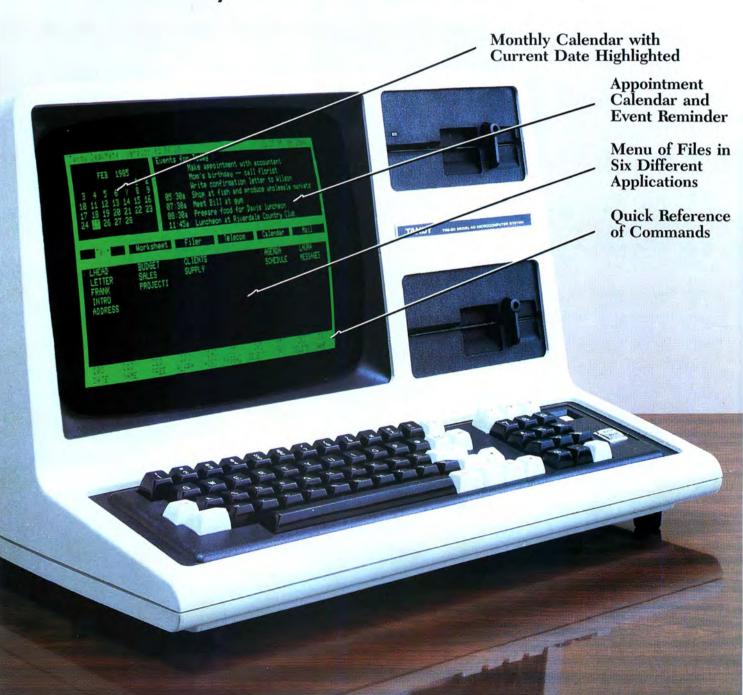
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The picture above is an actual unretouched photo of the main menu command screen.

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# PowerSoft NewsFlash #8

Thank you for reading our latest installment of PowerSoft's Newsflash. This space will contain information that doesn't really fit into a regular ad-type format. We'd appreciate knowing if these columns are of any value to you. Remember that these appreciate knowing it these columns are of any value to you. Rentender that these columns are written 2-3 months before they are printed, so if something gets out-of-date, that's why, but we try to keep it current! Thanks to all those who have already written or called with your support! We love to hear from you! For fastest service on a catalog request, DONT use the Reader's Service Card, but call or write instead! We appreciate receiving your comments as well as your orders!

A Visit from Peterborough...

We were delighted to meet with Peter Hutchinson and William Smith from 80-MICRO last week (actually March 12th). They were in the area visiting advertisers and let us in on a few things that will be happening with 80-MICRO in the near future, and it sounds great! Look for exciting new developments soon! And that means TRS-80 too.

# Is the Model 4D dead or alive?

A collection of rumors, news, and views...

A rumor currently circulating that TRSDOS 6<sup>TM</sup> support will be dropped by Tandy at the end of this year (and therefore the 4 and support thereof) does not seem to be true.

Even though the 4D is not generally carried in the stores, our sources tell us that the 4D will continue to be available for the next two years. Probably to fulfill school contracts is a guess, but they can be ordered. ->>\*We just received the May 80-MICRO and were delighted to see that Tandy had a two-page spread on the 4D! That's great, but the ad says to "see it in your local store." Trouble is, they aren't there and the manager doesn't want to order one unless he has a deposit! (Why aren't they in the stores??)

Hint to Tandy - lower the price on the 4D a bit, put it in the stores where people can see it, and it will sell and sell to Model I/III/4 users who don't need a PC but would like to update their hardware and want to stick with the TRS-80! How about a 4HD? Put a 20 meg drive in it for \$1499-\$1599! How bout it? (These Model I's and III's and even older 4's are starting to wear out! Does that mean that we have to start over??) The 4D will also sell to new customers based on the amount of software available and versatility of the machine. It is a GREAT computer - no question, and can sell right alongside the MS-DOS machines for the right price.

Look how long Apple has been selling the old APPLE II technology! About eight years now and still a very major part of their product line. They would no longer think of dropping APPLE II support, than they would getting out of computers. It is the bread and butter of their product line.

The reality of the PC world is there, however. Apple was not smart enough to recognize this reality until just recently with their recent promise to "bridge the gap" at their January stockholders' meeting. On the other hand, TANDY has done a fantastic job of getting into the PC arena with their very complete and highly competitive line of MS-DOS machines. That should not mean there isn't enough room or time at the Towers for the 4D anymore, however. (Unofficial sales figures we have heard from our sources, not Tandy, say that the 4/4P/4D was the second best seller for Tandy last year, topped only by the 1000.) It, like the CoCo and portables, can augment the line. But if they are not carried in the stores, and stay at their current price level, they will die. if they are not carried in the stores, and stay at their current price level, they will die.

# OLDTIMER's Dept. (revisited)

Anyone going back a few years with the TRS-80<sup>TM</sup> will probably remember the name LEO CHRISTOPHERSON (from 80-US). Leo was the absolute master of graphics, and came up with many technics which paved the way for other authors. Leo's main contribution to the history of the TRS-80 was his fabulous games - which are classics. Names like ANDROID NIM, DANCING DEMON, DUELING DROIDS, BEEWARY, SNAKE-EGGS, and others will probably jog a brain cell or two for many. These were the first games to bring SOUND and fully animated graphics to the TRS-80. His characters have a life of their own in the machine. They even blink their eyes! Leo's games were more than fun and innovative. These were not the average shoot-em-up type games. They each taught something - whether it was counting, strategy, skill, humor, or even coordinating music with dance steps. We have recently completed negotiations with Leo to bring back his wonderful games (on disk for the first time) as a low-priced collection titled LEO'S GREATEST HITS. More info coming soon!

# GOODIES OF THE MONTH

\*TRS-80 Goodie of the Month - PowerMAIL Plus for the UIII or 4/4P/4D. Received a FOUR-STAR review in 80-MICRO and EXCELLENT in all catagories in INFOWORLD! The very best mailing list program there is - and it runs on the TRS-80! Normally \$99.95, this month we are reducing PowerMAIL Plus to only \$79.95! (+\$3 sh)

\*MS-DOS Goodie of the Month - Your choice of either DISK OPTIMIZER or DoubleDOS (normally \$49.95 each) for only \$42.95 each or both for \$79.95! Save \$20! See an earlier Newsflash or SoftLogic ads for descriptions. Not for Tandy 2000 or 1000° ('ill running MS-DOS 2.11.) Tandy 1000 running PC-DOS 2.1 or 3.1 or TANDY's MS-DOS 3.1 is OK.

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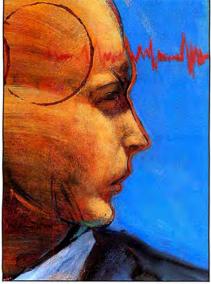
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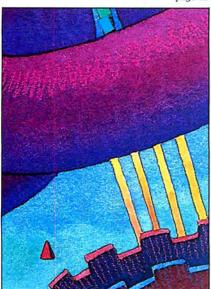
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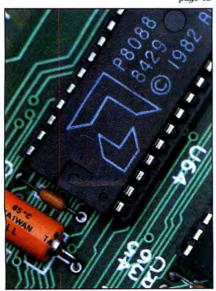
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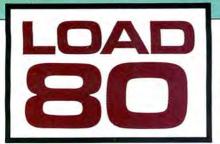
To simplify proofreading and debugging, many 80 Micro Basic listings include a checksum value for each program line. For information on typing in listings containing checksums, see How to Use 80 Micro Program Listings on p. 112.

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

Load 80 programs are ready to run, and can save you hours of time typing in and debugging listings. Load 80 also gives you access to Assembly-language programs if you don't have an editor/assembler. And, it helps you build a substantial software library.

Using Load 80 is simple. If you own a tape system, load the Load 80 tape as per the instructions provided. If you own a Model I or III disk system, you boot the

Load 80 disk and transfer the files to a TRSDOS system disk according to simple on-screen directions. If you own a Model 4, copy the Model 4 programs from the Load 80 disk to your TRSDOS 6.x disk using the COPY 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 system requirements box that accompanies the article to find out what system configuration individual programs require.

If you have any questions about the programs, 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 \$21.47 or on cassette for \$11.47, including postage. To place a subscription order, or to ask questions about your subscription, please call us toll free at 1-800-343-0728 between 9 a.m. and 5 p.m. Or, you can write to Load 80, 80 Pine St., Peterborough, NH 03458.

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Each line of most 80 Micro Basic programs contains a checksum, which is equal to the sum of the ASCII values in that line. Use our checksum program to check the listings you type in against the original program. Language: Disk Basic. Cassette filespec: E. Disk filespec: CHECKSUM/BAS.

BAS = Basic SRC = source code CMD = object code

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# notograph by Frank Cordelle

# MS-DOS or Bust

In the fall of 1984, I had dinner with the president of a company that sold software for Tandy's I/III/4 line. Remarkably, he wasn't interested in marketing products for MS-DOS computers, even though Tandy was about to introduce the Model 1000. He was a dyed-in-the-wool Z80 man and didn't want to learn a different microprocessor. He also was intimidated by the massiveness of the MS-DOS market and certain that he would quickly be overwhelmed by the many larger companies.

"When the Model 4 goes, then I'm gone," he declared.

A year and a half has changed his perspective. His company now is not only selling MS-DOS products, but is advertising them in the PC magazines.

He's not alone. Driven by an instinct for self-preservation, an increasing number of third-party manufacturers in the TRS-80 and Color Computer markets are stepping into the MS-DOS fray.

The shift to MS-DOS is no surprise. The companies in the Tandy market have hung on over the years because they know how to stay with the consumer. They moved from the I to the III and then to the 4, and they realize that MS-DOS is the next logical step.

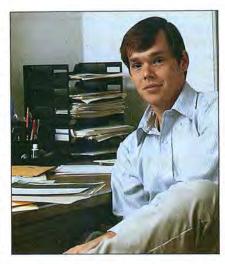
In fact, companies that are not developing MS-DOS products are committing suicide. Vendors that try to survive by selling exclusively to the Z80 and 6809 markets are destined to follow in the failed footsteps of the companies that stuck exclusively with the Model I.

# To Market, to Market

The market opportunities unquestionably exist and are growing. Tandy is selling Model 1000s at a healthy clip. The folks in Fort Worth claim that they've overtaken Compaq as the number 1 compatibles manufacturer. Some people say that Tandy is matching IBM sales machine for machine.

The proud new owners of Model 1000s are looking for all sorts of products—memory boards, disk drives, monitors, and software. The companies that supply these people are guaranteeing their own health and welfare. As Bob Dylan once wrote, you don't need a weatherman to know which way the wind blows.

Old-guard Tandy vendors are not the only ones who stand to benefit. The PC market is loaded with companies selling



every manner of product to IBM owners. Smaller vendors would be smart to think about shifting to the Tandy 1000 market, where the competition isn't as stiff and customers are searching for products. Some might be better off as larger players in a smaller market than as a smaller players in a larger market.

Of course, Tandy is doing whatever it can to hold on to the new users. Its Express Order Software (EOS) service is a vigorous attempt to get people to buy software at the local Shack or Computer Center. But Tandy's strategy has weaknesses. Most obviously, not every third-party vendor is selling through EOS. Also, not every store manager is doing his best to encourage EOS sales. Finally, the consumer often pays more through EOS than he would by mail order or at a generic computer store.

Also helping the market is Tandy's unwillingness to support third-party hardware products. Fort Worth would much prefer that you give your local RSCC \$320 for a memory expansion board than see you pay someone else \$110 for an equivalent product.

The number of Tandy 1000s in use, combined with Tandy's inability to serve all of the people all of the time, leaves the door wide open for companies interested in expanding their product lines.

# Consumer Report

Of course, the consumer is who will most benefit from a resurgent market.

Model 1000 owners will have a choice of products from vendors who treat the 1000 not simply as another PC clone but as a distinct entity. These companies will understand that Model 1000 users have unique needs to be met and special problems to be solved, and will tailor their services accordingly.

Users of the I, III, 4, and Color Computer will be assured that the companies they've depended on over the years will still be around.

But the Tandy market will not grow on its own. Its vitality depends on the support of the consumer. You can take an active role in determining whether manufacturers commit themselves to developing and selling MS-DOS products.

First, if you're looking for a specific product, don't simply walk into your Radio Shack store and buy whatever they've got in stock. Shop around. Compare product features and prices. Call advertisers in 80 Micro and the PC magazines and find out if they've got what you want.

Second, ask third-party vendors whether they support the Tandy 1000. Don't settle for some answer like, "Yeah, we support most PC compatibles"; it's a sign that the company probably doesn't understand the difference between a 1000 and an IBM PC.

Finally, let manufacturers know what you think they should be making or selling. A good company listens to its customers. If it starts receiving regular requests for a particular product, it might decide to market that product. We know of at least one company that is now selling Tandy 1000 memory boards in response to consumer demand.

As Tandy goes, so goes the market. Tandy has done its part; the rest is up to us, the vendors and users.

# Shack Flak

Over the years, many TRS-80 and Tandy owners have complained about lousy service from their local Radio Shack stores. On the other hand, I've heard many customers who've had nothing but praise for Radio Shack.

I figure the time has come for an informal survey of 80 Micro readers. What kinds of experiences, good or bad, have you had with Radio Shack?

If you feel good about Radio Shack, send your letter to Don't Whack the Shack, 80 Micro, 80 Pine St., Peterborough, NH 03458. If you feel otherwise, send your letter to Whack the Shack at the same address. We'll publish the best letters in an upcoming issue.



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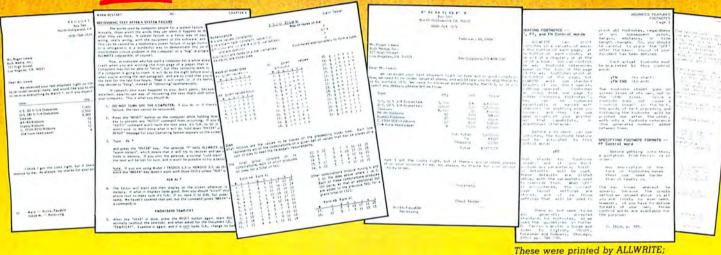
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80 MICRO, Nov., 1984

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# Guidelines to making successful mail-order purchases.

ail-order business is as American as apple pie, but you might encounter problems not found in over-the-counter merchandising. Apart from the obvious fact that you can't examine a product until it arrives, you might receive goods flawed because of negligent manufacture, inspection, or handling. And if you find yourself slighted, accidentally or maliciously, you have to contend with a stranger hundreds of miles away in a different legal jurisdiction.

That doesn't mean you should shun the mails. A shrewd buyer can take steps before ordering and after delivery to ensure satisfaction. And the mail-order branch of the microcomputer industry does lie within reach of our system of justice.

Under the Uniform Commercial Code, a buyer can reject a product "within a reasonable time" if, after usage, it evidences a breach of warranty. What's a reasonable time? That would be up to a court to decide. Just make sure you bring any problem to the seller's attention as soon as you discover it.

# An Ounce of Prevention

First, you should follow these steps when you order a product by mail:

- Read the advertisement's fine print and know exactly what you're buying. If you can't find details you want in the ad; if some of the published information seems unclear, contradictory, or wrong; or if you don't understand the meaning of a disclaimer, phone or write the seller for clarification before placing your order.
- Ask in advance about the seller's return policies. Some houses charge "restocking" fees; some require that the buyer pay return postage.
- Never send a cash payment by mail.
- When your order arrives, save all boxes, wrappings, instructions, and other papers until you're sure the product is OK. If it was damaged or lost in transit, carriers usually will make amends. United Parcel Service, for example, either sends someone to check the package or returns it to the shipper at no cost to you. If the U.S. Postal Service handled the shipment, you can lodge a complaint with your local post office or contact Consumer Advocate, U.S. Postal Service, Washington, DC 20260.

• Never return a damaged product without communicating with the seller first. True, you might save time by returning it immediately, and you might receive a replacement or refund by return mail, but you could also create complications for yourself.

# How to Complain Effectively

What happens when you've paid your money, taken delivery, and you wind up with shoddy merchandise or an item you don't want? What happens if you send in your check and the days turn to weeks, the weeks to months, and still you receive nothing?

You're not at the seller's mercy; you do have recourses. But before you take action, remember that it's most unlikely that you're dealing with a crook. The U.S. Office of Consumer Affairs estimates that consumers resolve 88 percent of their problems simply by contacting the seller or the seller's supervisor. Mail-order merchants generally aren't out to steal people's money, they're out to do business.

If you do run into a problem, you should first write a letter to the company's president or consumer contact. Your letter should include the dates you ordered and received the item and identify the product by model name/number and serial number. Detail the problem and ask for the form of satisfaction you deem appropriate: replacement, refund, or substitution. Attach copies, not originals, of the advertisement that attracted you and of receipts, warranties, canceled checks, or other pertinent documents.

Bear in mind that it won't hurt, and might help, to squelch your irritation and keep the letter's tone friendly. The person you're writing probably isn't the person who caused your woes, but one who can expedite a remedy.

Unless the seller specified that delivery might take longer, the law requires that vendors deliver merchandise within 30 days of the order. If a company fails to deliver within the allotted time, you have the right to cancel your order at no cost. If you exercise that right, the seller has seven days to refund your money or credit it to your charge account.

Note that when you negotiate mail-order problems, the last thing you should do is threaten to "turn the matter over to my lawyer." Hiring a lawyer should be your final resort. Lawyer's fees aren't cheap, and winning your case won't necessarily exempt you from having to pay costs.

Keep copies of all correspondence to and from the seller.

Wait three weeks. If the matter isn't settled, try a second letter, repeating your complaint and declaring that if you don't get immediate satisfaction, you'll notify the deputy chief postal inspector in the vendor's home region.

For the vendor, this now becomes serious business. The U.S. Postal Service has a nationwide law enforcement arm authorized to investigate mail fraud. The Postal Service can cut off mail deliveries to a vendor's address. If the Postal Service convicts a seller of mail fraud, he could face a stiff fine and possibly jail.

The government is most likely to launch a full investigation when it receives numerous complaints against a seller. Moral: Don't hesitate to report a truly serious problem. If you're really up against an unscrupulous dealer, yours could be the complaint that brings Uncle Sam into the action.

Other consumer defenders include the Mail Order Action Line of the Direct Marketing Association (6 E. 43rd St., New York, NY 10017). This commercial trade association follows up complaints by contacting vendors. It has no power of enforcement, though.

Better Business Bureaus and state or local consumer protection offices might be able to help you, but it can be confusing to find the right place to make your particular complaint. The U.S. Office of Consumer Affairs' Consumer Resource Handbook lists the appropriate agencies. You can get a free copy by writing to Handbook, Consumer Information Center, Pueblo, CO 81009.

Finally, if you're having a problem with an 80 Micro advertiser, you might want to send a copy of your complaint to 80 Micro, 80 Pine St., Peterborough, NH 03458.■

Daniel E. Harmon is the managing editor of The Lawyer's PC newsletter, P.O. Box 1108, Lexington, SC 29072.



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# The ALPHA SPEECH SYNTHESIZER

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This is your chance to experience the power and pleasure that speech

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\*When purchased with text
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   Simple BASIC commands
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   Only \$39.95

**Small Print:** Hardware Power supply, speaker and manual included. Model Lunit plugs into keyboard or expansion interface 40 pin bus. Model III,4,4P unit plugs into 50 pin I/O bus. Model 4P needs short 50 pin extension cable \$14.95. Use our "Y cable" (see next page) if your bus is already used. **Software** Works with all DOSes (not CPM), is 6.2K long, and relocates itself to the top of available memory. **Manual** available for \$5.

# Dr. SIGMUND

Artificial Intelligence at work!
If you want to show off your computer, run "Dr. SIGMUND" and see their expressions as your TRS-80 has an intelligent conversation with you. Even you will be impressed!

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By George McCoy of Rehab Research. The Alpha Speech Synthesizer was chosen for this functional word processor with full speech capability. A perfect example of computer speech.



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Each of these three programs require 48K and are available on disk only. The Alpha Speech synthesizer is required for speech. Each program is only ...........\$29.95

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Model III,4 \$59.95

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 "SETCLK" to set your computer's internal clock (at power up) or use "TSTRING" so that the "TIMES" function reads the Newclock.

Connection: Model I: plugs into the keyboard or expansion interface. Model III,4,4P: plugs into the 50-pin I/O bus. 4P needs short 50-pin extension cable \$14.95 Compatible with all operating systems.





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Overseas, FPO, APO add 10%

# One Lost Sheep

A letter from Paul R. Withun of El Paso, TX (Input, March 1986, p. 12) produced several dozen impassioned responses from readers. After hearing a friend boast of the "whole line of equipment" and plentiful free software for his Commodore 64, Paul regretted buying his Model 4.

-Eds

I'm so sick of hearing "Trash-80" that I'd like to chainsaw every Commodore computer ever made. Stand tall, shoulders back, chest out, face to the wind, and take confidence in yourself and your computer.

Who was calling the Tandy line "Trash-80" in the early Model I days? Some of the greats of modern computers, such as LNW, SOL, Pets, Atari, Timex/Sinclair, and Apple with its disk Basic and overheated boards. Where are many of these name-callers now? In the "trash" can.

They were buried by fantastic numbers of intelligent, clear-thinking, enthusiastic Tandy owners. Paul's friend, the Commodore 64 owner, bought himself a toy computer—pretty pictures and sounds, and that's about it.

Paul should join a TRS-80 users group and take advantage of classes at his local Radio Shack Computer Center.

Long after the Apples have gone to seed, the PCjr is a memory, and the Commodore has gone down with the ship, the TRS-80 will be humming along—balancing the checkbook, helping the kids with homework, writing letters, playing games, and more.

Ted Paul Fredonia, NY

The Model 4 is one of the most powerful 8-bit systems available. Some of its capabilities, such as pipes and filters, are often found only in far more expensive and complex systems. The true powers of the Model 4 will become evident to Paul as he delves deeper into the joys of computing. If he chooses to expand his system, Radio Shack offers a wide range of choices—additional drives, high-resolution graphics, and communications capabilities.

For software, he should start with *The* 1986 Radio Shack Software Reference and Tandy Computer Guide, which con-



tains 96 programs for the Model 4. The book covers only programs available directly through Radio Shack. We also offer an *Applications Software Sourcebook* (catalog number 26-1378, \$7.95) listing more than 2,500 ready-to-run programs sold by a variety of vendors.

CompuServe Information Service offers free software on its LDOS, Tandy Professional, and Education special-interest groups (SIGs) for the Model 4. Paul can also communicate with other users through CompuServe.

With all this support, I hope Paul can find the help he needs to take full advantage of the Model 4. Computers are wonderful tools for work, learning, and fun. All it takes is an inquiring mind and a sense of adventure.

Amy Arutt Asst. manager of marketing information Radio Shack

The Model 4 is not a games machine, like the Commodore 64, but it's a damn good business machine. I bought mine in August 1984, a year before Paul got his, and I've never regretted my decision. I've found that the Model 4 per-

80 Micro's BBS is open 24 hours a day. It offers programs you can update and download, special-interest groups, and a classified section. You can reach the board at 603-924-6985; UART settings are 300/1,200 baud, 8bit words, 1 stop bit, no parity. forms at least as well as MS-DOS computers in the applications that are most important to me.

The mailing list and bookkeeping programs for my business, a New York City repertory company, are modified versions of programs I copied from books and 80 Micro.

I, too, have had to endure childish references to "Trash-80," but so what? I wouldn't have subjected my business to the clumsiness of a Commodore toy computer for the sake of some ignoramus' opinion.

Jerry Engelbach New York, NY

While the early Model I days might have rightfully led, in some cases, to TRS-80 being taken as an abbreviation for "trash," subsequent Tandy computers are more accurately described as "the right stuff."

> Anthony G. Perri Jr. Kenosha, WI

Paul's friend with the Commodore 64 may call the Model 4 a "Trash-80" if he wants, but that's only because he stumbled onto a computer that matches his intelligence, rather than one that *requires* intelligence.

David J. Oleksak Vancouver, WA

Paul hit the nail on the head.

A fairly sophisticated software package for the Commodore 64 costs \$39.95, while a comparable Model 4 package from an 80 Micro advertiser costs \$100.

Commodore will eventually bury Tandy in the recreational PC market because the Model 4 line isn't designed for the recreational user any more than the IBM is. Unfortunately, many of us who wanted to use the Model 4 as a hobby learned this too late.

Jon P. Fishback Sunnyside, WA

I get sick when I see all the Commodore 64 programs in stores. There seem to be so few programs for the Model 4, and they cost much more than Commodore programs.

Radio Shack doesn't approve of computer clubs that would be helpful to their customers, perhaps because they fear programs would be traded and they The Amazing A-BUS
Hobbyists, Engineers, Scientists, OEMs,

universities, the A-BUS is for you!

What is the A-BUS? The A-BUS is the best way to connect a variety of Input and Output cards (such as analog converters, relays, sensors, motor controllers, etc.) to

your computer.

A typical A-BUS system consists of: • An adapter card and cable to connect your computer to the A-BUS standard • The A-BUS motherboard, with several slots in which you plug the different Input and Output cards. 

Your choice of cards listed below, depending on your application. (Many more cards will be released soon.)

The "A" stands for Amazing, and here is why:
The A-BUS works with any TRS-80 models I, III, 4, 4P, 4D, 1000, even 100, 200 and CoCo. In addition, it will also work with IBM or Apple computers. Should you ever move to another system, your investment is protected. Only the low cost adapter card has to be changed!

The system is expandable to meet current and future needs easily.

13 Low cost and reliability will ensure your project success.

A-BUS Adapter for Model I Plugs into 40-pin I/O card edge (on KB or E/I) AR-131...\$39 A-BUS Adapter for Models 3,4,4P,4D Plugs into 50-pin I/O bus. AR-132...\$49

Cable (3 ft.) Computer to A-BUS CA-163...\$29 A-BUS Motherboard, for up to 5 cards (not needed if using only one card) MB-120...\$99

A-BUS Relay Card: RE-140...\$129
This industrial grade output card includes 8 relays. (Contact rated 2 Amp @ 125V) All

the decoding necessary is included which means that you can connect up to 64 cards (which is 512 relays.) Easily controlled using "OUT" commands. For example OUT 0,0 turns all the relays off on card #0. Eight LED's show the states of the relays.

new Isolated Input Card: IN-141...\$49 A-BUS

This optically isolated input card makes it safe and easy to connect external devices (switches, sensors, thermostats, keypads) to your computer. Simple INP commands read the status of the eight inputs. Full address decoding allows up to 64 input cards (that's 512 channels) per computer.

new Analog Input card: AD-142...\$119 A-BUS

8 channel 8 bit Analog to Digital converter. Your computer 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 64 Analog-80's can be connected to your computer for a total of 512 channels!

A-BUS Dual Stepper Controller: ST-143...\$69

Don't be afraid of stepper motors anymore. The special package (below) includes everything you need to get familiar with steppers: • Controller card drives 2 steppers (12V bidirectional) ST-143...\$69 • Stepper: 48 steps per revolution, up to 300 steps/ second. MO-103...\$15 • Power supply PS-126...\$10

Special Package: Controller, two steppers and power supply: PA-181......\$99

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

Y-Cable for Mod I bus (40 pin): • X2-40...\$29 • X3-40...\$44 • X4...\$59 • X5..\$74 Y-Cable for Mod 3 & 4 bus (50-pin): • x2-50...\$34 • x3-50...\$49 • x4-50...\$64

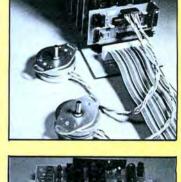
Disk drive cable (34 pin): • 2-drive...C162:\$32 • 4-drive...C163:\$45 Our cables are made with high quality gold plated connectors to ensure utmost reliability.

Green Screen.....\$12.50

Do your eyes a favor, put on a green screen. Tens of thousands are in use because they work. Contrast is enhanced and eye fatigue is greatly reduced. Our green screen is curved; it fits right on the face of the tube. (Fits Models I,II,III,4,12,16)

Printer-Switcher.....\$59

A must if you have two printers, plotters, or any devices using the standard parallel printer port. End the hassle of plugging and unplugging cables. You can select either device at the flick of a switch. For Models I,III,4,4P,4D.

















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# **INPUT**

wouldn't be able to sell the few they have.

Lois E. Patterson

Normal, IL

# Is It Safe?

As an electrical engineer, I recommend that people *not* try Joe Lindsey's modification of the Epson MX-series printer to increase printing speed ("Speed Writing," January 1986, p. 52).

With this change, the Epson print head heatsink, stepper motors, and power supply will run hotter and ultimately fail because they weren't designed to dissipate the extra heat. I've also seen power transistors and other devices explode from overheating.

Epson designed the printer to run slower than it is "capable" of for just this reason.

Lee Pelletier Wenham, MA

I disagree with Mr. Pelletier on the heatsink's limitations. Epson engineers built in a timer to regulate power in the print driver circuit. A balancing effect between pulse width and frequency keeps the power dissipation within safe limits.

Although I, too, have seen components swell, explode and even vaporize trying to dissipate too much power, I haven't noticed even the lights dim when I turn on my faster printer. Several people I know have been using the modification for more than a year without incident.

—Joe Lindsey

# **Bring Back Piracy**

I beg to differ with Eric Maloney's assertion that copy-protection is no longer an issue (Side Tracks, September 1985, p. 8). 80 Micro has simply chosen to ignore it.

Apart from TRSDOS, I know of no Tandy disk program that isn't copy-protected. I've passed up VisiCalc at a terrific sale price because I won't knowingly buy protected media, period. You might make friends among TRS-80 users by running articles revealing Tandy's copy-protection schemes.

Willi Wald Hamilton, Ontario

# Starbridge Reinforced

An improved Starbridge DOS has been released since David Engelhardt reviewed the first version (May 1986, p. 31).

This faster version lets you copy twice as many files, put system files on disk with the format option, and run 25 (instead of only nine) programs from the custom menu. It has back-up and restore options, improved on-screen keyboard help, and is no longer copyprotected.

Kim Mackintosh Starbridge Technologies Los Angeles, CA

# Translation, Please

I will be obtaining an editor/assembler program so I can type in Assembly-language listings from *80 Micro*. I have read that all assemblers handle the programs a little differently.

I suggest that you require authors to mention the name of the assembler program used, so those of us who don't really know Assembly language can copy, assemble, and run these listings without changes.

Frederick L. Mass Garnerville, NY

Most Model III source code listed in 80 Micro was created with Radio Shack's EDTASM, most Model 4 source code with EDAS. In future issues, we'll specify the editor/assembler used. For a discussion of differences in editor/assembler programs, see Hardin Brothers' "Mutual Understanding," (June 1985, p. 82).

-Eds.

# Misosys' Guide Fades Away

Your readers may be interested to know why we at Misosys chose not to reprint *The Programmer's Guide to TRSDOS*.

The *Guide* was first published in August 1983. Since the book was directed at the Assembly-language programmer, it was devoted more to the hacker than the general Model 4 user. The bottom line total is 1,248 books sold in over two years—a dismal showing.

We just don't expect the market to present significant quantities of new Model 4 owners to justify a reprint of 500 books—the minimum quantity necessary for reprinting. If the TRS-80 community of users wishes us to continue publishing this book, they need to get more serious in their purchase of it.

Roy Soltoff President, Misosys Inc. Sterling, VA

# Fleet-Footed Model 4

It would be rather presumptuous to say that the Model 4 is the best microcomputer on the market. But for those who write programs in Basic, that's not far from the truth. The diversity and completeness of commands available in Model 4 Basic are matched only by the IBM implementa-

tion. I've recently found also that Model 4 Basic is the fastest interpreter among the major Basic implementations.

As an example, I ran this one-line program:

10 FOR I = 1 TO 5000: A = A + 1: NEXT on different computers with the following results:

- 1. Model 4, 15 seconds
- 2. IBM PC, 16 seconds
- 3. Apple II+, 18 seconds
- 4. Apple IIe, 18 seconds
- 5. Commodore 64, 20 seconds
- 6. Model III, 34 seconds

Obviously, these figures will vary depending on the operations involved, but the ranking remains the same in most cases (the IBM, for instance, deals with complex operations better than the Model 4 does).

Roberto Refinetti Santa Barbara, CA

# Of TRSDOS, MS-DOS, And Tandy

I've learned to appreciate the TRSDOS 6.2 operating system and other programs by Logical Systems Inc. In fact, I've introduced 11 people to the Model 4. They seem to like their machines as much as I like mine.

Now Tandy wants to put all their efforts into MS-DOS machines.

If MS-DOS (and the software that runs under it) is the best the computer industry can come up with, and if Tandy lets the Model 4 die, then it's back to pencil and paper when my Model 4 dies.

William R. Greep San Jose, CA

### Refundamentals

Your readers may not know that if a Radio Shack product goes on sale within 30 days of purchase, they can get a refund for the difference if they request one within the 30 days. Tandy says the customer is, in effect, returning the merchandise for a full refund (as company policy explicitly allows) and buying it back at the reduced price.

James P. Wright Corpus Christi, TX

A Tandy spokesperson says such refunds aren't part of official policy, but Tandy is committed to resolving any reasonable complaints that customers bring to its attention.

-Eds.

Send your correspondence to Input, 80 Micro, 80 Pine St., Peterborough, NH 03458. We reserve the right to edit letters.

# Did you know? Only one spelling checker:

- works with both Scripsit and Superscripsit.
- integrates with all other popular word processing programs as well.
- requires no special document placement! Even runs on a single drive system.
- · displays its dictionary so that you can find the correct spelling of words.
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Displays Correct Spellings: If you don't know the correct spelling of a word, EW will look it up for you, and display the dictionary.

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Hyphenates Automatically: (Optional). Inserts discretionary hyphens throughout text.

Grammar & Style Checker: (Optional). Identifies 22 types of common errors. Makes suggested corrections with the stroke of a key. Runs within EW.

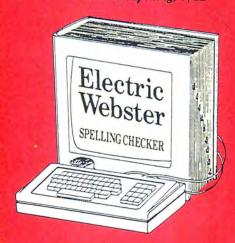
50,000 Word Dictionary: Uses only 2½ bytes per word; add as many words as you wish.

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Integrates: with WordStar, Deskmate, Spellbinder, Volkswriter, Open Access, Allwrite, Newscript, Lazy Writer, Superscripsit, Scripsit, Electric Pencil, Copy Art, Powerscript, Zorlof, and LeScript (specify). Begins proofing at the stroke of a key; returns you to word processing automatically.

When ordering, stipulate word processing program and operating system.

"The Cadillac" of spelling checkers — 80 Microcomputing, 9/82



# ACCLAIMED:

"Electric Webster is the best. Just read any review in any magazine and I don't believe that you will find even one disagreement to that statement." CINTUG, Cincinnati's Users Group Mag. 4/83

"The most helpful program I've found is Electric Webster. After looking at nine proofreading programs, I've settled on Webster..." Creative Computing 11/83

This dictionary is not published by the original publishers of Webster's

Performance "Excellent"; Documentation "Good"; Ease of Use "Excellent"; Error Handling "Excellent". Info World, 8/82

"Electric Webster, a fantastic spelling and grammar checker" 80 Micro 4/85

# Now see for yourself!

# Try Before You Buy:

or the second straight year, 80 Micro readers have voted Electric Webster the #1 Spelling checker. Find out for yourself how accurate, fast and easy proof-reading can be. For only the \$5 cost of postage, materials and handling, we will send you a special Electric Webster demonstration disk that works just like Webster, but proofs only half the alphabet. With it, you'll get a coupon worth \$5 towards the purchase of Electric Webster.

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# Cornucopia Software

POST OFFICE BOX 6111, ALBANY, CALIFORNIA 94706, PHONE (415) 524-8098

Send your questions or problems dealing with any area of Tandy/Radio Shack microcomputing to Feedback Loop, 80 Micro, 80 Pine St., Peterborough, NH 03458.

• Lawrence Pavco's disk drive • cleaning program in the November Feedback Loop (p. 14) works well, but since I don't have four drives, I made the following changes:

10 CLS:Z\$ = " ":POKE16412,1

which stops the cursor from blinking (a personal preference);

51 IFAA\$ = "A"THEN64

which changes the pointer to line 64;

64 INPUT "ENTER NUMBER OF DRIVES"; T:N = T - 1

which takes your keyboard input on the number of drives and assigns it to a variable; and

70 FORC = 0TON: 'the rest of this line remains the same

which inserts the drive variable into the program. Also, the colon that should be after the first command statement in line 70 was missing from the Listing. (Darcy Swensen)

A Good work on solving the problem. Thanks.

• I've been trying to interface a • Model 4 to communicate via the RS-232 with a 1050 General Electric Numerical Control used in machine tools.

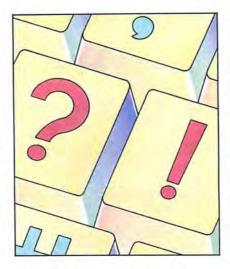
The RS-232 is set and connected as follows:

DB-25	DB-25
2	3
3	2
4-	4
5-	5
<del>-6</del>	6-
7	7
	20

Set \* CL to COM/DVR Setcom (B = 1200, S = 2) Link \* DO \* CL Link \*K1 \*CL BASIC

I can communicate perfectly from the Model 4 to the GE Control. But when I try to communicate back to the Model 4, I get only part of the information and the error message "Undefined line number, syntax error."

Maybe the GE is too fast for the Model 4. Do you know what I'm doing wrong? (Georges Rouleau, Redford, MI)



Pin 4 of the GE should be connected to pin 5 of the Model 4, and pin 5 of the GE to pin 4 of the Model 4. Pin 4 is normally the hardware request-to-send line and pin 5 is the hardware clear-to-send line. For more information on building an adapter device, see "Transfer Points," p. 78 of this issue.

• I own a Tandy 1000 with the onechip BIOS ROM, version 1.00.00. Is Tandy ever going to notify me of the updated ROM version 1.01.00 and whether I'll be allowed to upgrade? Will they charge me because I own a 1000, and will I be allowed to put the new BIOS in my own computer? I feel left in the dark. (Jeffrey Johnson, Mesa, AZ)

Tandy usually tries to notify computer owners of updates, but can't always keep up with the hundreds of thousands of machines sold every year. The solution is to periodically stop by your local Radio Shack Computer Center and ask about updates.

You don't need to change BIOS ROMs because you already have the most recent version. The original Model 1000 used the two-chip BIOS, but now Tandy is shipping it with the one-chip BIOS (\$13.01). The two-chip BIOS is not even available as a replacement part. If your BIOS dies, Tandy automatically replaces it with the one-chip version.

When you change the BIOS chips, you also have to change the memory array chip, U53 (\$7.15), so the BIOS can correctly address the memory. You also need to change the zero-ohm jumper resistors R1 and R2. If you have the one-chip BIOS, R1 must be jumpered. The two-chip BIOS uses R2.

• I'm having a problem with the • GW-Basic (2.02) Screen statement on my Tandy 1000. In the older version of GW-Basic, you could display screen zero while the program was writing in screens 1, 2, and 3. It seems this feature doesn't work in Tandy's new version, 1.01. The active screen will display itself regardless of which screen I select for display.

For example, if I code SCREEN 0,0,0,0, the Print statements that follow will be written to screen zero. With SCREEN 0,0,1,0, the Print statements should be written to screen 1 and screen zero should remain on the monitor, unchanged—that is, until the statement SCREEN 0,0,1,1 is issued, when the monitor will display the contents of screen 1.

In the new GW-Basic, every time you change the active screen the display screen disappears and the active screen writes itself on the monitor. This is annoying because the software I've written will no longer work properly. Any suggestions? (Jim Woodruff, Pineville, LA)

A • That one has me stumped. Microsoft calls the change an "improvement," and won't do anything to help. Any suggestions from readers?

•I own a Tandy 1000 computer and a VM-2 composite monochrome monitor. The display leaves much to be desired. I do a lot of work on spreadsheets and find the poor resolution of a composite monitor annoying. Will a color (RGB) monitor give me better text? If not, can I use a TTL monitor and display card, and do I have to disable the built-in display electronics? (David G. Trulli, Playa del Rey, CA)

▲ • The composite signal is the prob-•lem: as long as you use it you'll have poor resolution. Switching to an RGB monitor and output will noticeably improve text quality.

You don't have to go to TTL electronics, but if you do, don't worry about the built-in electronics. The new TTL card will just intercept the bus line, take out the information it needs, and send it through its own output port.

• I've never received update notices • for the MS-Pascal and MS-Assembler software I bought a little over a year ago for my Tandy 2000. Advertisements for these packages state that new versions are available. My Radio Shack dealer thinks new versions don't exist. Any suggestions? (Peter M. Jagielski, Ada, OH)

There may be new versions of MS-Assembler that don't run on the 2000, which isn't completely IBM-compatible. Most MS-DOS packages require modification before they'll work on the 2000. Unless Microsoft says there is an updated version of those programs for the 2000, no updates or upgrades are available.

• I've written a program (see the Program Listing) to help Gil Seiler suppress the Daisy Wheel II printer's built-in line feed (October 1985, p. 16). I'm not sure the program will work with Gil's AT&T 6300, since that means working with the BIOS ROM, but it works on my IBM PC.

I used PC-DOS INT 27H (terminate-butstay-resident) to interject a file terminate in INT 17H. Because the Daisy Wheel II cable has no pin provision for the hardware interrupt, I decided to send in the two codes each time INT 17H experienced a carriage return (OD hexadecimal).

The procedure is as follows: assemble with MASM (ASM), link, and generate the COM file with EXE2BIN DAISY\_II.EXE DAISY\_II.COM. (Frank P. Barnes, New York, NY)

A Thank you for the solution.

• I've installed two double-sided drives in my Model 4 (early version, black-and-white monitor), and built two power supplies so the standard Radio Shack drives can be used externally. I realize the drives must be addressed as zero and 1; this was no problem, since I had an old Model I cable to guide me. Unfortunately, the drive motors start when the power is turned on and won't turn off, even after a drive has been addressed.

I was able to access the drives as 2 and 3 after realizing the drive-select lines are different. They work but still won't turn off. I know my cable is working because another external drive works fine as either drive 2 or 3, and it turns off when it's supposed to.

Perhaps the boards for these drives are different. Should I cut a trace or install a jumper? There are no jumpers on the board to configure the drives. (Pete A. Lopresti Jr., Birmingham, AL)

A • You forgot to put a termination resistor pack in either of the outboard drives. The floppy drive controller automatically includes a termination resistor on the disk drive control lines, but has no such provision for outboard drives. You must supply a termination resistor for the last drive on your out-

Program Listing. Removing the Daisy Wheel II printer's built-in line feed. ; DAISY\_II.ASM generates a COM file that stays resident in DOS. there is a CR code (ODH), the resident program sends codes IBH (27) and ISH (21) to the printer. This causes the DAISY-WHEEL II printer to cancel the extra line-feed it normally would convert ; cancel the extra line-feed it normally would generate. INTERRUPTS SEGMENT AT OH ;This is where the printer ; interrupt holds address of ORG 17H\*4 PRINTER\_INT LABEL DWORD ; service routine. INTERRUPTS ENDS SEGMENT ASSUME CS: CODE\_SEG ;Make into COM file. ;First time jump to initialize. ?;Location of original printer ORG 100H LOAD CR FIRST: JMP OLD\_PRINTER\_INT ; interrupt. ;INT 17H will now come here. LF\_OUT PROC NEAR ;Is character a CR (ODH)? ;No. Jump to ROM-BIOS routine. ;Yes. Hold ODH in stack. ;Prepare for first code LBH. ;Send to DAISY-WHEEL II. CMP AX, ODH OUT JN2 PUSH MOV AX,1BH 17H Prepare for second code 15H. ;Prepare for second code 15H. ;Send to DAISY-WHEEL II. ;Bring back ODH from stack. ;Jump to ROM-BIOS routine. AX,15H 17H MOV POP OUT: JMP OLD\_PRINTER\_INT LF\_OUT ENDP ;Procedure initializes resident prog.;Data segment will be interrupt area. LOAD CR ASSUME DS: INTERRUPTS AX, INTERRUPTS DS, AX MOV ; Puts 0000H segment into DS ; Get offset address of INT 17H an ; put it into holding buffer. ; Segment address. We can now jutto address of ROM-BIOS INT 17H. AX. PRINTER INT MOV 17H and OLD\_PRINTER\_INT, AX MOV AX. PRINTER INT[2] MOV CLI ;Disable interrupts during change. PRINTER\_INT,OFFSET LF\_OUT ;Now load the address of our MOV ; printer routine into ptr int. ;Re-enable interrupts. ;Set up everything but LOAD\_CR to ; stay and attach itself to DOS. MOV PRINTER\_INT[2],CS STI MOV DX, OFFSET LOAD\_CR TNT CODE SEG ENDS LISTING ONE. End

board cable. You can order this part, a 6-pin 150-ohm pack, from Radio Shack National Parts (900 E. Northside Drive, Fort Worth, TX, 76102, 817-870-5662). The pack costs \$1.08 plus shipping; the part number is ARX0241. You can also have your local Radio Shack store order it, using the reference number 26-1164 in addition to the part number.

• I paid \$265.35 to replace the power supply in my Model III to repair a shrinking screen display. How can I prevent this problem, and if it happens again, what should I check first?

The computer wouldn't boot when I got it back from repairs. The repairmen said the head amp was loose and repaired it for nothing, but I don't think that was the whole problem. The head amp was replaced one previous time for \$100. Can I replace the part myself if it goes again? The Technical Reference Manual never refers to the head amp. Does anyone sell a repair and trouble-shooting manual for this unit? (Howard Kepple, Pittsburgh, PA)

Sometimes power supplies go bad and nothing can be done about them. Should yours fail again, consider building one based on the diagram in the technical manual. That should be

cheaper than having the unit repaired; it may, however, cause problems if repairs are needed for some other reason.

There is no part called a head amp: the term refers to the amplitude of the signal sent to the disk drive head. Some drives have a plug-in 3470 chip that controls the head amplitude.

With an oscilloscope, you can troubleshoot the drive head electronics to see if the amplitude is within the manual specifications. If your drive's 3470 chip isn't in a DIP socket, replacing it will be a lot of work.

The latest Model III Technical Reference Manual lists both types of drives. If your manual doesn't contain this information, get a newer one from Radio Shack National Parts.

• I own a 16K Model III with an Aerocomp single-drive kit, and bought two Jameco Electronics kits to upgrade to 48K. Jameco's instructions only cover 4K to 16K conversions and the company hasn't yet answered my query. I've sent you a copy of the CPU board.

Perhaps I have a bad C ROM. On MEM-TEST (TRSDOS 1.3), the checksum should be 2B91, 2EF8, or 2F65, but my C ROM's checksum is 2F84. (Bill Rollins, Honolulu, HI)

# FEEDBACK LOOP

• Your CPU (central processing unit)
• board has three rows of eight sockets in one corner. Only one row has chips—the other two are empty. To upgrade the memory, plug 16K RAM chips into the empty sockets and you'll have a 48K machine. Make sure all the chips are oriented properly and their notches are pointing in the same direction.

The 2F84 checksum is correct for your computer's ROM C.

• I'm having problems with the speed adjustment on a new Radio Shack disk drive for my Model I. When it was new, the drive ran at 301.5 rpm. Most of the time I get a 302-plus reading. At this high speed, the drive will only boot systems and load some programs in drive zero. In other drives, the result is murder to the operator: lost data, parity errors, and so on.

I want to control the speed, as I am able to do with the original Shugart drives. Can you help? (Randy Schuetz, Mendota, IL)

Speed is not the problem. The drives, controller, and software are designed to allow the drives a 1-percent drift from specifications. As far as the controller and software are concerned, a drive speed between 297 and 303 rpm is OK. The 300 rpm specification is only meant to be an average.

Drive head alignment may be the real culprit. To align the drive yourself, get J&M Systems' Memory Minder diagnostic program for disk drives (15100-A Central SE, Albuquerque, NM, 87123, 505-292-4182). The Model I version costs \$89.

Also, Gerard Kiernan's 80 Micro article "Making Adjustments" (March 1986, p. 44) explains how to modify the drive speed on the Models III and 4 without opening the case.

• I'm a nurse and a freelance writer • of medical articles and books. For letters and short documents, Super-Scripsit performs adequately, but for long documents, the processor is becoming a pain.

On several occasions I've typed in a lengthy manuscript (greater than 20 pages), only to have file access denied, either at the point where I've gone to print a segment or after printing a draft. Sometimes I get the message, "There is no more space left on this diskette," even though there are many free bytes left. When I try to reaccess the file (after going to TRS-DOS to check disk space), I receive the message, "File access denied."

Other times, I'll be typing very fast and "Please wait a moment" comes up, but instead of the usual pause followed by a return to the last character position, the

next page comes up blank with an arrow in the upper-left corner. After much confusing shifting between pages when I try to recall the original page, print commands produce a "Please wait a moment" blurb that goes on for many moments. By then, I'm completely hung up and have to reset. Attempts to reaccess the file bring up the message, "Record number out of range." File access is denied.

Should I buy a disk "zap" program, or give up and get another word processor? (Pat Koch, Temple Hills, MD)

• Keep an eye on the file name in the lower left corner of the screen to avoid running out of space. When you start to run out of room, the file name will disappear and the number of spaces left for characters will appear. Quit the file immediately.

The amount of room left on the disk isn't directly related to what the directory says when you call it at the DOS prompt. Don't continue to use a file if SuperScripsit says there's no more room. Start a new floppy disk to continue the document.

If you feel you must stay on the same disk, call the Compress a Document routine from the menu. This may free enough room for your needs.

In the cases where you were able to print a draft, but subsequent attempts to access the file failed, you may have exceeded the available disk room (at least according to SuperScripsit) when you returned to the draft and made editorial changes and additions.

At frequent intervals, stop writing and send everything you have to disk via the control-W command.

I suggest you get the book Super-Scripsit Word Processing For The TRS-80 Models III, 4, and 4P by Jeanette J. Bieber-Moses (Scott, Foresman and Co., \$17.95, ISBN 0-673-18086-7).

• I have a Model 4 with two disk drives and 64K, and I'd like to run a four-page Basic program that was written all in capital letters on a Model I. Is there a program to convert capital letters to lowercase? I don't mind having to change the first letter of each sentence, but rewriting the entire program is out of the question. (Mario G. Mucciolo, Floral Park, NY)

Load the program into memory and save it as an ASCII file with the command SAVE "filename", A. Then write a simple Basic program that reads the target file a line at a time with LINE INPUT, uses the MID\$ function in a For. . .Next loop to scan the line and add ASCII 32 to each character (except for those with an ASCII value below 65), and then writes the new, all lowercase line back to your disk. The program works

slowly, but it's easy to write and quicker than retyping the whole program.

When you reload the program, Basic will automatically convert the commands and variable names to uppercase, leaving the text (anything between quotes) in lowercase. All that remains is to put capital letters in the proper places.

• Is there a program or method to • make the Epson printer 100-percent compatible with the Model 4P? (Leon Field, Tinton Falls, NJ)

• I'm not sure what you mean by compatible. Three programs for making the MX-80 and RX-80 print dumps of the Model III screen (which the Model 4P emulates) were published in this column in November 1985 (p. 16).

We don't yet have a program listing for dumping Model 4 screen graphics. Does anyone know of one?

• Some of the new daisy-wheel typewriters come with computer interfaces, but I've found none for my Model III. Do you know of any? (D.B. Cameron, Middleburg Heights, OH)

Most typewriters that are supposed to double as computer printers are designed as typewriters first and computer printers second, and are usually meant to work with an RS-232 or a similar interface. Most manufacturers make translation boxes that accept Centronics parallel input and convert it to something usable by the typewriter.

Start by determining which interface is built into the typewriter. If it's a Centronics standard parallel port, you can probably just connect it to the computer printer port, although you may have to get a special cable if the connector on the typewriter isn't a Centronics. If the typewriter has a Centronics connector, you can use the normal printer cable sold by Radio Shack.

If the typewriter uses an RS-232-type connector, you have to configure the computer to send the material to be printed out the RS-232 port (if you have one), or buy the typewriter manufacturer's conversion box. Again, you must make sure the proper cables are available.

It's cheaper to buy an inexpensive letter-quality printer rather than fool around with printer typewriters.  $\blacksquare$ 



Terry Kepner is a freelance writer, programmer, and editor. He writes monthly columns for Portable 100 Magazine, Pico, and 80 Micro, and is publisher of The Kepner Letter.

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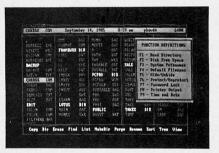


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# Zenith Walks Away With Portables Contract

# Hot Item

The Internal Revenue Service took industry pundits down a peg in February when it awarded its prized laptop computer contract to Zenith Data Systems of Glenview, IL. Estimated at \$27 million, the contract is the largest laptop order ever placed by a federal agency. The agreement calls for Zenith to deliver 15,000-18,000 Z-171 laptops to the IRS over the next 18 months. IRS field auditors will use the computers to access the agency's mainframe files, review books, and file reports when con-

ducting on-site tax audits.

Each unit will have 256K of RAM; two 5%-inch disk drives; a backlit, 10-inch diagonal, 25-line by 80-column liquid-crystal display (LCD) screen; an internal 1,200-baud modem; video adapters for external monitors; and rechargeable battery packs. Zenith will also bundle in applications software, including Enable, an integrated package from The Software Group; RBase 5000, a data base manager from Microrim; and Poly Windows, a desktop organizer from Polytron Corp.

The IRS will pay \$1,100-\$1,200 per machine, which is the winning bid put forward by Zenith. For the IRS, it's not a bad deal, considering that the units (without the internal modem and video adapter) retail at \$2,399.

Industry analysts had all but given the contract to IBM. With Zenith the winner, they still think the contract will "legitimize" the laptop market.

February was a four-star month for Zenith. In addition to the IRS contract, the company won an order from the Department of Defense for delivery of 90,000 Z-200 personal computers to the Air Force, Navy, Army, and Marine Corps over the next three years.

Zenith Data Systems is now firmly entrenched as the number one supplier of PCs and laptops to the government, having won four of the last five major procurements since 1983. (Federal Data Corp. won the other contract.) IBM has yet to win its first microcomputer contract from Uncle Sam.

# Tandyland

If you haven't visited your local Radio Shack Computer Center recently, I'd advise stopping by to see if Tandy's unadvertised software sale is still going on. In February, Tandy began shipping software to the RSCCs for quick sale at bargain-basement prices.

The sale has created a yard-sale atmosphere at some of the computer centers, with system-specific software selling at incredibly low prices in bundled packages. One center I contacted was selling a Model 4 "grab box" containing Pascal 4, CBasic 4, Enhanced VisiCalc, and Spectaculator for \$69.99. Together, the packages would normally retail for \$449.95.

Though a boon for buyers, the sale has RSCC managers wondering what to do with their regular software stocks. The same software packages being offered on sale continue to sit on shelves at their regular prices.

Tandy says the unadvertised clearance is an effort to consolidate stock and relieve two of its Fort Worth warehouses of overstocked items. Tandy gave no indication at press time of how long the sale would continue. You might also note the price of the

Tandy 2000 the next time you visit a
Radio Shack Computer Center. Fort
Worth slashed the price to \$999
for 30 days last winter in order
to generate interest in the problem child of its MS-DOS family. The consensus among
Tandy watchers at press
time was that the company
will continue to pare down
the 2000's price tag after
tallying the results of the
30-day "fire sale."

The success of Tandy's

MS-DOS line is raising questions about the life expectancy
of the Model 4D. In March, reports on CompuServe and in a
TRS-80 newsletter fueled rumors that Tandy had stopped production of the 4D. Amy Arutt, Tandy's assistant manager of marketing information, assured me that the rumors were false. She reiterated the official statement of CEO John Roach that Tandy intends to sell and support the 4D "for at least two more years."

The Tandy 1000, meanwhile, continues to be the computer division's top seller in 1986, with monthly volume sales reaching the tens of thousands. The Tandy 3000 is also selling well, outperforming the company's expectations with monthly volume sales in the thousands.

Contrary to indications made to me at Comdex/Fall, it now appears that Tandy will not involve itself soon in the laser printer market. The company is working on a new line of printers, which we may see this summer, but a laser printer is not among the offerings. When asked about the possibility of Tandy introducing a laser printer in the near future, Ed Juge, Tandy's director of market planning, said, "As far as I know, we are not seriously considering a laser printer now. Six or eight months ago we decided that the price was too high and that it was still a niche market."

Tandy has big plans for Express Order Hardware (EOH), the companion project to its Express Order Software (EOS) system. Though still in its infancy.

# **PULSE TRAIN**

EOH already includes almost a dozen products that you can order through Radio Shack Computer Centers. According to Amy Arutt, the company plans to add more expansion/memory boards and tape back-up systems to the current list of EOH products. The company also hopes to make alternate keyboards

available through the EOH system, she said. Tandy plans to publish the list of EOH products in its summer catalog.

# Third-party support of

Tandy laptop computers has received a boost from Travelling Software Inc. The Seattle company recently introduced two new operating systems—TS-DOS and LAP-DOS—that permit information sharing between a Tandy laptop and an IBM PC or a compatible. TS-DOS, a disk operating system for the Models 100, 200, and 600, formats information on the laptops' 3%-inch portable disk drives so that it can

be read by IBM PCs or compatibles running LAP-DOS.

Travelling Software sells both operating systems, a cable for connecting the Tandy portable disk drive to a PC, and a file-sharing program called Exchanger for \$89.95. With the Exchanger program, files generated on a PC with Lotus 1-2-3, dBase III, or SideKick can be accessed with the company's Ultimate ROM II integrated software chip.

# MicroTrends

Educational applications are the fastest-growing segment of the home-computing market, according to a report by Link Resources of New York. From 1984–1985, the percentage of home computer users who ran educational applications on their micros grew from 45 percent to 64 percent.

The application with the second most significant increase is information filing and storage. In 1985, 59 percent of home users ran data base applications compared to 49 percent in 1984. Link predicts that 69 percent of home users will run data base applications on their micros in 1986.

Interest in entertainment programs has declined in the home market, according to Link, with 64 percent of users running entertainment packages in 1985 compared to 66 percent in 1984. Interest in budgeting and financial management applications, on the other hand, is increasing. In 1985, 36 percent of home users ran financial applications

and Link expects use to increase by 33 percent in 1986. Word processing use increased from 30 percent in 1984 to 39 percent in 1985 (see the Figure).

Commenting on the study, Andy Bose, Link's director of microcomputer analysis, said, "Collectively, the popularity of the home productivity and home busi-

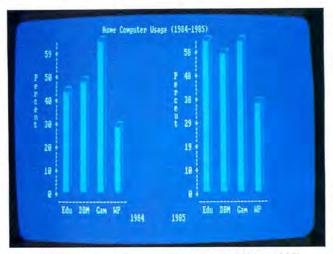


Figure. Home computer applications (1984–1985).

ness applications matches, if not exceeds, the education categories. This is not surprising, considering the heavy usage of the personal computer by heads of households."

Activision, a home software producer based in Mountain View, CA, and Infocom Inc., the number-one developer of interactive fiction, have signed a merger agreement to be finalized in June. Activision will exchange 2 million shares of its common stock for all outstanding shares of Infocom stock. The transaction has a cash value of approximately \$7.5 million.

For Infocom, speculation that it was losing money trying to promote its Cornerstone data base program made the merger almost inevitable. At this time, Activision plans to allow Infocom to continue operating as a separate entity with product development and marketing activities based in Cambridge, MA.

As computer manufacturers and software publishers wonder what to do about soft sales, many are eyeing the educational market, where software sales are stronger than ever. During the 1985–1986 school year, software expenditures by America's schools (grades K–12) were \$150 million, compared to \$130 million in 1984–1985. The average number of new programs bought by schools went from 13 in 1984–1985 to 14 in 1985–1986, accounting for the 15 percent increase in sales.

According to Anne Wujcik, senior an-

alyst at New York's Talmis research firm, schools that have owned microcomputers for five years or more boosted their software purchases by as much as 25 percent during the past school year. Schools using micros for less than five years increased expenditures by 8 percent, while those with a year or less of

computer experience decreased software budgets by 25 percent.

Answers to a Talmis survey sent to 5,000 junior and senior high schools across the country revealed a marked decrease in the numbers of entertainment and drill-and-practice programs being bought by schools. The move these days is towards applications programs in word processing, data base management, problem solving, and Logo programming.

Popular programs are Bank Street Writer from Broderbund Software Inc. and Scholastic Inc.; Apple Writer and Apple Logo from Apple Com-

puter; PFS:File from Software Publishing Corp.; Master Type from Scarborough Systems; The Factory from Sunburst; Snooper Troops from Spinnaker Software; MECC Elementary Volumes from MECC Instructional Services; Typing Tutor from Microsoft; and Microzine from Scholastic Inc.

The results of the Talmis survey suggest that America's grade-school-level computer classes are beginning to move away from the superficial microcomputer applications that once predominated. Students today are being encouraged to use computers as learning tools that will help them after they leave school. But while teachers are increasingly leaning toward simulation and problemsolving software, the traditional drill-and-practice programs will no doubt continue to have a place in America's classrooms.

# Face to Face

Tandy's president, John Roach, is slated as the keynote speaker at this year's PC Expo to be held in New York in July. According to the press release from PC Expo organizers, Roach will discuss PC options and directions applicable to corporate volume buyers and large resellers, and other industry trends. Says Roach, "I cannot promise a speech either extolling the best of times or lamenting the doldrums of doom, but [I do] hope to deliver an accurate and interesting commentary on the exciting and ever-changing industry."

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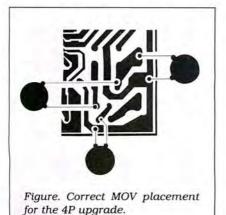
# Making the Upgrade

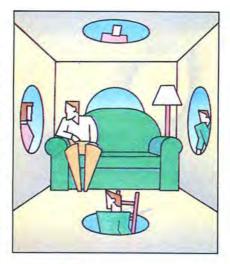
Two do-it-yourself modifications published in the January issue have prompted feedback. Author Joe Lindsey and reader Peter Nissen report that souping up the MX-100 by replacing its 6 MHz and 8 MHz crystals with two 10 MHz crystals ("Speed Writing," p. 52) can cause problems. The printer works fine for normal printing, but in compressed and emphasized mode, it drops dots, creating characters of uneven density.

According to Tsun Tam ("On the Upgrade," p. 40), the instructions for upgrading the 4P contained a few errors. In Photos 8 and 9, the internal cables should show male, not female, connectors. On the external cable in Fig. 2, the pin labels for the two female edge connectors (right end of the diagram) were reversed.

In addition, the last physical drive should be terminated with a resistor pack so that the signal reaching the drive is the proper voltage. Finally, because blown MOVs short out, they should be installed after the fuse. The Figure below, which replaces Photo 6 of the original article, indicates proper MOV placement.

Although many 4P owners have successfully completed the upgrade, a few have had problems getting the disk drives to read double-sided disks. Tsun's upgrade requires that the drives be configured according to the industry standard—a standard that Radio Shack doesn't follow. To ensure proper operation of the drives, follow the directions for modifying the old cables carefully or purchase new internal (and external) cables.





If you haven't found a source for the external drive extension cable mentioned in the article, try Alpha Products (79-04 Jamaica Ave., Woodhaven, NY 11421, 800-221-0916). They sell an 8-inch cable (catalog number C160) for \$9.95.

# From the Files

Model 4 owners with Epson printers who've been looking for a screen dump routine to use with 80 Micro's MacPaint-style graphics program ("Drawing in Detail," September 1985, p. 56) are in luck. Dale Rogerson's routine for the Model III ("Rembrandt Redux," December 1985, p. 76) will run on the Model 4 without changes.

Raymond C. Boggs has passed on

readers' tips for using Finder ("Basic Changes," November 1984, p. 56) to manipulate Basic. Dennis Lewis of Fresno, CA, tracked down the addresses required to use Finder with BasicG 1.1.0 (see the Program Listing).

One useful extra is Finder's ability to save a program if you accidentally return to TRSDOS with the System command. At TRSDOS Ready, type in FINDER; you will be returned to Basic with the program intact. Then type in Q at Finder's \$ prompt. At the Basic Ready prompt, type in SAVE"file name:d". Immediately reboot the computer without trying to run your program. Just to be safe, you should carry out this procedure using a blank, formatted disk.

Boggs points out that TRSDOS 6.2 users are at an advantage when using Finder. They don't need to run the memory header printed in Reader Exchange in April 1985 (p.27). You can automatically insert a header by using MEMORY (HIGH = X'nnnn').

# Setting the Record Straight

"Vital Statistics: Analyzing Data on Your Micro," listed the **wrong price for Walonick Associates' StatPac** statistics program (April 1986, p. 34). StatPac now sells for \$495.

"Hard Decisions" (October 1985, p. 40) contained an incorrect address for Western Digital. The correct address is 2445 McCabe Way, Irvine, CA 92714, 714-863-7767.

Drogram	Licting	BacieC	110	modifications	for	Dindor
Frogram	Listing.	Dusicu	1.1.0	modifications	JUI	rinuer.

		DUST C MOULTIN	ADDRESSES	
	EQU	6011H	CONVERT ASCII TO BINARY	
BINASC	EQU	3139Н	BINARY TO ASCII AND PRINT	
EDIT	EQU	3D2BH	;BASIC LINE EDIT ROUTINE	
EXPAND	EQU	7ААЗН	;BASIC LINE EXPAND ROUTINE	
EXPAN1	EQU	7AA6H	; SAME AS EXPAND, EXCEPT	
			;USER DEFINES BUFFER IN BC	
KBLINE	EQU	974DH	KEYBOARD INPUT ROUTINE	
PSTSRC	EQU	5AD6H	; PST SEARCH ROUTINE	
READY	EQU	5942H	;1ST BASIC READY ADDRESS	
READY1	EQU	595DH	;2ND BASIC READY ADDRESS	
VDLINE	EQU	7A9AH	;PRINT LINE TERMINATED	
			;WITH BYTE OF OOH	
;*****	*******C	OMMUNICATIONS	REGION ADDRESSES**********	
BASBUF	EQU	70C5H	; ADDRESS OF EXPANDED LINE	
BASEND		722BH	; END OF BASIC PROGRAM PTR	
BASTRT		6F2AH	;START ADDRESS OF PROGRAM	
BINBUF		738BH	;BINASC CONVERSION BUFFER	
NOLINE	EQU		; NO SUCH LINE MESSAGE ADR	
AUTOLIN		7214H	; CURRENT AUTO LINE NUMBER	
AUTOFLG		7213H	; AUTO INCREMENT FLAG	
AUTOINC		7216H	; AUTO LINE INCREMENT	
	DRESSES		TAKE CONTROL FROM BASIC*****	
JUMP1		5985H		
	EQU			
OLDJMP	EQU	974DH	; WHAT WAS IN THOSE AREAS	
	*****		*********	
NUM	EQU	80H	CONSTANT FOR UNNEW	

End

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# The Model 3000: Tandy's Bundle of Muscle

# by Dave Rowell

\*\*\*\*

The Tandy 3000 comes with 512K, a 1.2-megabyte disk drive, a built-in real-time clock, and a parallel/serial adapter. The 3000HD comes with an internal 20-megabyte hard disk. Tandy/Radio Shack, One Tandy Center, Fort Worth, TX 76102. The Model 3000 (catalog number 25-4001) is \$2,599; the Model 3000HD (catalog number 25-4002) is \$3,599.

The Tandy 3000 is, by all reports, a fully operational clone of the IBM PC AT. Tandy has trimmed

a few nonessential AT features, speeded it up, and undercut the AT's premium price. The 3000 is clone enough that you don't have to buy software or hardware upgrades from Tandy when you can find a better deal elsewhere. You can have the best of both worlds: Tandy service and the IBM marketplace.

Tandy's made-in-Texas clone runs its 16-bit 80286 microprocessor at 8 MHz (megahertz), 33 percent faster than the AT's 6 MHz clock speed. The 3000's ROM BIOS is guaranteed 100 percent AT compatible by developer Phoenix Software. Tests done for Tandy by Future Computing back this claim; of 48 major PC software packages tested, four didn't run on the 3000. They don't run on the IBM PC AT, either.

# The Equipment

The 3000 provides 10 expansion slots, seven full-length 16-bit AT-type slots and three (one of them half-length) 8-bit XT slots. That's one more of each type than on the AT. Like the AT, the 3000 comes with 512K RAM, a slim-line 1.2-megabyte 5½-inch floppy disk drive, a serial/parallel port expansion board, a socket for an 80287 math coprocessor, and a battery-powered clock. The 3000's 84-key key-board closely follows the AT layout. In addition, the 3000HD comes with a half-height, 20-megabyte internal hard drive.



The 3000 lacks the AT's lock-and-key mechanism, which physically secures the AT case and electronically locks up the keyboard. What may turn away some potential 3000HD prospects, however, is the relative slowness of the 20-megabyte hard drive. It's an IBM PC XT-type drive, not a voice-coil technology drive like the AT's. The older type of drive runs much faster on the 3000 than it would on an IBM XT, but not as fast as the AT's more expensive hard drive.

For most users, the 3000HD will feel exceedingly fast. The hard disk slowdown will be noticeable only with a few applications requiring lots of random file access. For handling large data bases or running the Unix operating system, Tandy will be coming out with a very fast 40-megabyte hard drive. And a few third-party, half-height, AT-fast hard

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80 Micro's star ratings reflect our reviewer's impression of a product.

The stars mean:

- \*\*\*\* Superior;

  \*\*\* Excellent;

  \*\* Good;

  \*\* Fair:
  - \* Poor.

drives are available. If a fast hard drive really matters to you, add \$500 to the 3000HD's price when comparing it to the AT. It may still seem a bargain.

# Outside In

The hefty 3000 is solidly constructed of steel except for its stiff plastic front panel. The large main unit measures  $6\frac{1}{8}$  inches high and 19 inches wide by 18 inches deep. Tandy stayed with their usual off-white color for the 3000's textured case and keyboard. It's not an unattractive computer.

The slotted air intake occupies most of the front panel. Behind it, the fan

draws cooling air through a filter. The square, orange reset button sits to the left, easy to reach but safely recessed. Below the reset button, two red lights indicate power and hard drive activity.

Openings for two floppy drives occupy the sunken area to the right of the intake grille. The 3000's 1.2-megabyte drive A occupies the top slot. Reach around the right side, towards the rear, and you'll find the power switch-just like on an IBM. After passing through the power supply, cooling air leaves the 3000 through two louvered areas at the right rear. The ac power cord plugs in below the louvers, as does the power cord for the 3000's monitor. You need only flip the 3000's power switch to turn on both computer and monitor. Covered expansion slot openings, numbered 1-10, fill the other half of the metal backside. The keyboard plugs into the center back slot.

The plastic keyboard is sturdy, but light enough for lap work. Two legs fold out easily and click into place to angle the keyboard up. Rubber pads at the bottom front prevent sliding. The six-foot coiled cord is thick and strong, with a straight section reaching out from the plug around to the side of the computer—a nice touch.

The 3000 uses the sensible AT key layout: 10 function keys in two columns on the left, and a numeric keypad to the

# REVIEWS

right with all the calculator operation keys except "/", which isn't far off. The arrow keys on 2, 4, 6, and 8 control the cursor until you toggle to number mode with the Num Lock key. Large enter and shift keys are within easy reach of the home row. You must stretch to reach the "|", "\", and backspace keys above the enter key, however.

LEDs (light-emitting diodes) indicate the state of Caps Lock, Num Lock, and Scroll Lock right on the keys rather than in a bank of lights above the numeric keypad as on the AT. The mysterious Sys Req key in the top row of the numeric keypad will have uses under Unix (it has a dedicated interrupt vector).

My 10 fingers agree that the 3000's keyboard possesses an easy, positive key action that brings out their typing abilities like no other keyboard they've used.

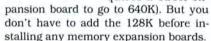
and time, but also hardware configuration information. When you add memory or hard drives, or change monitor type or the date and time, you must run the 3000's Setup program to update the CMOS RAM.

Over the right front area rests a clear plastic airflow covering, which channels the airflow through the power supply compartment.

The powerful (and fairly loud) fan sits at left front in a cast metal housing. A thermostat throws it into high speed at very high temperatures, but most users will never witness this phenomenon. A removable metal-fiber air filter slides up in front of the fan. It slides out the bottom of the frame when you undo its velcro fastener. The 3000's speaker occupies space to the left of the fan.

The motherboard under the fan holds

512K of RAM in two banks of nine 256K chips. The ninth chip in each bank implies that the 3000 uses the same parity memorychecking scheme as IBM computers. Behind the system RAM are two more banks of nine-chip sockets. They're for the 18 64K chips that bring RAM to 640K (the AT requires a 128K ex-



Centered below the expansion board area is the central processing unit (CPU), the 80286 microprocessor. With a 16-bit data bus, improved instruction processing, and faster clock speed, the 3000 leaves the Tandy 1000/1200's 8088 CPU in a cloud of dust. The 80286 can also address 16 megabytes of RAM, while the 8088 is limited to 1 megabyte.

The empty socket in front of the 80286 is reserved for a 5-MHz 80287 math coprocessor (Tandy sells one for \$400). The 3000's ROM is contained in two chips to the right of the 80286. Like the AT, the 3000 has two extra ROM sockets for future enhancements.

All 10 expansion slots have the 62-pin connector used for XT-type cards with 8-bit data bus. You can stick an XT expansion board (if AT compatible) in any of the 3000's 10 slots. The seven AT-type slots have an additional 36-pin plug-in, providing access to the full 16-bit data bus and 16-megabyte RAM addressing.

The half-length XT-type slot 10 is occupied with the serial/parallel adapter board. The parallel port is a female 25pin submini-D connector and accepts IBM printer cables. The pin assignments are pure IBM. You can use any printer designed for an IBM, or a Tandy printer that has an IBM mode. The 3000's serial port, like the AT's, is a 9-pin connector. The drive adapter board is in slot 9, and the video board (an XT-type) should go in slot 1 or 3.



The 3000HD drive controller card (Western Digital WD1002-WA2) supports two disk drives and two hard drives. The 3000 comes with a controller card that handles two floppies only. If you add a Tandy hard drive later, you must buy both a hard drive controller card (\$500) and a drive (\$800). That's \$300 more than the price difference between the 3000 and 3000HD.

The 3000HD takes three internal drives, but all must be half-height units. You can, for instance, mount two internal hard drives in addition to the 1.2-megabyte floppy. Maximally configured, the 3000HD can run two internal floppies, an internal hard drive, and an external hard drive.

The 3000's Mitsubishi 1.2-megabyte floppy drive uses special 5¼-inch high-density disks (\$59.95 for 10 from Tandy). The disk format is 80 track, double-sided, but with 15-sector tracks. At 360 rpm, the capacious floppy runs faster than the 360K drives (300 rpm), and its average access time of 91 milliseconds (ms) and track-to-track interval of 3 ms is quicker than some hard drives.

The high-density floppy drive can read and write in 360K format, but there are some restrictions. First, even if formatted to 360K, high-density disks can't be read by 360K drives because the magnetic signal strength is too high. Second, the 1.2-megabyte drive can read disks created by 360K drives with no problem, but you must take precautions writing to 360K disks with a 1.2-megabyte drive so they can be read by a 360K drive. The disk should be new or bulk-erased before formatting and the 360K drive must be well aligned.

The current 3000 version of MS-DOS 3.1 can't read or write to the 720K floppy format used by the Tandy 2000 (you can take a directory, but that's all). The next release of the DOS will probably add this capability (along with the ability to treat large hard drives as two logical drives).

The 3000HD's 20-megabyte hard drive, also made by Mitsubishi (MR522), uses four heads (two platters) to read 614 cylinders with 17 sectors per track. The 85 ms average access time and 18 ms track-to-track time are in the same class as an XT drive, but slower than the 52 ms and 14 ms ratings of an AT hard drive.



The 3000's power and video plugs and expansion slots.

### Uncovered

Remove three screws from the back panel and the 3000's case easily slides forward from its steel frame, revealing space for a rank of full-sized expansion boards. A large, perforated metal cage at right rear houses the 175-watt power supply, rated at 2.1 amps maximum current drain. The 3000 gets by with less power than the AT's 192 watts partly because it uses 18 power-conserving 256K memory chips to achieve 512K, while the AT uses 72 64K chips. The 3000 can be set to use 120-volt or 240-volt power sources.

The metal drive compartment occupies the area in front of the power supply. There are arrangements for three internal half-height drives. The top bunk holds the 1.2-megabyte floppy drive. The 3000HD's half-height hard drive sits in the bottom. The middle compartment can hold either a floppy or hard drive.

To the left of the drive cage, a large 6.8-volt lithium battery attaches by velcro to the inner front metal panel behind the plastic facade. When the computer is off, the battery powers the 3000's CMOS RAM, which holds not only current date

# REVIEWS

I ran several hard drive tests to get a feeling for the hard drive's capability. The Doran test (running Norton Utilities' Disktest program with the /D parameter) reads the whole hard drive sequentially, testing for read errors. The test took 328 seconds to read 20 megabytes with 16 disk buffers available-a rate of 63 kilobytes per sec (kb/s). An AT tests out around 70 kb/s. The PC XT 10-megabyte hard drive reads only 44 kb/s. The fast 80286 CPU allows the 3000 to use an interleave of three (i.e., the drive reads every third sector on a track and takes three disk revolutions to read a whole track). The XT uses an interleave of six, taking twice as long to read a track sequentially.

I also ran two test programs from *PC Magazine*. The first, called Bench01. EXE, performs random reads and writes and sequential reads on a large test file. The 3000's hard drive performed random writing and sequential reading at an equal or faster rate than an AT drive. Random reading revealed the slower head movement of the 3000's hard drive; it took three times as long as an AT with 512-byte records, but only 23 percent longer with 578-byte records.

The Core International test for drive speed (Bench06.EXE on PC Magazine benchmark disk) determines drive access speeds by averaging repeated read/write head movements. As many people have discovered, the 3000's hard drive fails miserably with the Core test, giving inconsistent access times much higher than the drive's rated speed. The cumulative test time for random access was so long as to overflow the test program's storage capacity, producing an obviously incorrect "30 percent faster than AT" rating.

It turns out that this stressful test uncovered a minor bug in the 3000 BIOS. According to Tandy, the bug shows only with the Core test and doesn't affect normal drive operation. The other hard disk tests bear this out. The BIOS ROM has been fixed and worked into current production.

What does all this mean? Benchmarks aside, the speed of the 3000's hard drive access depends on what you're using it for. For pure sequential file reading, the 3000 compares favorably with an AT. With pure random file I/O, it's slow. Most applications use sequential file I/O or use random access only sporadically, so drive access time isn't usually important. For large data bases doing sorts on disk or a Unix system using the virtual memory capabilities of the 80286, the 3000's hard drive becomes the limiting factor in getting the job done. It's for these uses that Tandy is bringing out a fast 40-megabyte hard drive.

Because the AT uses full-height drives, fast half-height drives are not common; in

fact, they're just becoming available. The Tandon 755, for instance, is a new half-height, voice-coil, 40-megabyte drive that you can purchase by mail for \$1,395 from BT Enterprises (10 Carlough Road, Bohemia, NY 11716, 800-645-1165). If you start with the single-floppy 3000, you'll need a new controller board, too. The Tandy card is \$500. Because all ATs (even the floppy-only model) come with hard drive adapters, there isn't a big third-party market for them.

# More Memory

The 80286 can address up to 16 megabytes of RAM, but not under MS-DOS 3.1, which normally can address only 640K. MS-DOS uses the 80286 compatibility mode so that you can run software

written for a PC's 8088 chip. Any expansion above 640K can be used only as a RAM disk unless you buy a third-party memory board that follows one of the expanded memory standards. For instance Intel's Above Board follows the Lotus/Intel/Microsoft extended memory standard and allows some software to address the extra RAM.

This year, Tandy will come out with

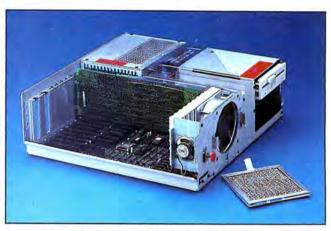
Microsoft's Xenix 5.0, their version of the Unix System V. This operating system runs the 80286 in its protected mode, allowing multitasking, use of virtual memory (1 gigabyte), and addressing the maximum 16 megabytes of RAM. Tandy plans to introduce a 2megabyte expansion board in the second quarter of this year to make use of this capability. With the disk controller taking one 16-bit slot, six AT slots are left for 2-megabyte boards, so you can run 12.6 megabytes of RAM. The board comes with 512K for \$499, and additional RAM from Tandy will come in sets of 256K (25-3062) for \$220-an exorbitant \$1,060 for 2 megabytes.

### Video Electives

One decision you make when buying a Tandy 3000 is what type of monitor to buy. You can run anything from a TV to a high-resolution color graphics monitor. You must also purchase an adapter appropriate to your chosen display. Tandy has tested a wide range of PC and AT video adapters, and they're confident that the 3000 is totally IBM compatible.

The 3000HD I reviewed came with Tandy's Deluxe Graphics Display Adapter (\$500) and their top-of-the-line CM-1 monitor (\$599). Although capable of displaying 640- by 400-pixel graphics, it displays standard PC graphics (640 by 200) by scanning 200 lines twice. Text is as sharp as a good monochrome display, and the eight-color palette (16 is standard) is more than adequate for most applications software (missing are the paler colors produced with the intensity bit on RGBI monitors). The combination of clear text and sharp, bright color graphics explains why Tandy is selling so many 3000s with this monitor. This adapter, made by STB, also drives the VM-1 monochrome monitor (\$100), too.

Tandy's Deluxe Text Display adapter (\$250) drives the CM-1 and VM-1 monitors, producing high-resolution text, but



Inside: AT compatibility and expansions galore.

color only (on the CM-1) in text mode (colored text characters and background). In addition, the Tandy 1200's three adapter boards (mono, graphics, and master graphics) can be used in the 3000 (one must be patched when used with the VM-3 high-resolution monochrome monitor). These boards can be used with the monochrome and RGB monitors Tandy sells for the 1000 and 1200. With a fast machine like the 3000, you may want to run Digital Research's GEM or Microsoft's Windows in color. You'll need a monitor and a board that can handle the IBM's Enhanced Graphics Adapter (EGA) and get the 640 by 350 resolution in 16 colors. EGA boards and monitors are expensive; IBM equipment totals \$1,500. Tandy is pushing to get their own EGA board out for the 3000.

# Performance

The 3000 seems to perform in two modes: fast and instantaneous. I ran some computing benchmarks with known results on the AT. The Norton Utilities system information program (SYSINFO) rates the 3000's computing performance at 7.3 (times the IBM PC's). The IBM PC AT gets a 5.9. The 3000's advantage is 24 percent, not the 33 per-

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The 3000 seems to perform in two modes: fast and instantaneous.

cent you'd predict just from the clock speed increase. A prime number calculation (Bench02.EXE from *PC Maga*zine) ran only slightly faster on the 3000 (14 seconds versus the AT's 15 seconds).

I also ran some Basic speed tests (from Byte magazine, Vol.10:11). Two tested sequential file access by writing and reading 128K records to a 64K file. The 3000 read the file in the same time as the AT (24 seconds), and wrote the file slightly faster (25 seconds compared to the AT's 26). The 3000 performed the standard Sieve of Eratosthenes prime number program at the same speed as the AT (80 seconds), but it performed a single-precision calculation test quite a bit faster (24 seconds compared to the AT's 27). Keep in mind that differences between the two Basics may affect the comparison.

You should be able to go right out and buy software designed for the AT, although Tandy versions of MS-DOS software provide support for Tandy printers (and remove support for non-Tandy printers). Old programs tied to the PC's 4.77 MHz clock tick (usually copy-protected programs) won't run on an AT or 3000, and a few rare programs tied to the AT's 6 MHz clock might not run on the 3000. The 3000 doesn't have a 6 MHz mode like some AT clones.

# Manuals

When you buy the 3000, you get a small Installation and Operations Manual and a utilities disk. The manual contains everything you need to know about setting up your new 3000, including the hard drive. Lots of well-drafted diagrams show clearly the appropriate circuit board placement of any jumpers used in hardware modifications. A jumper on the motherboard must be set for color if you use a color monitor, and another set when you bring total RAM on the motherboard to 640K. There are also two jumpers on the serial/parallel expansion board; one selects serial port 1 or 2, and the other switches the baud rate generator between USA and international settings.

The self-booting utilities disk provides a menu-driven set of programs for setting up the 3000. The disk contains a low-level formatter for the hard drive and a Setup utility to program the CMOS RAM. Also provided are the Shiptrak program to park the hard drive read/ write heads safely for transport, and simple format and disk-copy programs for the floppy drive.

Like the AT, the 3000 doesn't come with operating system software. You have to buy the MS-DOS 3.1/Basic/DeskMate package from Tandy (\$100).

The resident MS-DOS system files take 37K of RAM (not including Command. COM, which yields its space in high RAM to other programs if necessary). DOS 3.1 offers better support of hard drives than 2.11, which comes with the Model 1000. You can, for instance, run a program in another directory if you specify its full path name. DOS 3.1 also supplies a RAM disk (VDISK), a program to change disk volume names, and the ATTRIB command to change file attributes (readonly, hidden, and system). DOS 3.1, like 2.11, however, addresses only 1 megabyte of RAM, 640K of which is available for program use. VDISK can use any RAM above 640K.

Basic 3.11.00 (Tandy version) runs fast with an 80286 microprocessor. Functionally, it's the same as the AT's Basic (or BasicA), but isn't ROM-based. Several small programs I wrote using the graphics commands ran nicely on the CM-1 monitor and were extremely fast and sharp. In screen mode 1, the CM-1 limits you to eight colors; colors 8–15 come out the same as 0–7.

### **Unix Soon**

Microsoft's Xenix 5.0 will soon be available for the 3000 from Tandy. One Tandy change will be the addition of device drivers for their Tape and Disk Cartridge Systems. DeskMate will also be part of the package.

Tandy has an expansion card in the works that will allow up to six people to use the 3000 under Xenix. It will provide four more serial ports and a Z80 microprocessor for improved performance. The AT, as IBM supports it, can handle three users (console and two serial ports). However, Xenix will not be a great system for very large applications because it must work around the 80286's 64K memory segmentation.

### Conclusion

The Model 3000 is an excellent machine, and with a fast hard drive, it will be a great machine. Tandy has put more into this computer than any other: quality of construction, attractive design, and most of all, function. Tandy has made great strides over the last year with their MS-DOS machines, and the 3000 crowns Tandy's comeback.

# AFM: Freedom Of Information

by Harry Bee

 $\star\star\star$ 

**AFM: Automatic File Manager** runs on the Model III (48K) and requires two disk drives. PowerSoft Products, 17060 Dallas Pkwy., Suite 114, Dallas, TX 75248, 214-733-4475. \$99.95.

any data base managers are too strict. They force you into rigid data structures and demand that you modify your data to fit. AFM, however, is a freewheeling data base manager that imposes no such restrictions. It's a filing system designed for those of us whose desire to get organized exceeds our discipline.

AFM is more difficult to learn than it should be and it displays some inconsistencies. Its help screens are less than illuminating and one command didn't work. In spite of all this, I like the program.

# **Easy Entry**

To set up a data base under AFM, you supply names (called tabs) for the fields you think your records will contain. You don't have to decide how long each field will be or what sort of information you'll put into it. A field (for example, "phone:") may occur several times within a record, or not at all. The program allows 60 field names and can retrieve records by 26 of them.

An individual record is just that: individual. Rather than a cubbyhole of predetermined size and shape, it is a collection of related items as large or as small as necessary. The limit is a generous 4,096 characters per record.

AFM uses a "clipboard" of 64 continuous lines as a work area for most functions, and provides an adequate text editor. To build a data base, you type your data on the clipboard (including tabs) and use the editor to play with the format. When you're satisfied with a record, pressing the break key gets you out of the editor and another single-key command writes the record to disk. The program removes your data from the clipboard and leaves the field names in place as a form for the next record. But you're not locked into that format. You can add, delete, and rearrange fields for each record and maintain a library of data-entry forms to call as needed.

The program can also read ASCII text created by other data base programs or word processors directly into your files. I found this feature handy for gathering information from remote data bases by modem.

When you retrieve a record by enter-

# REVIEWS

ing a field name, it appears on the clipboard the way you wrote it. The format, though, is not set in cement. You are as free to edit as when you first created the record. As you page through records, options allow output to the printer or another disk file, and deletion. The Run command permits retrieval by fairly complex search criteria for continuous review, output, editing, or deleting.

# A Disk Miser

With all this flexibility, you'd think AFM would gobble up your disk space. But the opposite is true: AFM stores only what each record contains, not unused fields or portions of fields.

For comparison, I transferred to AFM an address book I'd been keeping with Profile III+. In creating the AFM file, I was able to include all my data for each individual without having to make separate records to catch the overflow. I'd left room on Profile for only two phone numbers and one address in each record: with AFM it didn't matter. In addition. I was able to attach liberal notes to the AFM records (the names of children and dogs, birthdays, anniversaries) instead of being limited to the 32 bytes I'd allowed with Profile. AFM used about 20 percent less disk space, yet I felt I had more (and more useful) information in the new file.

# The Puzzle Book

Forget that the 70-page user's guide is insensitive (librarians are "prim young ladies behind the desk"), puerile ("Isn't that nice?"), and noisy (!). It's inadequate. The flag-waving prose covers installation, setup, data entry, and simple retrieval well enough, but once you're ready for the program's more complex and powerful features, all you'll find are intriguing possibilities never explained. Nine commands listed in the manual's appendix do not appear in the manual proper.

The demonstration program supplied with the package is a hands-on guide to the same material in the manual and leaves the same puzzles. AFM's help screens are reminders only and shed little light.

### **Hidden Power**

The real power of a filing system is its ability to return your data, sorted into an intelligible format. This is where AFM shines. There seems no end to the variety of reports it will produce or to the extent of the criteria you can search by.

To produce a columnar report, you enter a series of commands to establish its physical parameters, define the fields to include, set up your search mask, and run the report. Once you've puzzled out what everything is for, you can easily

run a report directly from the keyboard. However, it's no more trouble to use the template supplied with the program to create report generators, keep them on file, and run them when needed. You can also use AFM by itself to create serviceable form letters.

Although the syntax takes getting used to, you can set up separate search criteria for each field in your file, and AFM searches by all of them at once. Its Lookup feature uses data from one file to search another.

One operator deserves special attention. Preceding a search term with an apostrophe (') tells the program to search the entire text of a field for the given string. It's not perfect. The term "commu" will pull up "communication" or "community," but also finds things like covers modal music. The possibilities of this feature, however, make AFM stand out among Model III data bases

# No Fatal Flaws, But. . .

The first time I ran AFM, I was greeted with an error message. In fact, there was no real error, and the condition disappeared after I set the program to execute automatically on bootup. This is typical of the anomalies that compound the manual's deficiencies. Nothing I tried crashed the program, but this sort of thing kept me wincing.

More serious are the inconsistencies. The search term ">B<B", used one way, will find items beginning with B. Used elsewhere, the term finds nothing; you have to change it to >B<C to get the same results. Another quirk shows up in sorting. The program is supposed to provide three distinct sorts. I found two, there being no discernible difference between the Standard and ASCII options. These two are more interesting than the Numeric sort, though. They shuffle numbers into the alphabet: "2" winds up between "Q" and "R."

The most serious flaw is the \*SCAN command, which is supposed to let you recover otherwise unrecoverable records. \*SCAN didn't work.

# Conclusion

If you have the experience and the time to work around the documentation's shortcomings and the program's eccentricities, AFM turns out to be surprisingly easy to use. If the information you need to organize doesn't come in uniform packages and you feel as though regular data bases are just too difficult to work with, then AFM was made for you. Its flexibility and casual style, combined with its judicious use of disk space, allow applications that are not possible with other Model III data bases.

# A Laptop Media Event

# by Thomas L. Quindry

# \*\*\*

The Portable Disk Drive works with the Models 100 and 200 and requires at least 8K RAM (more recommended). Tandy/Radio Shack, One Tandy Plaza, Fort Worth, TX 76102. Catalog number 26-3808. \$199.95.

Pinally, affordable data storage for the Models 100 and 200. Tandy's Portable Disk Drive is inexpensive, light (less than half the weight of a Model 100), and convenient to use. The drive will easily fit into a briefcase with a Model 100 or 200, a supply of disks, and an optional power supply.

### The Facts

The Portable Disk Drive is a single-sided, 40-track,  $3^{1}/_{2}$ -inch drive that transfers data at 19,200 baud through the RS-232 port, rather than through the 40-pin expansion bus. It is powered by four AA alkaline batteries or an optional power supply. (The power supply is the same type that can power a Model 100 or 200 and costs only \$5.95.)

While manufacturers of other disk drives for the 100 and 200 have chosen to use higher-capacity drives of 360K per disk, Tandy's smaller drive holds only 101K. But the difference in price makes up for the storage disadvantage.

Setting up the drive is easy. You should have at least 8K of RAM in your computer. Actually, 16K should probably be the minimum, since an 8K Model 100 only has about 5K of free RAM. When you use the drive for the first time, its four DIP switches have to be set to the on position—the drives should be delivered this way. You type in a three-line Basic program that loads the key program, Floppy.CO, from the supplied utility disk into your computer. After Floppy.CO is loaded, you set the four switches to the off position so that the file management program can be run. I did have trouble determining the on/off position of the switches since they aren't clearly marked.

The disk drive isn't much of a power grabber. A set of four alkaline batteries that would last 20 hours in a Model 100 will last about 10 hours in standby mode with the disk drive. The batteries will power about two hours of actual read/write operations. But two hours is a long time for disk input/output (I/O). It's rarely necessary to keep the drive on for more than a few seconds at a time; you

Continued on p. 114

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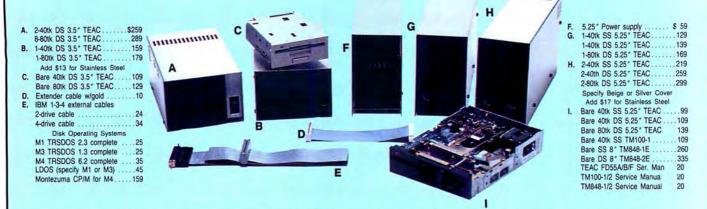




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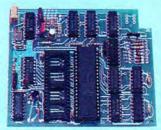
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had 40 tracks. In single density the tracks on the diskette surface are divided into 10 sectors. Each sector contains 256 bytes of data for a total of 2,560 bytes or 2.5k per track times the number of tracks your drive is capable of addressing. Double density, on the other hand, allows each track to be divided into 18 sectors. As in single density each sector contains 256 bytes but now there are 18 sectors instead of 10 giving an new storage capacity of 4,608 bytes or 4.5k per track. The result is 80% more data in the same space. You may wonder why Radio Shack did not choose to use double density in the beginning. The reason is simple. It costs more money. Double density disk storage techniques were more expensive to implement back then.

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## Pulling Strings by Lewis Rosenfelder

ne way to make your programs friendlier, faster, and more compact is to take advantage of Basic's Instring (INSTR) function. INSTR finds the position of one string within another, which can help you decode and validate keyboard input, filter or change unwanted data, perform program branching, and conduct high-speed searches of disk files. Once you master a few techniques for using INSTR, you'll find it to be a powerful and versatile tool.

#### Covering the Basics

Let's begin with a review of how INSTR works. Try typing in this command in Basic:

PRINT INSTR("MICROCOMPUTER", "R")

When executed, this returns an answer of 4, since the first occurrence of the letter R is in the fourth position of the string MICROCOMPUTER. The string contains another R; to check for it, Basic must conduct a second search beginning one position beyond the first match:

PRINT INSTR(4 + 1, "MICROCOMPUTER", "R")

The optional first argument (4+1) tells Basic to begin searching at position 5, resulting in an answer of 13.

Now try typing in:

PRINT INSTR(0,"MICROCOMPUTER","C")

## Basic's versatile Instring function encourages program code that is fast, friendly, and concise.

This is an illegal function; the optional argument must be greater than zero.

Here's another example:

PRINT INSTR(13+1, "MICROCOMPUTER", "R") When executed, this command returns an answer of zero, Basic's response when it cannot find the search string. The search failed because there are no occurrences of R past the 13th position. Indeed, there are only 13 positions in the string.

If you were to enter the command:

PRINT INSTR("MICROCOMPUTER", "X")

Basic would again answer with a zero, as there is no X in the searched string.

You can use INSTR to search for more than one character. Type in:

PRINT INSTR("MICROCOMPUTER", "COMPUTER")

In this case, Basic returns an answer of 6.

If a search string is null (" "), as in this example:

PRINT INSTR("MICROCOMPUTER"," ")

it "slips through the crack" at the first byte. Thus, the answer is 1.

#### Validating Input

Testing for valid keyboard input is the most common application of the Instring function. Type in and run these two lines:

10 LINE INPUT"Do you want to continue? ":A\$
20 IF INSTR("YyYESyes".A\$) THEN PRINT
"Let's go!"

As desired, the If condition in line 20 tests true if a user types in a Y, y, YES, or yes, or if the enter key is pressed. However, it also tests true if the user types in an E, the letter sequence ES, or any other sequence that can be derived from the letters in the string.

To eliminate the possibility of Basic accepting invalid input, rewrite line 20 like this:

20 IF INSTR("/Y/y/YES/yes/","/" + A\$ + "/")
THEN PRINT "Let's go!"

Bracketing each valid option with slashes tells Basic exactly which letters and letter sequences to search for. If a user types in ES, INSTR searches for /ES/, which, of course, it won't find.

You can use the same string to show users which options are valid and to validate the choice. Try this technique:

- 10 VC\$ = "RED,GREEN,BLUE"
- 20 PRINT "Valid choices are: ";VC\$
- 30 LINE INPUT "Choose a color: ";A\$
- 40 IF INSTR("," + VC\$ + ","," + A\$ + ",") = 0 THEN 20
- 50 PRINT A\$:" is a good selection."



#### **System Requirements**

All systems Basic To change the options, all you need to do is modify line 10. Notice that I used commas instead of slashes to separate the options.

#### **Option Strings**

INSTR is also useful for programming yes/no choices. You can avoid the tedium of coding in questions like, "Do you want to do this?" or "Do you want to do that?" by assigning letter values to actions, as in Program Listing 1.

You might conceivably make this screen appear before a receivables printout. The user could obtain a doublespaced listing of accounts that are active but past due by typing in DAP, a singlespaced listing of inactive accounts by typing in I, and so on.

Use the Instring function to test for options. For example, to handle the possibility of a double-space request after the report line is printed, you might write the following:

230 IF INSTR(OP\$,"D") THEN LPRINT " "

Here's how you would check whether the user wants active accounts only:

210 IF INSTR(OP\$,"A")>0 and B# = 0 THEN 240

If the condition tests true and the balance is zero, the program jumps to line 240. (When using the AND/OR operators with INSTR, be sure to use equal to or greater than zero, as I did in the test for A in line 210. This forces a true (-1) or a false (zero) result, rather than a position.)

#### Converting to Numbers

INSTR works well for converting string responses to numbers, which computers handle more easily. Suppose you have a string of branch offices, coded ATL, BOS, CHI, CLE, DAL, DEN, DET. It might make your coding easier if you could refer to the branch offices as numbers 1–7. With the help of INSTR and a bit of math, Basic can make the conversions (see Program Listing 2).

The secret is keeping the codes the same length—four characters (including the comma) in this case. Let's say a user enters the branch office code CHI. Line 40 adds commas to both sides of the list, changes the search key to ".CHI," and finds a match in the ninth position. Line 50 subtracts 1 from 9 (to get 8), divides 8 by 4 (to get 2) and adds 1 to produce the answer, 3.

Another application of INSTR is for creating menu choices and program branching. For this application, use INSTR with an On. . .GOTO statement as shown in Program Listing 3. If the user types in A, control goes to line 100; W forces a branch to line 200; P forces a branch to line 300. If the operator presses any other key, including enter, the message "Bad choice" appears on-screen, and the program loops back to line 10. (Pressing enter results in

an empty quote or null string (""), which, as I mentioned earlier, returns an answer of 1. A question mark will also return a 1.)

#### Simplifying Number Codes

INSTR also converts nonconsecutive numbers into consecutive ones for easier handling. An error-recovery routine is a perfect example. Suppose you anticipate four disk errors when writing a file:

- 61 Disk full
- 67 Too many files
- 70 Disk write protect
- 72 Disk media error

(These are error codes for the Tandy 1000, 1200, 2000, and 3000.) If one of these errors occurs, the error routine is called. You can convert the error code contained in the ERR variable to a number from 1–4 or a zero if it isn't one of the four expected. An On. . . GOTO statement then makes the program branch accordingly:

1200 A% = INSTR(" 61, 67, 70, 72,",STR\$ (ERR)+",")

1210 IF A% THEN ON (A% - 1)/4 + 1 GOTO 1310, 1320, 1330, 1340

Though I've used two lines for clarity, you can combine them. The STR\$ function converts the error code to a string. Since error codes are always positive, a blank is always in the sign position. Accordingly, blanks appear to the left of each number in the string. For the math in line 1210 to work, each number, including its trailing comma, must take exactly four positions.

If ERR is 70, INSTR searches for "70," and finds it at the ninth position. Line 1210 converts 9 to 3, forcing control to line 1330. An error code not in the list sends the program down to the next line, presumably 1220.

#### Filtering Data

Programmers who sort records alphabetically often store last names first in disk files. But what if you want first names to appear first in printouts and screen displays? Type in the following program to see how this might be done:

- 10 LINE INPUT "Last name, first: ":A\$
- 20 A% = INSTR(A\$,", ")
- 30 IF A% THEN A\$ = MID\$(A\$,A% + 2) + " " + LEFT\$(A\$,A% - 1)
- 40 PRINT AS
- 50 END

Run the program and then type in JOHNSON, JERRY. INSTR looks for the comma and the space after it. Then line 30 changes the string to JERRY JOHNSON. If you enter ABC SUPPLY, it remains unchanged, since the name doesn't contain a comma and space together.

Sometimes you might want to filter characters from a string. Maybe your printer goes berserk when it receives a particular code, or maybe you want to alter data in a file you've downloaded over the phone line. The example in Program

#### Program Listing 1. Assigning letter codes to print reports. "Select the options wanted (if any) by typing" 10 PRINT 20 PRINT 30 PRINT "any combination of the following codes: 4381 528 4344 "D=Double space I= "T=Totals only A=. "P=Past-due only S=. INPUT "Options: ";OP\$ I=Inactive accounts only" A=Active accounts only" 40 PRINT 50 PRINT 4124 PRINT S=Stop after each page' 70 LINE INPUT 2055 End Program Listing 2. Converting strings to numbers. 10 BR\$="ATL, BOS, CHI, CLE, DAL, DEN, DET" 2228 PRINT "Branch offices: " :BRS LINE INPUT "Enter the branch office code: ";A\$ A%=INSTR(","+BR\$+",",","+A\$+",") 3821 1725 A%=INSTR(","+BR\$+",",","+A\$+",") IF A%=0 THEN 20 ELSE BR%=(A%-1)/4+1 PRINT A\$;" is on diskette";BR% 2059 2433 60 PRINT AS; End Program Listing 3. Presenting menu choices. 10 PRINT "A=Add new employee" 20 PRINT "W=Write paychecks" 30 PRINT "P=Print reports" 2285 2109 40 PRINT 529 50 LINE INPUT "What do you want to do? ";A\$ 60 ON INSTR("?AWP",A\$) GOTO 70,100,200,300 70 PRINT "Bad choice. ":GOTO 10 2362 End Program Listing 4. Filtering characters from a string. 100 OPEN"I",1,"OLDFILE" 110 OPEN"O",2,"MEWFILE" 120 IF EOF(1) THEN CLOSE:END 130 LINE INPUT \$1,AS 140 A%=INSTR(A\$,"/"):IF A% THEN MID\$(A\$,A%)="-":GOTO 140 1359 1716 PRINT #2,A\$ 841 160 GOTO 120 675 End Program Listing 5. Index.BAS. 'index.bas 100 100 'Initialize 110 GOSUB 1000 145 787 200 'Select demonstration 210 LINE INPUT "A-Add S-Search L=List Q=Quit ";A\$ 220 IF LEN(A\$)<31 THEN 210 230 ON INSTR("ASLQ",A\$) GOTO 300,400,500,600 146 1445 2472 674 240 GOTO 210 300 'Demonstrate adding a key 310 LINE INPUT'Key to add: ";K\$:GOSUB 3000 320 IF K% THEN PRINT "Added as #";K% ELSE PRINT "Index full" 320 IF k% THEN PRINT "Added as \$";k% ELSE PRINT "Index full" 330 GOTO 200 400 'Demonstrate searching, changing, deleting 410 LINE INPUT"Search for: ";k%:GOSUB 2000 420 IF k% THEN PRINT "Found at \$";k%:GOTO 440 430 PRINT "Not found.":GOTO 200 440 LINE INPUT "C=Change D=Delete R=Resume Search Q=Quit ";A% 450 IF LEN(A\$)<>1 THEN 440 ELSE ON INSTR("CDR",A\$) GOTO 470,480, 490 4109 673 148 2862 2879 4693 490 3849 677 GOTO 200 470 LINE INPUT "Change to: ";K\$;GOSUB 3050;GOTO 200 480 PRINT "Deleting.":K\$="":GOSUB 3050;GOTO 200 490 PRINT "Resuming search.":K\$=0:KP\$=KP\$+1:GOSUB 2020;GOTO 420 3339 3064 4333 'Demonstrate getting keys by number 149 404 1781 GOSUB 4000:IF K\$="" THEN 200 IF K\$=STRING\$(KL%," ") THEN PRINT "<Deleted>"; ELSE PRINT K\$ 540 PRINT TAB(KL%+1), K%: K%=K%+1:GOTO 520 2335 600 END 'initialize index 1000 193 578 1010 KL%=25 1020 KC%=100 key length 'index capacity 'keys per string 'array size 612 1030 KS%=INT(255/KL%) 1035 KA%=KC%/KS% 892 1040 DIM KA\$(KA\$) 'dimension array 1050 DEF FNKL\$(K\$)=LEFT\$(K\$+STRING\$(KL\$," "),KL\$) 'padding function 2779 1060 RETURN 2000 'search index 2010 K\$=FNKL\$(K\$):KI\$=0:K\$=0:KP\$=0 1916 2020 KP%=INSTR(KP%+1,KA\$(KI%),K\$):IF KP% THEN 2050 2030 IF LEN(KA\$(KI%))<KS%\*KL% THEN RETURN 2482 2040 KI%=KI%+1:IF KI%>KA% THEN RETURN ELSE 2020 2050 IF (KP%-1)/KL%=INT((KP%-1)/KL%) THEN 2070 2060 KP%=INT((KP%-1)/KL%)\*KL%+KL%:GOTO 2020 2814 2555 2463 2103 2070 K%=KI%\*KS%+(KP%-1)/KL%+1:RETURN Listing 5 continued

Listing 4 reads a file called Oldfile and creates a new one called Newfile, in which all slashes are changed to dashes. Notice how INSTR reexecutes in line 140 if a given line contains more than one slash.

#### **Indexing Disk Files**

At some point or other, you've probably tried accessing random disk files in Basic and encountered obstacles. To access a record, Basic must know the record number. If you have an inventory file in which Widgets is the 340th record, you can't type in WIDGETS and expect Basic to find it. You must either search the entire file or perform some fancy programming to convert the search key to a record number.

Deleting records is another problem. Let's say you have an inventory file in which Buggy Whips is the 42nd record. Your company no longer manufactures buggy whips; therefore, you'd like to delete the record. Doing so creates a hole, which, ideally, you would fill with the next new product in the inventory file.

Keeping track of record deletions and available records at the end of a file can be a very confusing and slow process. Again, INSTR comes to the rescue. Index.BAS (see Program Listing 5) creates an index in Basic for accessing and managing random disk files.

All the search keys are stored in a string array. Instead of one string for each key, the program stores multiple keys in each string of up to 255 bytes. This means that if 42 6-byte keys are stored in each string, only nine Instring searches are required to find the 378th key!

The subroutine that begins at line 1000 dimensions the KA\$ array according to the key length and index capacity specified in lines 1010 and 1020. It also contains a function that pads or truncates search keys that are shorter or longer than the indicated key length.

The subroutine at line 2000 performs the search. If you put the key in K\$, it returns the record number in K%. If K% is zero, the key was not found. Otherwise, you can use K% with a Get statement to access your random disk file.

When INSTR (line 2020) finds a match, KP% is the position in the string. Line 2050 checks to see if the match is on an even key boundary. If it is, line 2070 converts the position to a key number. If the match isn't on an even key boundary, the search resumes at the next key.

If a key is found, check for duplicates by making K% zero, adding 1 to KP%, and performing a GOSUB to line 2020. K% returns the record number if a subsequent match is found.

To add a key to the index, put it in K\$ and GOSUB 3000. On return, K% contains the record number the subroutine has chosen. If K% is not zero, use it with a Put statement to write the record to disk.

If K% is zero, the index is full and the record cannot be added.

To find the position for adding a new key, the subroutine at line 3000 searches for a blank position created by a previous deletion. If one is available, the routine at 3050 changes it to a new key. Otherwise, the key is added at the end of the index. The program does not check to see if the new key already exists; if you want all keys to be unique, do a GOSUB to line 2000 first. Then, if K% is zero, you can add it by performing a GOSUB to line 3000.

To delete a key, you must find it first by performing a GOSUB to line 2000. Then make K\$ equal an empty quote (" ") and GOSUB to 3050. To change a key, you must first find it and then put the new value in K\$ and GOSUB 3050.

I provided subroutine 4000 in case you have a record number and you need the key that goes with it. Put the record number in K% and GOSUB 4000. On return, K\$ has the key. If K\$ is null, the record number is too high. If K\$ is all blanks, the record number represents a deleted key.

I've included a demonstration at the beginning of the program. Since it doesn't write anything to disk, you'll need to add disk routines for applications. After initializing the variables with GOSUB 1000,

load the index from a sequential file. For example:

700 OPEN "I",1,"ACCTINDX"

710 KI% = 0

720 IF EOF(1) THEN 740 ELSE LINE INPUT #1.KA\$(KI%)

730 KI% = KI% + 1:GOTO 720

740 CLOSE 1:RETURN

Then open the random file to be indexed. Note that lines 700-740 assume the index already exists, so you'll need to create an empty file before the first run. Here's how you'd do it:

OPEN "0",1,"ACCTINDX":CLOSE 1

Before ending a program in which you've updated an index, be sure to close the random file and rewrite the index to disk as follows:

800 OPEN "O",1,"ACCTINDX"

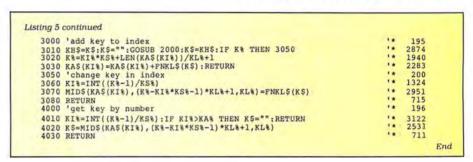
810 KI% = 0

820 IF KA\$(KI%) = " " THEN 840 ELSE PRINT #1.KA\$(KI%)

830 KI% = KI% + 1:IF KI% < = KA% THEN 820 840 CLOSE 1:RETURN

As you can see from these examples, knowing the position of one string is useful in a variety of applications. I hope the techniques I've covered will help you write better Basic programs.

Lewis Rosenfelder is a software developer, author, and vice president of Tradewind Software, Honolulu, HI. His published books include Advanced BASIC Faster & Better (Walnut, CA: Blue Cat Inc., 1985). You can reach him at 3026 Edwards Place, Riverside, CA 92503.



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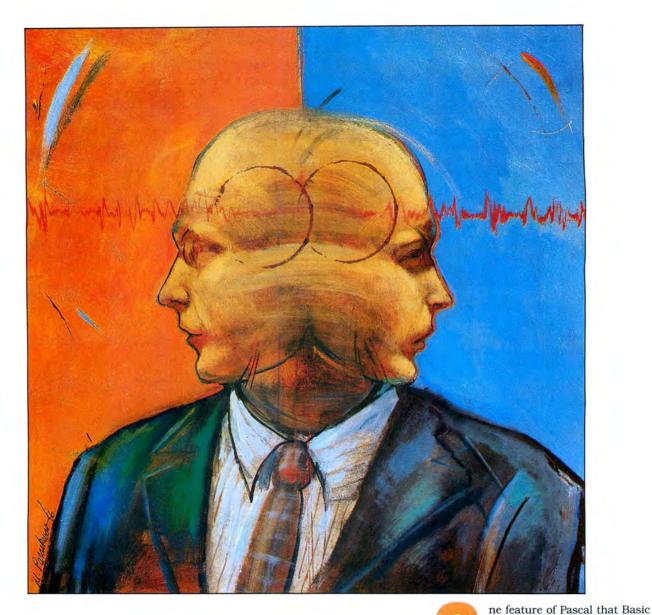
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programmers often find attractive is its use of Boolean operators and functions. You don't have to learn Pascal, however, to take advantage of Boolean operations. Basic has most of the same logic capabilities as Pascal and other structured languages, though they are poorly documented and rarely discussed in books and articles.

Advanced programmers make frequent use of Boolean operations to simplify their programs, no matter what language they are written in. In this article, I'll explain how Boolean operations work in Basic and provide examples that I hope will lead you to more sophisticated programs.

#### **First Principles**

To begin, let's explore how Basic assigns true and false values. In Basic, type in the command:

#### PRINT (3<4)

This asks Basic to evaluate the truth of the statement "three is less than four." Basic responds by printing "-1" to the screen.

Try typing in the command:

PRINT (3>4)

# Truth AND Consequences by Hardin Brothers

## Expand your programming repertoire to include Basic's Boolean operators—AND, OR and NOT.

This time Basic responds by printing a zero to the screen.

The integers -1 and zero are Basic's internal machine-level representations of true and false. When you ask Basic to evaluate the truth of a statement, it does so by assigning a value of -1 or zero. In an If. . . Then or a While statement, Basic always evaluates the conditional portion first and assigns either a true (-1) or false (zero) value before deciding what action to take.

As another experiment, type in the command:

IF - 1 THEN PRINT "True"

Basic responds (as you probably guessed) by printing "True." If you substitute a zero for the -1, Basic prints nothing. Try other numbers after the conditional If and you'll discover another fact: Basic interprets any nonzero value as true, even though it always generates a -1 when asked to evaluate a true statement.

The designers of Basic chose -1 and zero to represent true and false because of the way computers store integers. Every integer requires 2 bytes (16 bits) of internal storage. Not surprisingly, zero is stored as 16 bits of zero. Its exact opposite, 16 bits of 1, is the internal representation of -1. It makes sense to us to say "Not false is true." Basic and your computer agree with that logic. If you type in:

PRINT NOT 0

Basic returns the true value, -1.

#### So What?

With this background, you are ready to put truth values (also called logical values or Boolean values) to work in a program. There are hundreds of possibilities; we'll look at only a few.

Programs that handle sequential disk files often include routines that read an entire file into an array in memory. The Basic function EOF() returns a -1 (true) when your program reaches the end of a file and a zero (false) when there is still more to read. The following routine is a simple method for reading an entire sequential file into the array A\$:

WHILE NOT EOF(1)

COUNT = COUNT + 1

LINE INPUT#1, A\$(COUNT)
WEND

(Some of the examples in this article, including the above, must be modified for use with Model I/III Basic. See the sidebar on p. 45 for changes.)

The expression NOT EOF(1) returns a true value as long as your program hasn't reached the end of the file. When it has, the value changes to false, and the program falls through to the line following Wend.

Another common routine is one that waits for a user to press one of a specified set of keys. For example, a menu might have five choices numbered 1–5. The following routine makes the program wait for legitimate input after the menu is displayed:

OKAY = 0 OKAY.KEYS\$ = "12345" WHILE NOT OKAY KEY\$ = INPUT\$(1) OKAY = INSTR(OKAY.KEYS\$,KEY\$) WEND

As the program fragments show, Boolean statements like While Not Okay and While Not EOF() are easy to read and understand; used correctly, they can make a program easier to read and debug.

#### **Logical Functions**

Boolean values are especially powerful when included in user-defined functions. I find this technique useful in data-oriented programs for testing the validity of user input.

Suppose, for example, you are writing a program that develops a list of phone numbers, which will be the basis of an automatic dialing program. The input loop for a phone number might look like this:

PHONE\$ = " "
WHILE NOT FN VALID.PHONE(PHONE\$)
display a prompt
get input in PHONE\$
WEND

Notice that nothing in the five lines detracts from the main logic of the program, which is to keep asking for a phone number until the user types something the program considers valid.

You might decide that a valid phone number can have any of three forms: 555-1234, 800-555-1234, or (800) 555-1234. In this case, you must write a function—we'll call it FN Valid.Phone—that returns a true value only if a string conforms to one of the three forms. This is easy to do if you break the task into small steps.

First, call the three phone number forms Phone 1, Phone 2, and Phone 3. Then write the function like this:

DEF FN VALID.PHONE(X\$) = FN VALID. PHONE 1(X\$) OR FN VALID.PHONE2(X\$) OR FN VALID.PHONE3(X\$)

This defines a string as valid if it fits one of three special forms. If FN Valid.Phone1 or FN Valid.Phone2 or FN Valid.Phone3 returns a true value, then FN Valid.Phone will also be true.

The first format looks the easiest, so let's tackle it first:

DEF FN VALID.PHONE1(X\$) = (LEN(X\$) = 8)
AND FN THREE.DIGITS(LEFT\$(X\$,3)) AND
(MID\$(X\$,4,1) = "-") AND FN FOUR.DIGITS
(RIGHT\$(X\$,4))

This function says that a string fits the first format if (and only if) it is eight characters long, the first three characters are numerals, the fourth character is a hyphen, and the last four characters are nu-

merals. The conditions are connected with AND operators because you want all four to be valid.

Next you'll want to check whether you have three or four digits in a row. One way to do this is to write three related functions as shown in Program Listing 1. Once you've written the code to test for one phone number format, you should have no trouble writing the code for the other two. Program Listing 2 shows how everything would fit together in a program.

If you look carefully at the code we've written so far, you may notice a way to save a great deal of space. FN Four.Digit could check one character and then use FN Three.Digit to check the other three. Both FN Valid.Phone2 and FN Valid.Phone3 could use FN Valid.Phone1 to check the last seven characters of a phone number.

Having functions call one another like this requires less typing and might improve program flow. Even so, I do not recommend this technique, for two reasons. First, Basic takes longer to evaluate multiple-linked functions. On a Model 4, the program in Listing 2 can evaluate the validity of a phone number in about a quarter of a second. It will take almost twice as long if the functions are more tightly linked.

Second, Basic uses a fair amount of stack space to store the partial results of one function while it calls another. If you link the functions in Listing 2 as tightly as possible, the Model 4 will send an "Out of memory" error message. You can overcome this problem by using the Clear command to allocate more stack space (CLEAR,,600 seems to work well), but you'll then run into a bug in the Basic interpreter. In addition to using more memory space than it should, the Clear command uses additional memory space every time you invoke it; it won't release that space until you leave Basic.

I originally wrote Listing 2 using tightly linked functions and added the command CLEAR,,600 in line 15. Then I began to correct typographical errors and test the program. After running it only a few times, I found that I had less than 5,000 bytes of memory left. To reclaim the memory confiscated by Clear, I had to save the program, return to TRSDOS, and reenter Basic. So much for programming elegance.

You should have little trouble adapting the programming techniques in Listing 2 to create routines that validate the format



System Requirements

All systems Basic In Basic, the operator NOT changes every bit in an integer into its opposite.

of Social Security numbers, dates, times, and other standard input formats. You can use FN Is.Digit as a guide to writing similar low-level functions that will check for alphabetic characters, punctuation, control characters, and so on. Higher functions can use these to determine whether user input fits the formats needed by a particular program.

#### Tied Up in NOTs

A technique I use often in Basic programs is to define a string of characters with an If. . .INSTR(). . .Then construction. Let's say I have a string of characters called Special\$. For checking user input, I'd include two lines similar to these:

KEY\$ = INPUT\$(1)
IF INSTR(SPECIAL\$,KEY\$) THEN . . .

The If. . . Then statement can branch to a help screen, error message, or any kind of special routine.

The advantage of using this construction is that it is easy to understand and it saves a small amount of processing time. The functionally equivalent statement If. ..INSTR() <>0. ..Then forces Basic to convert the zero to binary form and then perform a comparison every time the line is interpreted. Since Basic interprets every nonzero value as true, the comparison is a waste of Basic's time and resources.

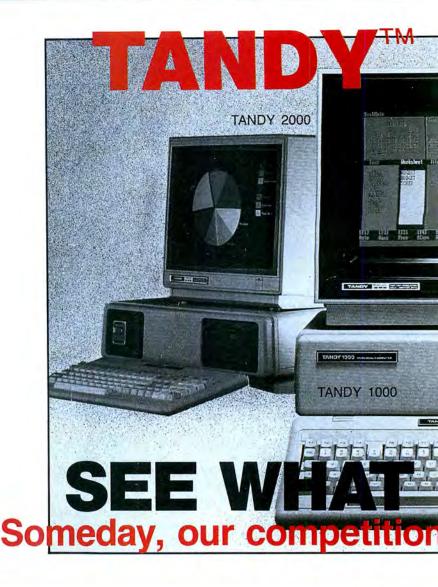
You might be tempted to use an opposite and related expression:

IF NOT INSTR(SPECIAL\$, KEY\$) THEN . . .

This will fail, however. Though the statement looks as if it should produce the opposite effect of the previous one, it will, in fact, always test true. Nothing a user types in will make Basic skip the Then clause.

A = B = 0 A = B = C = 0 A = B = C = D = 0 A = B = C = D = E = 0 A = B = C = D = E = F = 0

Figure. Test what you know about logic programming by determining the value of A in each expression.



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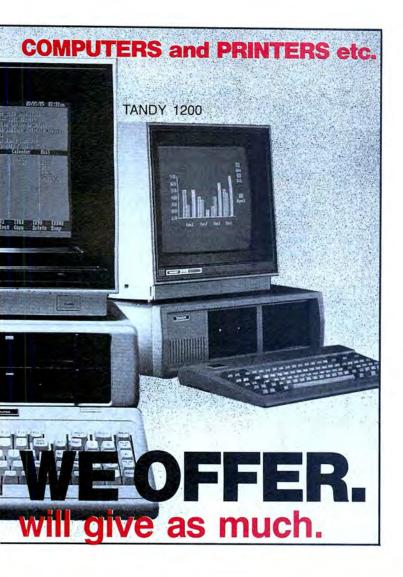
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The NOT operator is behind this paradox. Some languages (C, for example) have two NOT operators: one produces a logical negative and the other generates a bit-by-bit complement of an integer. In Basic, the NOT operator appears to be a logical negative, since it turns false values into true ones. It does so, however, only because of the bit patterns that make up the values for zero and -1.

In Basic, the NOT operator changes every bit in an integer into its opposite. False is composed of 16 bits of zero; true is composed of 16 bits of 1. Basic recognizes all nonzero values, including -1, as true. In the expression given above, if Key\$ is not contained in Special\$, then the value of the INSTR() function will be zero and the result of the expression NOT INSTR() will be the complement of zero, or -1.

On the other hand, if Key\$ is contained in Special\$, the result of the INSTR() function will be a number between one and the length of Special\$. The NOT of every positive integer is a negative integer, so NOT INSTR() produces a negative integer. Basic sees the negative integer as a nonzero (or true) value and therefore branches to the statement in the Then clause.

The moral of this is to be careful when using operators such as AND, OR, and NOT in logical expressions. All are really bit-wise Boolean operators. They do what you expect if you limit their operands to

#### Model I/III Modifications

Several examples on p. 44 of this article contain While. . . Wend statements, which Model I/III users must convert to If. . .Then statements. Also, Model I/III users must limit variable names to one or two characters.

The routine for reading a sequential file into array A\$ should appear as follows:

10 IF NOT EOF(1) THEN C = C + 1: LINE INPUT#1, A\$(C):GOTO 10

The routine that waits for legitimate user input should be coded like this:

10 OK = 0: OK\$ = "12345" 20 I\$ = INKEY\$:IF I\$ = " " THEN 20 30 OK = INSTR(OK\$,I\$) 40 IF NOT OK THEN 20

And the input routine for a phone number should look like this:

10 P\$ = " "
20 IF NOT FNV(P\$)THEN
display a prompt
:get input in P\$
:GOTO 20

—Beverly Woodbury 80 Micro Technical Editor

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#### On Your Own

At first, incorporating Basic's logic functions into everyday programs may require extra effort and thought. But if you keep at it and debug carefully to catch mistakes early, you'll eventually be able to program faster and move from Basic to other languages with less difficulty.

You'll also find that your finished programs require less debugging and the process will be easier. Logic functions are not a programmer's panacea, but they can help solve some difficult programming problems.

To test what you've learned about logic programming, I'll leave you with the puzzle in the Figure. See if you can determine the value of A in each of the expressions. Assume that all variables have been set to zero with a Clear command before each line.

I won't tell you the answers (your computer can do that for you), but you should see a pattern develop that will help you understand both this and other logic problems. ■

You can contact Hardin Brothers through CompuServe. GoPCS-117 to the Writers' and Editors' SIG (WESIG). Or write to Hardin at 280 N. Campus Ave., Upland, CA 91786. Enclose a stamped, self-addressed envelope for a reply.

Program Listing 1. Three functions to test whether you have three or four digits in a row .

```
DEF FN IS.DIGIT(X$) = (X$=>"0") AND (X$<="9")

DEF FN THREE.DIGITS(X$) = (LEN(X$)=3) AND
FN IS.DIGIT(LEFT$(X$,1)) AND
FN IS.DIGIT(MID$(X$,2,1)) AND
FN IS.DIGIT(KIGHT$(X$,1))

DEF FN FOUR.DIGITS(X$) = (LEN(X$)=4) AND
FN IS.DIGIT(LEFT$(X$,1)) AND
FN IS.DIGIT(MID$(X$,2,1)) AND
FN IS.DIGIT(MID$(X$,3,1)) AND
FN IS.DIGIT(MID$(X$,4,1))
```

End

#### Program Listing 2. Program to test for valid phone numbers.

```
10 DEFINT A - Z
30
                Phone number functions
40
45 ' Test for one digit
50 DEF FN IS.DIGIT(X$) = (X$=>"0") AND (X$<="9")
Test for 3 consecutive digits

ODEF PN THREE.DIGITS(X$) = (LEN(X$) = 3) AND

FN IS.DIGIT(LEFT$(X$,1)) AND FN IS.DIGIT(MID$(X$,2,1)) AND
             FN IS.DIGIT(RIGHT$(X$,1))
65 ' Test for 4 consecutive digits
70 DEF PN FOUR.DIGITS(X$) = (LEN(X$) = 4) AND
PN IS.DIGIT(LEFTS(X$,1)) AND FN IS.DIGIT(MID$(X$,2,1)) AND
             FN IS.DIGIT(MID$(X$,3,1)) AND FN IS.DIGIT(MID$(X$,4,1))
73 1
75 ' Test for format: 555-1234
80 DEF FN VALID.PHONEI(X$) = (LEN(X$) = 8) AND
FN THREE.DIGITS(LEET$(X$,3)) AND (MID$(X$,4,1) = "-") AND
FN FOUR.DIGITS(RIGHT$(X$,4))
83 !
            Test for format: 800-555-1234 PN VALID.PHONE2(X$) = (LEN(X$) = 12) AND FN THREE.DIGITS(LEFT$(X$,3)) AND (MID$(X$,4,1) = "-") AND FN THREE.DIGITS(MID$(X$,5,3)) AND (MID$(X$,8,1) = "-") AND FN FOUR.DIGITS(RIGHT$(X$,4))
90 DEF
103 !
105 ' Test for any valid format
110 DEF FN VALID.PHONE(X$) = FN VALID.PHONE1(X$) OR
FN VALID.PHONE2(X$) OR FN VALID.PHONE3(X$)
990 '
                Test loop for phone functions
NOTE: If Basic reports an err
991 '
                          If Basic reports an error in one of the following lines, the error may actually be in one of the
                           above functions.
994 1
1000 CLS
1000 CLS
1010 PHONE$ = ""
1020 WHILE PHONE$ <> "END"
1030 INPUT "Type in a phone number to test ==> ", PHONE$
1040 IF FN VALID.PHONE(PHONE$) THEN PRINT "VALID" ELSE PRINT "INVALID"
```

End

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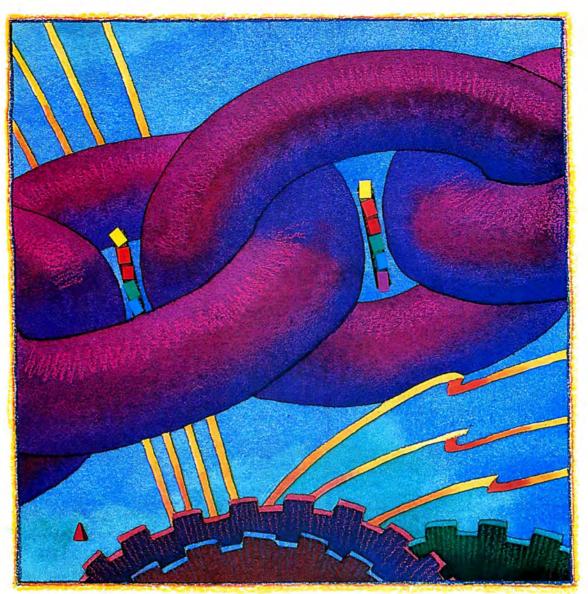
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by Bruce Tonkin

f you program on a Model 4 or one of Tandy's MS-DOS computers, you probably feel cramped in the skimpy space Basic allows for your programs. On an MS-DOS machine with 640K of memory, you'd expect to have more than 60K for your programs. If you use a 64K Model 4 or a 128K Model 1000, you're likely to have less than 30K. What happened to the good old days when Basic took up only 8K?

Life would be much easier and your programs better documented if you had more elbow room. It would be nice, for instance, if you didn't have to worry about the space remarks take up. The more remarks, the easier a program is to debug or enhance six months later. For the same reason, it would help to have long, descriptive variable names and error messages that make sense. It would be even better to write an application as one enormous program composed of many modules.

But if you're like most programmers, you're convinced you can't do these things: there's just not enough memory. So, you write programs with tiny error messages, or none at all. You remove all remarks or put (Your separate file, of course, is never up- ≧ to-date. If you make the idle mistake of renumbering the original program, your documentation turns into garbage.)

#### Give your Basic programs more structure—and more room with this round-trip chaining technique.

You might also use compression routines to squeeze air out of your programs. The result is generally unreadable, sometimes unprintable, and often unlistable. When it crashes, the disaster is completely unmanageable.

You might use cross-reference programs to look for variable names and replace every long one with a single letter. You trace the program to see which variables are needed where, eliminate new ones when possible, and reuse the old ones. This makes for new disasters when you run the result. But you may save as many as a hundred bytes!

In short, the programs you write are typical microcomputer Basic programs: difficult to maintain, hard to debug, and limited in features by available memory. Structurally, they resemble a pile of jackstraws held together with string, paste, and spit.

Just as garlic oil is supposed to repel vampires, so computer science instructors believe a little oil of Pascal will repel programs like this. Fortunately, there's a better solution.

#### Chain Gang

If you use the Microsoft Basic that comes with all Tandy MS-DOS computers, the Model 4, and with CP/M, you may be familiar with the Chain command. The purpose of the command is simple: it allows you to run another program, saving variables in memory. Files remain open for use in the program to which you've chained. All you stand to lose are user-defined functions and type definitions (unless you use the Merge option). The syntax of the Chain command is:

#### CHAIN file name [,line][,ALL]

The file name can be any legal Basic program name. (For use under the interpreter, however, the program chained to must not be saved as an ASCII text file unless you use the Merge option.) The optional line number can be a variable, and the line chained to must exist in the program to which you are chaining. The All parameter specifies that all variables will be retained.

Like subroutines, chaining gives programs structure and makes them easier to debug. If you've tried chaining, however, you know it is different from running a subroutine in at least one important respect: once you've chained from the main program to another, you can't truly return without using the Merge command. Merges let you overlay the lines of the chained program on the main program, maintaining user-defined functions and type definitions. There are penalties involved, however; you must reserve certain line numbers throughout your programs, your program must be saved as an ASCII text file, and you can't compile.

But though Basic has no Chain return, there is a way to create one. The secret lies in the Chain statement itself: the fact that the line number can be a variable means you can save it, compute it, or massage it in a number of interesting ways.

Let's say you were somehow able to save the current line number and program name. You could then chain to a subprogram and return to that line number or one before or after. By subprogram, I mean one that runs under the control of the main program while existing separately on disk or in memory. It functions much like a subroutine, except that it has all of your Basic memory space available to it.

All that prevents you from chaining to a subprogram is a means of saving and using the current line number. I know of only one way to determine the current line number in Basic: force an error with the Error command. This works regardless of how the program is later renumbered. The Basic interpreter saves the current line number and the current error code in the special reserved variables ERL and ERR. You can save these and use them to control how and where to chain.

Program Listing 1 shows how sample code might look in the main program (listings begin on p. 51). X% is the number of an available file buffer and Current% is a flag variable. The name of the current program (up to 14 characters in length) is saved in the variable Program.Name\$. The name of the subprogram to execute is saved in the variable Go.Program\$. The variable XX holds the current line number.

The subroutine uses PN\$ and LN\$ to save the name of the current program and the name of the line number to execute. These values are saved in the file called TEMP. The line number is saved as a single-precision value, since program lines can exceed 32767.

The subprogram begins executing at line 10, as you can see in line 50060. To return, you'd execute code similar to that in Program Listing 2. The subprogram returns to the same line of the main program that was last executed (before the routine at line 50000). In this example, the program returns to line 10010. However, the subprogram has changed the value of the variable Current% to zero. That means line 10020 will execute, since the conditional If in line 10010 of the main program no longer tests true.

In effect, the chaining program creates a "stack" on the disk, which saves the name of the program that originated the subprogram call and the line number to which program control should transfer. You can manipulate the stack and alter the record length in various ways. On MS-DOS machines, you may want to use more than 14 characters to save the complete

name of the Basic program. MS-DOS names may include a path specification of almost arbitrary length. (In practice, even under MS-DOS, a path specification length of 25 or 30 characters should be adequate.) You may also use a variable to indicate which line number to chain to in the subprogram.

Program Listings 3 and 4 are sample programs that you should be able to run on your computer. Listing 3 contains a main program, ThisCode.BAS. Listing 4 contains a subprogram saved as ThatCode.BAS. (Model 4 file names would be written with a slash instead of a period before the extension.) I've changed the number of the file buffer from 4 to 1 and added a small amount of executable code so you can watch the program execute.

You may be surprised to see just how rapidly these programs run. If you don't care about power outages, you can usually put one or more of the programs on a RAM disk for even greater speed. Overall, the performance penalty is probably far less than you'd expect.

#### **Basic Advantages**

The chaining technique I've described offers numerous advantages. Here is a partial list:

- All programs and subprograms are reentrant. A program can chain to itself at any line.
- You can name chained-to programs by function; in effect, you're able to replace line numbers with labels up to 11 characters long.
- You can save commonly performed functions as modules and use them with many programs.
- You can alter the normal return sequence under program control. Unlike a normal GOSUB/Return, which can't be abnormally exited without leaving unnecessary values on the stack, this technique places the stack under the programmer's control.
- You can save variables in another disk file. The current program state (line executing and program name) can be saved at the top of the stack at any point. Therefore, you can halt a program and resume at another time.

If all programs are controlled through a master program, a minor modification allows the master program to determine which program was last executing. Thus a self-booting disk could resume processing without loss of data if you were to lose power while a program is executing.

#### System Requirements

Model 4, 1000, 1200, 2000, 3000, or CP/M-based computer Basic • You can save variables selectively by using a Common statement and not using the All option in the Chain command. This allows you to have local and global variables in the subprograms. Variables placed in a Common statement will be global; those not placed in a Common statement will be local. Even without using the disk file to save the program name, a program could chain to itself at any point and wipe out variables no longer needed. Under the compiler, chaining with a Common statement is necessary because the All option is not supported.

 The technique does not work well with poorly structured code, sometimes called spaghetti code. Thus, it forces you into the good habit of writing modular programs.

Even if the subprogram contains many modules, you can use self-explanatory variable names and values to simplify debugging and make program functions more clear. You might, for example, write something like the code in Program Listing 5. By controlling the line number at which the subprogram is entered, line 10010 precisely describes the action anticipated in the subprogram. The general subroutine is the same as in Listing 1, except for line 50060, which now directs control to the line specified by the variable Action Code.

Chaining eliminates virtually all mem-

ory limitations due to program size. If you use large arrays, you may still be limited by memory, but any reasonably modular program can be run, given sufficient disk space. You can use as many remarks as you like and variable names of whatever length you like. You will not need to compress programs. Contrast this with a typical microcomputer Basic program!

Bruce Tonkin's column, The Art of Programming, debuted in the May issue of 80 Micro. You can reach Bruce at 34069 Hainesville Road, Round Lake, IL 60073 312-223-8595.

Listings start on p. 51

## Yes, but...

All programming techniques have shortcomings, and chaining is no exception. Even so, many of the disadvantages you'll encounter with chaining are easy to overcome. And the overall benefits outweigh the small extra effort you'll put in to make the technique work well.

Following are some common questions, comments, and concerns about the chaining technique and my responses.

With chaining, won't you have a far more difficult job of cross-referencing an entire program and controlling all variables used?

This may be true, but you'll be able to control all the variables used in each module. That's more important, especially when you have many modules shared among a number of programs. In time, you'll develop a standardized set of variable names for equivalent purposes in all your programs.

Doesn't chaining make programs run more slowly?

Which would you rather have: a program that runs slowly, or one that doesn't run at all? Besides, "slowly" is a state of mind. If your modules are about the right size, it will take only several seconds to chain from one to another. It's likely that it will take far more time to execute the code in the module than it will to chain from module to module. With planning, you can minimize the difference in running times between modular programs and equivalent ones that don't use chaining.

Since one file buffer must always be reserved for controlling the disk "stack" allocation, won't you lose a file buffer? The extra buffer is lost only briefly while it is being used. The only real penalty is that the particular buffer used to control the stack must not be used for another file when it is needed to control the stack.

If you want to increase the speed of moving from one program to another, you can leave the file buffer open at all times; this puts more restrictions on all the programs and subprograms, however. For one thing, you won't be able to write unconditional Close statements.

Also, it doesn't really matter which file buffer is open for use: it might be buffer number 1 one time, and buffer number 2 another. One way to lessen the penalty is to write the routine so that it uses the first available buffer instead of a fixed one. The Program Listing contains some sample code using this method. Lines 50010–50030 form a loop. The variable X% is incremented until line 50020 executes successfully or until X% becomes too large.

The only real problem with this method is that too few file buffers or a

bad file name will make the routine "fall off the end." In the sample code I've given, I made the program print the message "Darn it!" when this happens.

Won't you lose your defined functions when you return from the subprogram?

Yes, but all you need to do is put the user-defined functions in a block at the beginning of each program or subprogram. Make these definitions occur as a subroutine, and call them whenever you return from the subprogram or enter a subprogram for the first time.

This method makes your program more modular and more compatible with the IBM or Microsoft Basic compiler. The compiler doesn't recognize function or type definitions until it encounters them in the program. If you try to compile a program for which a user-defined function appears before it is defined in the source code, you'll get an error. Putting all functions at the beginning ensures that this will never happen.

-Bruce Tonkin

#### Program Listing. Routine to use first available buffer.

```
10000 CURRENT%=1:PROGRAM.NAME$="THISCODE.BAS":ON ERROR GOTO 50000
10010 IF CURRENT% THEN GO.PROGRAM$="THATCODE.BAS":ERROR 255 10020 'More executable code appears here.

.
50000 X*=1:XX=ERL:RESUME 50010
50010 ON ERROR GOTO 50030
50020 OPEN"R",X*,"TEMP",18:GOTO 50040
50030 X*=X*+1:IF X*(15 THEN RESUME 50010:ELSE PRINT"Darn it!":END
50040 FIELD X*,14 AS PN*,4 AS LN*,
50050 GET X*,1:REC=VAL(PN*):IF REC=0 THEN REC=1
50060 REC=REC+1:LSET PN$=STRS(REC):PUT X*,1
50070 LSET PN$=PROGRAM.NAME$:LSET LN*=MKS$(XX):PUT X*,REC:CLOSE X*, 50080 CHAIN GO.PROGRAM$,10,ALL
```

End

#### Program Listing 1. Sample main program code.

```
10000 X%=4:CURRENT%=1:PROGRAM.NAME$="THISCODE.BAS":ON ERROR
GOTO 50000

10010 IF CURRENT% THEN GO.PROGRAMS="THATCODE.BAS":ERROR 255
10020 'More code follows; will be executed following the
return
50000 XX=ERL:RESUME 50010
50010 OPEN"R", X%, "TEMP", 18
50020 FIELD X%, 14 AS PN$, 4 AS LN$
50030 GET X%, 1:REC=VAL(PN$):IF REC=0 THEN REC=1
50040 REC=REC+1:LSET PN$=STR$(REC):PUT X%,1
50050 LSET PN$=PROGRAM.NAME$:LSET LN$=MKS$(XX):PUT
    REC: CLOSE X%
50060 CHAIN GO. PROGRAMS, 10, ALL
```

End

#### Program Listing 2. Sample code to return from the subprogram.

```
10000 X%=4:CURRENT%=0
10010 OPEN"R",X%,"TEMP",18
10020 FIELD X%,14 AS PN$,4 AS LN$
10030 GET X%,1:REC=VAL(PN$):REC=REC-1:LSET PN$=STR$(REC):PUT
10040 GET X%, REC+1:XX=CVS(LN$):PN$=PN$+"":CLOSE X%
10050 CHAIN PN$, XX, ALL
```

End

#### Program Listing 3. ThisCode.BAS.

```
10000 X%=1:CURRENT%=1:PROGRAM.NAME$="THISCODE.BAS":ON ERROR
GOTO 50000

10010 IF CURRENT* THEN GO.PROGRAMS="THATCODE.BAS":ERROR 255
10020 COUNT=COUNT+1
10030 PRINT"Returned from subprogram; loop execution
number";COUNT
number"; COUNT
10040 GOTO 10000
50000 XX=ERL:RESUME 50010
50010 OPEN"R", X%, "TEMP", 18
50020 FIELD X%, 14 AS PN$, 4 AS LN$
50030 GET X%, 11 REC=VAL (PN$): IF REC=0 THEN REC=1
50040 REC=REC+1: LSET PN$=STR$ (REC): PUT X%, 1
50050 LSET PN$=PROGRAM.NAME$: LSET LN$=MKS$ (XX): PUT
 X%, REC: CLOSE X%
50060 CHAIN GO. PROGRAM$, 10, ALL
```

End

#### Program Listing 4. ThatCode.BAS.

```
10 PRINT"Now in the subprogram."
10000 X%=1:CURRENT%=0
10010 OPEN"R",X%,"TEMP",18
10020 FIELD X%,14 AS PN$,4 AS LN$
10030 GET X%,1:REC=VAL(PN$):REC=REC-1:LSET PN$=STR$(REC):PUT
10040 GET X%, REC+1:XX=CVS(LN$):PN$=PN$+"":CLOSE X%
10050 CHAIN PN$, XX, ALL
```

End

#### Program Listing 5. Sample code using self-explanatory variable names.

```
100 UPDATE.RECORD=10:DELETE.RECORD=1000:DISPLAY.RECORD=2000
10000 X%=4:CURRENT%=1:PROGRAM.NAME$="THISCODE.BAS":ON ERROR
10010 X=4:CURRENTS-1:FROGRAM NO. 10010
10010 ACTION.CODE=DISPLAY.RECORD
10020 IF CURRENTS THEN GO.PROGRAMS="THATCODE.BAS":ERROR 255
10030 'More code follows
50000 XX=ERL:RESUME 50010
50010 OPEN"R", X%, "TEMP", 18
50020 FIELD X%, 14 AS PN$, 4 AS LN$
50030 GET X%, 1:REC=VAL(PN$):IF REC=0 THEN REC=1
50040 REC=REC+1:LSET PN$=STR$(REC):PUT X*,1
50050 LSET PN$=PROGRAM.NAME$:LSET LN$=MKS$(XX):PUT
X%, REC:CLOSE X%
50060 CHAIN GO.PROGRAM$, ACTION.CODE, ALL
```

End

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## NTEZUNA

**PRESENTS** 

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#### Can we talk? CP/M vs TRSDOS

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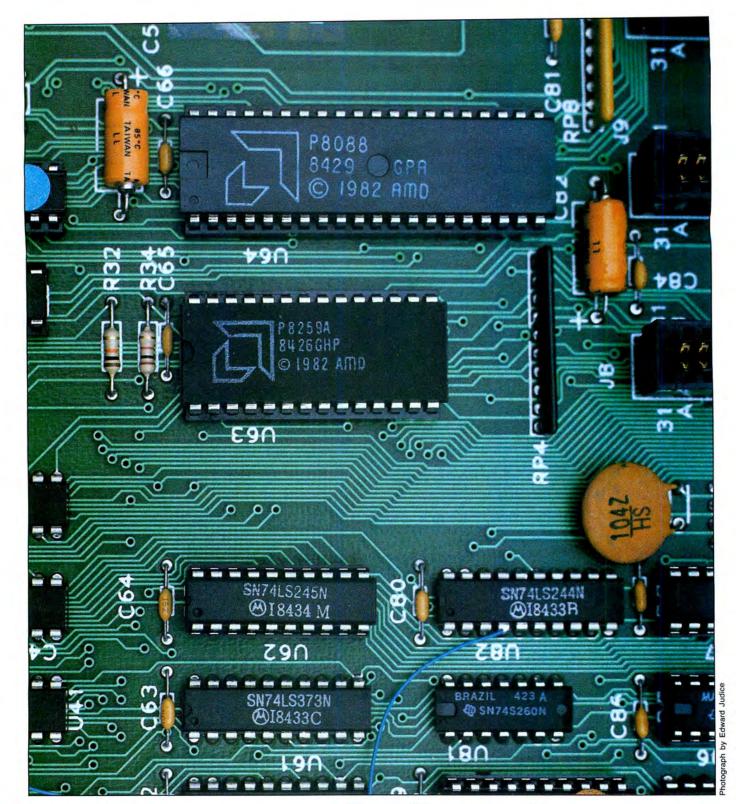
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## **Internal Affairs**

by Robert D. Covington

What you need to know about the 8088's architecture and machine-language instruction set.



But why learn another interpreted language, like C, Pascal, or Forth, when you could learn to program in machine language instead? Interpreted languages stand between you and your computer; machine language lets you communicate directly with your computer. It's the alphabet upon which all programming languages depend.

In this article, I'll help you get started with machine-language programming on an MS-DOS computer. I'll begin by introducing the architecture of Intel's 8088 microprocessor, the central-processing unit in the Tandy 1000 and 1200. Then, I'll cover a number of the instructions used to program the 8088. You'll need an understanding of terms like "bytes," "bits," and "memory." While I'll limit the discussion to the 8088, many of the concepts I'll discuss also apply to the 80186 and 80286 microprocessors.

#### **Memory Organization**

One of the most important functions of a CPU is transferring data to and from internal memory or external devices connected to it. In most cases, the CPU transfers data from one memory location to another. An 8-bit CPU like the Z80, 8085. or 6809 has a 16-bit address bus, which can address 65,535 (216) bytes of memory at a time. To access more than 64K of memory, 8-bit systems have a feature called bank switching, which allows the CPU to switch between two or more banks of memory. The Model 4 and Color Computer commonly use the ROM (read-only memory) that holds the Basic interpreter as a memory bank. When ROM is not in use, the CPU replaces its memory addresses with RAM (random-access memory).

Since a 16-bit CPU like the 8088 can address up to 1 megabyte (1,048,576 bytes) of RAM at a time, bank switching is not a usual feature. Instead, the CPU uses a 20-bit word to describe the address of each byte in the system's memory. The CPU's software derives the 20-bit address by converting two 16-bit values—one describing a 64K memory segment and the other describing an offset address inside the memory segment—to 20-bit numbers and then adding them. To convert the values to 20-bit numbers, the CPU adds 4 zero bits to the right of the segment value and 4 zero

#### System Requirements

Tandy 1000 or 1200

bits to the left of the offset value.

For example, suppose the segment value is 5678 hexadecimal (hex) and the offset value is 1234 hex. Adding 4 zero bits to the right of the segment value produces the 20-bit number 56780 hex. Adding 4 zero bits to the left of the offset value produces 01234 hex. Adding the two creates the 20-bit address 579B4 hex.

Though more complicated than standard linear memory addressing, memory segmentation has several advantages. Since the segment offset uses a 16-bit register, programs written for 8-bit machines with 16-bit address spaces can be made to run in one segment on the 8088. Also, if a program modifies only the segment offset when it operates, you can relocate the program to any 16-byte (24) boundary in the computer's memory by changing the initial segment value.

Machine-language programs typically hold the segment portion of the address constant, which means memory references in the current segment can be addressed with 16 bits instead of 20, generating more compact code. This is another important advantage.

The main disadvantage of memory segmentation is that the CPU can't easily address the entire 1 megabyte of available memory in a linear fashion. For it to address data that occupies more than 65,535 bytes, the program would have to modify both the segment and offset registers. This reduces the program's speed, since it has to calculate both the segment and offset values for an address. This is one reason why the creators of GW-Basic, Turbo Pascal, and many text editors limited the amount of data the programs can access to less than 64K.

#### 8088 Registers

In addition to the 1 megabyte of memory it can address, the 8088 contains 28 bytes of RAM divided into 14 named registers (see Table 1). Registers can be addressed faster than normal memory because they are stored internally in the CPU.

Each register is 16 bits wide. The AX, BX, CX, and DX registers can be divided into eight 8-bit registers: AH, AL, BH, BL, CH, CL, DH, and DL. (The letters "H" and "L" indicate the high and low bytes in the register.)

Though most registers are used for holding and manipulating data, each also has specific functions that it can perform in machine-language programs. The AX register, also called the accumulator, holds operands for math and logic functions. It may also be the source or destination of data moved between memory and input and output (I/O) ports.

The BX, BP, SI, and DI registers address data in the system's memory. I'll describe these registers in more detail later.

CX is the counter register for loops. The CPU decrements this register after each execution of a looping instruction. When the register is equal to zero, the loop falls through. In Basic, you would write the

code for this type of loop as follows:

FOR CX = 50 TO 1 STEP - 1:NEXT CX

The CPU may use the DX register for addressing I/O ports, but as port I/O is not common in machine-language programs, the register is usually reserved for storing data.

The registers discussed so far can be used either for their specific function or for storing and manipulating data. The following registers are not as flexible; they perform only their specific system functions.

The IP (sometimes called PC) register is a program counter. It works in conjunction with the CS (code segment) register to create a 20-bit address that points to the program instruction currently executing. When the contents of the IP register change, the program starts executing at the new address specified by the register. Since the IP register is only 16 bits wide, you have to change the CS segment register to access data beyond its 65,536-byte range.

The SP and SS registers also work in conjunction to point to the general-purpose data area called the stack. Applications programs save the contents of a register or memory address temporarily in the stack. The CPU also uses it to store important return execution points. I'll describe the stack in more detail later.

The status register indicates the status of the processor after it executes certain operations. The 8088 uses nine status bits or flags for this purpose (see Table 2).

CS, DS, SS, and ES are the four segment registers; they indicate the location of the 64K memory segment. The DS and ES registers, respectively, provide the segment portion for addressing program data. Having two segments makes it easy to work with two groups of data at the same time (when comparing strings, for example). The code, stack, data, and extra data segments can occupy the same, overlapping, contiguous, or separate areas.

#### Moving Data

Now that you are familiar with the 8088's architecture, you can begin experimenting with the microprocessor's machine-language instruction set. Let's start with the simplest and most common instruction: MOV.

The MOV instruction moves data from one area of memory to another. The syntax in Assembly language is:

MOV destination.source

where the destination and source may be registers, data, the contents of a memory address, or a mem/reg. A mem/reg is the 8088's global-addressing mode.

The simplest application of a MOV instruction is for moving data into a register. This is sometimes called "immediate" addressing. For example, the instruction:

MOV DX,32767

moves the value 32767 into the DX register.

A slightly more complex application is for moving data between the accumulator (either the AX or AL register) and the contents of a memory address. If you use the AL register, you can transfer only 8 bits of data; if you use the AX register, you can transfer 16 bits.

A memory address, remember, has two parts: the 16-bit segment offset and a 16-bit segment register. You must specify the 16-bit offset in the MOV instruction, enclosing it in brackets to signify that it is a memory address, not an immediate value to load into the accumulator.

In most cases, the CPU defaults to the 16-bit segment register DS to calculate the 20-bit address of the move. It then adds the segment register value and the segment offset value to create the 20-bit address. Let's say, for example, that the DS segment register value is 5678 hex. In this case, the instruction:

#### MOV AX,[1234H]

loads the AX register with the 16-bit value stored at 579B4 hex (56780 hex + 01234 hex = 579B4 hex).

If, for some reason, you don't want to use the DS register as the segment register, you can change the default with the SEG (segment override) instruction. For example:

#### SEGES MOVAX,[1234H]

loads the AX register with the combined address, calculated by adding the 16-bit value in the ES register and the value 1234 hex. The segment override option works only with the DS, ES, CS, and SS segment registers.

When assembling a program with either the IBM or Microsoft macro assembler, you must type in a segment register followed by a colon before the memory descriptor in brackets. For example, with the Microsoft compiler, or any of its compatibles, the segment override I just gave would be coded:

#### MOV AX,ES:[1234H]

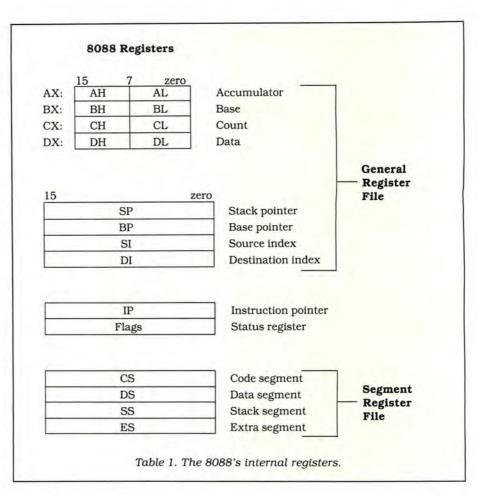
The most complex applications of the MOV instruction incorporate the 8088's global-addressing mode, traditionally called a mem/reg. A mem/reg instruction usually holds two parts: the source and the destination of an operation. The simplest data that a mem/reg instruction can describe as a source or destination is a register. If the operation uses 16-bit numbers, the available registers are AX, BX, CX, DX, SP, BP, SI, or DI. For 8-bit operations, the available registers are AL, BL, CL, DL, AH, BH, CH, or DH.

A mem/reg instruction can also describe the contents of a memory location. In this mode, you must enclose the address with brackets. For example, the instruction:

#### MOV BX,[1234H]

loads the 16-bit word at 1234 hex in the current data segment into the BX register.

In other modes, a mem/reg instruction can address the contents of a memory location by referencing the contents of the BX, BP, SI, or DI register with or without



Flag name	Status bit	Function
Carry	С	Indicates if there is a carry bit from bit 7 in an addition or a borrow bit in a subtraction. CMP and SUB set this flag if the second parameter of the comparison is greater than the first.
Parity	P	Indicates when the number of set bits in the des- tination of a logical operation is equal to an even number (even parity).
Half carry or Auxiliary carr	A	Indicates when there is a carry from bit 3. Usually used in BCD math or nibble operations.
Zero	Z	Indicates when the result of an arithmetic or logic instruction is equal to zero. CMP sets this flag when two items being compared are equal.
Sign	S	Indicates the current condition of the most significant bit used in the operation (bit 7 for bytes, bit 15 for words). In numerical data standards, the most significant usually reflects the sign of the number.
Trap	Т	When set, the 8088 performs an INT 1 after each instruction. This "single-step interrupt" is used primarily for debugging machine-language programs.
Interrupt	I	Disables all maskable enable interrupts if reset.
Direction	D	Indicates if a string instruction should auto-decrement (set) or auto-increment (reset).
Overflow	0	Indicates when the result of the operation causes an overflow in a signed number.



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an 8-bit or 16-bit offset added. Generally, the syntax for this is:

[base register + index register + displacement] where BX or BP is the base register, SI or DI is the index register, and the displacement is an 8-bit or a 16-bit value. The displacement can assume a negative value, allowing a displacement to be subtracted from the other register. Because of this, 8-bit displacements can be in the range of -128 to 127 and 16-bit displacements in the range of -32768 to 32767. For example, the program:

MOVBX,124 MOVSI,76 MOVCX,[BX+SI+100] MOVDX,[BX+SI-100]

loads CX with the 16-bit number at location 300 in the current data segment and loads DX with the 16-bit number at location 100.

The 8088 also supports an abridged version of this addressing mode, which allows you to omit index registers from the address calculation. Some examples of this are:

MOVCX.[BX] MOVCX.[BP+1234] MOVCX.[SI+1234] MOVCX.[BP+SI] MOVCX.ES:[SI]

#### **Moving Strings**

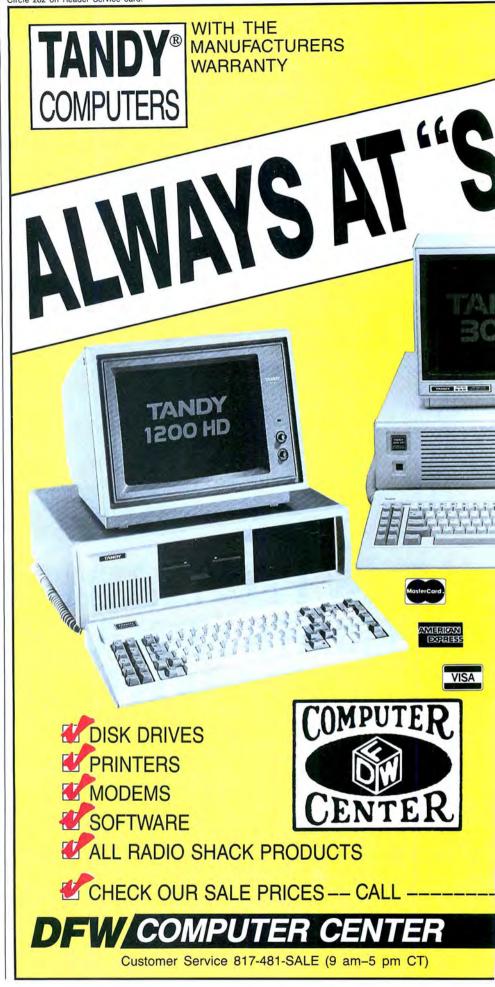
The 8088 supports five string-oriented instructions: MOVSx, LODSx, STOSx, SCASx, and CMPSx. I'll discuss only a few of these in this article.

In string instructions, the SI register points to the source offset address and DI points to the destination offset address. The offset in SI is referenced from the segment in the DS register. The offset in DI is referenced from the segment in the ES register.

When a string instruction executes, the CPU automatically increments or decrements the SI and/or DI registers. This allows the next instruction to access the next byte (or word) in the string. To set auto-increment mode, you must reset the D (direction) status flag by executing a CLD instruction. To set auto-decrement mode, use the STD instruction to set the direction flag. The CPU double-increments or double-decrements the SI and/or DI registers if the operation is a 16-bit word.

The string-movement instruction MOVSx moves the data pointed to by DS and SI to the address pointed to by SS and DI. If the operation transfers a byte (8-bit), then replace the x variable with a B (MOVESB). If it transfers a word (16-bit), replace the x variable with a W (MOVSW). For example, the program:

CLD PUSH DS POP ES MOVSI,0 MOVDI,100 MOVSW





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moves the word pointed to by the register pair DS and SI to the word pointed to by ES and DI. In this example, ES and DS are the same segment. The CPU double-increments (SI = 2, DI = 102) the SI and DI registers so that the next 2 bytes will transfer when you execute another MOVSW.

To make MOVSx and other string-based instructions more useful, the 8088 supports a repeat (REP) option, which causes the instruction to continue executing until the CX register is equal to zero. With each repetition of the string instruction, the CPU increments or decrements the index registers and decrements the CX register by 1. The program:

CLD MOVCX,50 MOVSI,0 MOVDI,100 REPMOVSW

copies the memory from zero to 100 in the DS segment to the memory from 100–200 in the ES segment.

You can terminate the repeat option by setting or resetting the zero flag with REPZ and REPNZ, respectively. These instructions are generally used only in string comparisons (CMPS and SCAS).

The instructions LODSx and STOSx move data between the accumulator and memory. LODSB and LODSW move the byte or word pointed to by DS:SI into AL or AX: STOSB and STOSW load the AL or AX register into the memory pointed to by ES:DI. You might use these instructions to manipulate data—for example, to convert a string to uppercase—between transfers. Because of the processing, these instructions are rarely used with the repeat option.

#### Stack-based Moves

In addition to its ability to move data between memory and its registers, the 8088 can access an area of memory called the stack. The stack is a last-in, first-out (LIFO) buffer that temporarily stores data used by the processor or a machine-language program.

You might think of the stack as a box that holds many sheets of paper. As you look down at the box, only the top sheet is visible. When you stack paper in the box, the last sheet you put in will be the first you can later take out. To get at a sheet of paper in the middle of the stack, you must first remove all of the sheets on top.

Instead of paper, the 8088's stack is filled with 16-bit values. The 8088 stores the address of the last entry in the stack in the two 16-bit registers SS and SP. When a new 16-bit value enters the stack, the stack pointer (the SP register) is decremented twice (once for each byte) to keep pointing to the top of the stack. To simplify this task, the 8088 supports the PUSH and PUSHF instructions, which save 16-bit values on the stack. The syn-

tax of the PUSH instruction is simply: PUSH source

where the source can be either a register (PUSHAX, for example) or a mem/reg (PUSH[BX], for example).

The PUSHF instruction saves the current status register status on the stack. As there is only one status register, the PUSHF instruction has no arguments.

For retrieving information from the stack, the 8088 has two complementary instructions: POP and POPF. The syntax of a POP instruction is:

#### POP destination

where the destination may be either a register or a mem/reg. A POP instruction loads the 16-bit value pointed to by the SS and SP registers into the register or mem/reg specified and then increments the SP register twice.

Interestingly, PUSHes and POPs do not store the register names along with the data. This means you can push a register onto the stack and then pop the value into another register. For example, to load the flags register into the accumulator, you could perform the following operation:

PUSHF

When using these instructions, you must make sure to manage the stack properly. You can have only one PUSH for every POP in your machine-language program; otherwise, the stack may become unbalanced, resulting in erroneous data from a POP or, in some cases, a system crash.

You must also be careful not to overwrite the stack by pushing more data into it than it can store. Though the 8088's stack can store as many as 32,767 16-bit values (64K), most programs start the stack pointer at a few thousand bytes.

The stack used by MS-DOS, for example, generally can store no more than 200–300 16-bit values. In most applications programs, you can store 50–100 16-bit values on the DOS stack without running into problems.

You can create a larger stack by reserving more memory for it in your machinelanguage program. Be sure, however, to write the address of your program's stack in the SS and SP registers if you decide to do this.

#### **Math Functions**

Though moving data is an important function, processing and manipulating information is the microprocessor's primary job. The 8088 supports an extensive set of arithmetic and logic-based instructions. The four most common are ADD, SUB, MUL, and DIV.

The syntax for ADD and SUB is:

Operation destination, source

where the source is an immediate value or a mem/reg and the destination is an accumulator or a mem/reg. The 8088 supports both 8- and 16-bit math operations, depending on the precision of the source and destination.

The 8088 performs the math on the source and destination data and places the result in the destination operand. For example, the program:

MOV AX,1000 ADD AX,500

produces the sum 1500 in the AX register.

INC (increment) and DEC (decrement) are two additional types of add and subtract instructions supported by the 8088. INC increments the operand by 1; DEC decrements the operand by 1. Each instruction has only one operand, which can be a register or a mem/reg. Examples of legal INC and DEC instructions are:

INC AX INC [2333] DEC [BX]

ADC and SBC are add and subtract functions that include the carry flag. The instructions add/subtract the source, destination, and carry flag, and place the result in the destination operand. For example, if the carry flag were set, the program:

MOV AX,1000 ADC AX,1

would place the value 1002 in the AX register.

After each math operation (except for INC and DEC) the 8088 automatically updates the math-oriented flags in the status register (C,P,A,Z,S, and O). The INC and DEC instructions update all status flags, except for the carry (C) flag.

Many times you may want to check the

status bits of a math operation without changing any of the data. To find out if the AX register is equal to 1234, you could execute a SUB AX,1234 and check if the zero (Z) flag is set. If it is, you know that AX is equal to 1234, since it's the only number that will produce a zero when subtracted from 1234.

The only problem with SUB AX is that it destroys the original contents of the AX register. One way to prevent this is to push the AX register, subtract the number, and pop the AX register.

An easier method is to use the CMP (compare) instruction, which compares the operations by subtracting the two numbers and setting the status flags. Unlike SUB, CMP does not modify the original contents of the compared items.

The 8088 supports both signed and unsigned multiplication and division with the MUL and DIV instructions, which multiply/divide a mem/reg operand to the accumulator. An 8-bit multiplication places the result in the AX register. A 16-bit multiplication places the result in the 32-bit integer generated by combining the AX register with the most significant 16 bits in the DX register.

An 8-bit division places the quotient in the AL register and the remainder in the AH register. Likewise, a 16-bit division places the quotient in the AX register and the remainder in the DX register. The following are examples of legal MUL and DIV instructions:

> MOV AL,2 MOV BL,5 MUL BL DIV BL

The IMUL and IDIV instructions multi-

Instruction	Condition to jump on	Required flag status
JA	Jump if above	C and Z flag reset
JAE or JNC	Jump if above or equal	C flag reset
JB or JC	Jump if below	C flag set
JBE	Jump if below or equal	C flag or Z flag set
JCXZ	Jump if CX register = 0	The state of the s
JE or JZ	Jump if equal	Z flag set

Table 3. Unsigned conditional jumps.

Instruction	Condition to jump on	Required flag status
JG	Jump if greater than	Z flag reset and S flag equals O flag
JGE	Jump if greater than or equal	S flag equals O flag
JL	Jump if less than	S flag does not equal O flag
JLE	Jump if less than or equal	Z flag set and S flag does not equal O flag

ply/divide signed integers and handle overflows into the 15th bit. On the 8088, the most significant bit (7 or 15) contains the sign of the value (reset is a positive integer, set is a negative integer). Signed integers can thus represent 8-bit numbers from -128 through +127 and 16-bit numbers from -32768 to +32767. IMUL and IDIV have the same operand configuration and exit conditions as the MUL and DIV instructions.

#### **Logic Functions**

AND, OR, XOR, and NOT are logic instructions that operate like their Basic counterparts. The syntax of all four is:

Operation destination, source

where the source is an immediate value or a mem/reg and the destination is an accumulator or a mem/reg. Like math operations, logic operations place results in the destination operand. Examples of legal logic instructions are:

> OR AX,1234 AND BL.[1234] XOR BX,345H

These instructions set the P, Z, and S flags in the status register to their proper values; the C and O flags are reset after each instruction executes.

You can use the TEST instruction in-

stead of AND to modify status flags without changing data, just as you can use CMP insead of SUB. TEST has the same entry/exit conditions and the same parameters as AND.

#### Absolute Jumps

The 8088 supports a family of JMP (jump) instructions for controlling program flow. In machine-language programs, jumps are either absolute or conditional. An absolute jump changes a program's flow to another address whenever the instruction executes. This type is the same as Basic's GOTO instruction, except that it uses memory addresses instead of line numbers to specify where a program should begin reexecuting.

The syntax for an absolute jump is:

JMP address

where the address can be a value or a mem/reg. Absolute jumps can be intersegment, intrasegment, or short. (Most assemblers automatically determine which type of jump to use if you jump to an address inside a machine-language program and you use a label.)

With an intersegment jump (sometimes called a long jump), a program can begin reexecuting at any address in the system's memory. The location has a 32-

bit address descriptor, which is defined by merging the CS segment register and the IP offset register.

With an intrasegment jump (sometimes called a near jump), a program begins reexecuting at any address in the current segment. The address descriptor is 16 bits wide so that the IP register can be changed to any address in the segment. Instead of loading the address descriptor into the IP register, however, the CPU adds it, making it possible for a program to jump to a section of code relative to the current location. This means that no matter where you load the program in memory, it can execute the same JMP instruction. Unlike a long jump, a near jump is relocatable.

A short jump is also relative to the current address, but it uses 1 byte instead of 2 to describe the address location. With a short jump, programs can begin reexecuting ± 128 bytes from the byte after the instruction.

CALL and RET are two additional absolute jumps supported by the 8088. Like Basic's GOSUB and Return instructions, they permit the use of large subroutine libraries inside machine-language programs.

CALL is the same as JMP except that it saves the 32-bit address descriptor (CS:PC) of the next instruction on the stack. An intrasegment call saves only the

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16-bit offset of the next instruction in the current segment. A return (RET) pops a 16- or 32-bit value off the stack and jumps to it. This instruction can be used with both intersegment and intrasegment calls. Some assemblers use the instruction RETF to designate an intersegment return and RET to designate an intrasegment one; others are supposedly smart enough to know which type you need. I advise consulting your assembler's manual to find out how it supports RET instructions.

INT is a special instruction that performs an intersegment call to an address specified in a lookup table in the first 1,024 bytes of the computer's memory. This table contains 256 32-bit addresses for subroutines in the system's memory. The parameter following INT can be a number from zero to 255 specifying which 32-bit entry you want to call.

INT is actually a forced interrupt, which performs a few other functions in the process of the call. Most newcomers to machine language use the instruction for accessing MS-DOS functions. For this purpose, it is equivalent to an intersegment call.

#### **Conditional Jumps**

Absolute jumps undoubtedly have their uses. Conditional jumps, however, add decision-making capability based on the condition indicated by the flags in the status register. For example, the program:

MOV AX,20 LOOP INC AX CMP AX,30 JC LOOP

causes the computer to loop nine times and then resume execution after the JC LOOP instruction. Table 3 lists the conditional jumps supported by the 8088 for unsigned values. Table 4 lists the conditional jumps supported for signed values.

All conditional jumps compensate for values that use the high-order bit for the sign of the number. Thus, if you compared –1 (65,535 unsigned) to 1 (1 unsigned), the JL instruction would cause a jump to the specified address, since –1 is less than 1. The jump would not execute if you used JB, since the computer reads the –1 as 65,535. Short address descriptors are the only limitation of conditional jumps. You have to use an additional near or long JMP instruction to jump nearer/farther than 128 bytes from the original instruction.

Three other conditional jumps—LOOP, LOOPZ, and LOOPNZ—emulate Basic's For...Next loop. These instructions decrement the CX register and jump to an address only if CX is greater than zero. (The LOOP instruction does not change the sta-

tus registers when it checks to see if CX is zero.) LOOPZ and LOOPNZ (sometimes referred to as LOOPE and LOOPNE) decrement CX and jump only if CX is greater than zero and if the Z flag is set or reset.

The following is an example of a legal LOOP instruction:

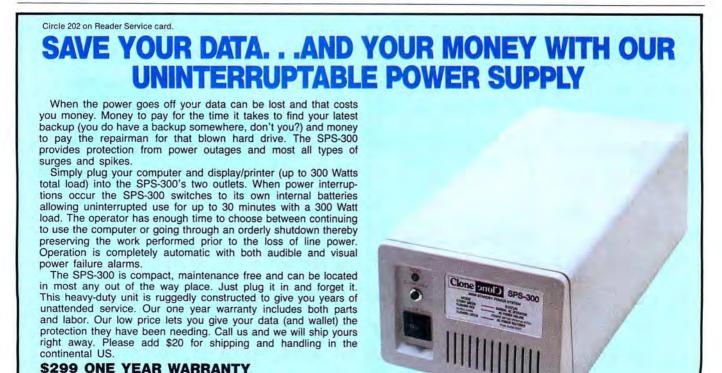
AXINC INC AX LOOP AXINC

When assembled and executed, this program increments the AX register by 30 and makes the CX register equal to zero.

#### **Parting Words**

The 8088 supports a number of instructions in addition to those described in this article. I suggest skimming the entire 8088 instruction set in your assembler manual before striking out on your own. Once you master the concepts and instructions I have covered, however, you'll be able to start writing your own machine-language programs.

Robert D. Covington is a technical consultant with the Regional Consortium of Educational Technology in St. Louis. You can reach him at P.O. Box 3007, St. Louis, MO 63146.



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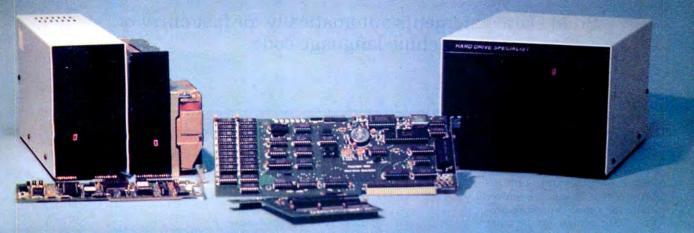
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## Have a Nice Data

Build Data statements automatically for fast entry of machine-language code.

The average Basic programmer reacts to machine language the way most of us do to cod liver oil. Everyone knows it's powerful stuff, but few find it easy to take. The standard methods for entering machine code into a computer are all unpalatable. I find the cost of an editor/assembler unacceptable for simply entering programs. DOS Debug utilities, on the other hand, are awkward to use and, unless you know what you're doing, dangerous.

Perhaps the best alternative is to put the decimal values of machine-language code into Data statements, which a Basic program then POKEs into memory or writes to disk. This is a tiresome process, however; you have to type in a line number, then the word DATA, a decimal number, and so on. The fact that the numeric keypad lacks a comma makes the process all the more cumbersome.

But what if you could automate this procedure? MakeData, a utility for the Models I/III/4 and the Tandy 1000, lets you do just that. You supply the decimal values and the program does the rest, producing an ASCII disk file of line-numbered Data statements.

#### On Cue

When you run MakeData (see the Program Listing), the program prompts you for a starting line number, a line number increment, the number of data items you want to insert on each line, and a file name. Type in this information and press the enter key. The program displays the opening portion of your first line and a prompt to begin entering data items.

Suppose you specify 10 as the first line of your file, a line increment of 10, and a maximum of five data items per line. After opening your file, MakeData displays the following:

10 DATA
Enter data item 1 = >



#### System Requirements

Model I, III, 4, or 1000 Disk Basic or GW-Basic

#### Program Listing, MakeData,BAS 1 CLS:CLEAR 200:GOTO 200 ' TRANSFER TO START OF PROGRAM 1451 121 2 3 \*\*MAKEDATA/BAS\*\* 51 52 By Pat Anderson 10 ' \*\*INPUT SUBROUTINE\*\* 124 173 20 PR\$="" 30 PRINT @ FN LO(R,C),"=>"; 'INPUT PROMPT 40 IN\$=INKEY\$:PRINT @ FN LO(R,C)+LEN(PR\$)+2, CHR\$(95);: IF IN\$=" " THEN PRINT @ FN LO(R,C)+LEN(PR\$)+2," ";:GOTO 40 'DISPLAY C 50 IF IN\$=CHR\$(13) THEN PRINT @ FN LO(R,C)+LEN(PR\$)+2," ";; RET URN 'RETURN ON <ENTER> KEY 55 IF IN\$=CHR\$(8) THEN PR\$=LEFT\$(PR\$,LEN(PR\$)-1):PRINT @ FN LO(R,C)+LEN(PR\$)+2," ";:GOTO 40 'BACKSPACE (LEFT ARROW) 60 PR\$=PR\$+IN\$ 'ADD INPUT CHARACTER TO EXISTING LINE 70 PRINT @ FN LO(R,C)+2,PR\$; " ";:GOTO 40 150 ' 1559 6639 3938 221 200 ' \*\*START OF PROGRAM\*\* 146 \* \*\*INITIALIZE VARIABLES, DEFINE PROMPTS & MESSAGES\*\* 148 240 DEFINT A-Z 240 DEFINT A-Z 240 DEFINT A-Z 250 I=1:K=1 ' I=TOTAL ELEMENTS, K=ELEMENTS ON CURRENT LINE 260 WI=64 ' SCREEN WIDTH, CHANGE TO 80 FOR MOD IV AND TANDY 1000 265 ' FUNCTION TO SIMULATE LOCATE STATEMENT, R=ROW & C=COLUMN 270 DEF FN LO(R,C)=(R-1)\*WI+C-1 ' DELETE FOR TANDY 1000 275 'FUNCTION TO GET COLUMN NUMBER TO CENTER CE\$ 280 DEF FN CE(CE\$)=WI/2-LEN(CE\$)/2 290 DT\$=" DATA" 300 MS\$(1)="MAREDATA/BAS":MS\$(2)="By Pat Anderson" 310 MS\$(1)="MAREDATA/BAS":MS\$(2)="By Pat Anderson" 310 MS\$(1)="For easy entry of elements in DATA statements" 320 MS\$(4)="Creates an ASCII file of numbered lines of DATA" 330 MS\$(5)="statements to merge with BASIC program" 340 P\$(1)="Pirst line number? ":P\$(2)="Line increment?" 350 P\$(3)="Number of data elements per line?" 360 FP\$="File name (incl extension and drive) for output" 370 P\$(3)="Number of data elements per line?" 380 CT\$="Press <ENTER> to continue" 390 NL\$="Press <ENTER> to continue" 390 NL\$="Press <ENTER> to to continue " 400 EM\$(1)=" CREATED FOR MERGE WITH BASIC PROGRAM":EM\$(2)="CONTA INING":EM\$(3)=" DATA ELEMENTS" 410 ' \*\*INTRO SCREEN\*\* 856 609 240 DEFINT A-Z 511 157 1757 158 1930 3347 4687 4228 3668 4878 3160 5852 220 151 \*\*INTRO SCREEN\*\* 440 ' 450 CLS 460 R=1:X=1 470 CE\$=MS\$(X):C=FN CE(CE\$) 223 1540 480 PRINT @ FN LO(R,C),CE\$ 490 IF X=5 THEN GOTO 510 ELSE R=R+1:X=X+1:GOTO 470 1538 3147 500 PRINT 578 2144 510 R=15:C=1:PRINT @ FN LO(R,C),CT\$; 520 C=C+LEN(CT\$):GOSUB 10 :CLS \*\*GET PARAMETERS\*\* 154 226 570 FOR X=1 TO 4:PRINT P\$(X):NEXT X 580 PRINT 2197 586 590 PRINT FPS 805 590 PRINT FPS 600 R=1:C=44:GOSUB 10 :LN=VAL(PR\$) ' LINE NUMBER 610 R=2:GOSUB 10 :LI=VAL(PR\$) ' LINE INC'ENT 620 R=3:GOSUB 10 :ME=VAL(PR\$) ' MAXIMUM ELEMENTS ON LINE 630 R=7:C=1:GOSUB 10:F\$=PR\$ ' OUTPUT FILE NAME 640 OPEN "O",1,F\$ 650 R=15:C=1:PRINT @ FN LO(R,C),CT\$:C=C+LEN(CT\$):GOSUB 10 :CLS 660 ' 2046 1753 1752 1612 914 3796 227 158 680 ' \*\*DATA ENTRY\*\* 700 ST\$=STR\$(LN)+DT\$ ' START WITH LINE NUMBER AND WORD "DATA" 710 R=1:C=1:PRINT @ FN LO(R,C),EP\$;:IP\$="Enter data item "+STR\$( 1) 720 R=5:PRINT @ FN LO(R,C),ST\$ 730 R=8: PRINT @ FN LO(R,C),IP\$ 740 R=8:C=LEN(IP\$)+1: PRINT @ FN LO(R,C)," 750 GOSUB 10:CE\$=PR\$ 760 IF CE\$=\*END\* AND K=1 THEN CLOSE:CLS:PRINT F\$;EM\$(1):PRINT EM\$(2); I-1; EM\$(3):END 70 IF CE\$=\*END\* AND K<1 THEN PRINT #1,LEFT\$(CL\$,LEN(CL\$)-1):C LOSE:CLS:PRINT F\$;EM\$(1):PRINT EM\$(2); I-1; EM\$(3):END 780 IF K<ME THEN GOSUB 820:GOTO 710 ' BUILD LINE 790 IF K=ME THEN GOSUB 910:GOTO 710 ' SAVE AND START NEW LINE 800 ' 1820 1842 2909 5065 6990 2139 2141 Listing continued



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820 ' **BUILD CURRENT LINE**	1.4	154
830 '	1.*	226
840 AD\$=AD\$+CE\$+CHR\$(44) ' ADD CURRENT ELEMENT AND COMMA	1*	1287
850 PR\$=ST\$+AD\$ ' BUILD LINE TO DISPLAY	14	863
860 R=5:C=1 :PRINT @ FN LO(R,C), PR\$; ' DISPLAY LINE	1+	2146
870 CLS=PRS	1.4	629
880 K=K+1:I=I+1:RETURN ' ADJUST COUNTERS	1 *	1390
890 '	1.*	232
910 ' **SAVE CURRENT LINE AND START NEW LINE**	1.4	154
920 '	1*	226
930 ADS=ADS+CES ' ADD CURRENT ELEMENT	1*	802
940 PRS=STS+ADS ' BUILD LINE TO DISPLAY	1 *	863
945 'DISPLAY FINISHED LINE AND SAVE IT TO DISK	1.0	162
950 R=5:C=1:PRINT @ FN LO(R,C), PR\$;:PRINT #1, PR\$	11.	2959
960 R=15:PRINT @ FN LO(R,C), NL\$;:C=C+LEN(NL\$):GOSUB 10	1.6	3410
965 'INCREASE LINE NUMBER BY LINE INCREMENT AND ADJUST COUNTERS	1 *	164
970 LN=LN+LI:K=1:I=I+1:AD\$="":ST\$=STR\$(LN)+DT\$	1 *	2782
980 PRS=STRING\$(64," "):R=15:C=1:PRINT @ FN LO(R,C), PR\$; :R=5:E	,	
RINT @ FN LO(R,C), PR\$;:PRINT @ FN LO(R,C), ST\$;:RETURN	1 *	7232

After the prompt, type in a data item (I'll use the number 12 as an example) and press the enter key:

> 10 DATA 12. Enter data item 2 = >

Continue typing in data items, pressing the enter key after each one. After you have typed in the maximum number (five, in this example), MakeData saves the line to disk and waits for you to press the enter key again. When you do, it moves on to the next line, which it numbers automatically:

> 20 DATA Enter data item 6 = >

Type in END when you finish entering data items for the file.

#### Stringing Along

Functionally, MakeData is an easy program to follow. Lines 10-70 contain an IN-KEY\$ input subroutine. The program builds lines (PR\$) one character at a time from each IN\$.

When the test in line 50 detects that you have pressed the enter key, control returns to the main program. Line 55 provides for limited editing of the input line with the backspace (left-arrow) key.

Lines 200-400 initialize variables and

define string constants. The program defines numeric variables as integers; that is more than enough precision for the simple math involved.

The variable WI (line 260) defines the width of the screen for the function in lines 270 and 280 that simulates GW-Basic's Locate statement. For the Models I and III. the screen width is 64: for the Model 4 and the Tandy 1000, change it to 80.

The function that simulates the Locate statement replaces ordinary Print statement syntax on the Models I/III/4. This allows Model 1000 users to substitute the statement:

LOCATE R,C : PRINT . . .:

wherever they see:

PRINT @ FN LO (R,C), ...;

Model 1000 users will also want to delete line 270, which defines the simulation function. Except for these Model 1000 modifications, the program works the same on the Models I/III/4 and the Tandy 1000.

Lines 550-650 fetch the parameters. The input routine returns strings for the starting line number, line increment, and elements on each line, which are converted to numbers with the VAL function. In order to display prompts and operator input, the row (R) and column (C) are defined for the simulated Locate statement

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before each call to the input subroutine. This section also opens an output file.

The STR\$ function in the data entry section (lines 680–790) converts the line number (LN) back into a string and inserts the word DATA at the beginning of every line. After you type in a data item, the program tests whether the maximum number (ME) has been reached for the current line. If it has not, the program branches to lines 820–880 and tacks on the new data item and a comma to the end of the display line.

If the maximum number of items has been entered, lines 910–980 save the line to disk. After you press the enter key, the program increases the line number (LN) by the line increment (LI) and starts a new line.

Lines 760–770 test to see if you have typed in END. If an End statement is detected as the first item on a new line, the program closes the output file and ends the program.

If an End statement is not the first line item, then the program saves the current line (CL\$), closes the file, and terminates. In either case, the screen will display both the file name and the number of data items saved in it.

#### Easy to Swallow

The file that MakeData creates is a straight ASCII text file. As the program includes no provision for editing input after you press the enter key, you will have to use either your word processor or the Basic line editor if you want to go back and edit a MakeData file.

Use a Basic program with a For. . .Next loop to POKE the data items into memory. Afterwards, write the program to disk as a /CMD file with the TRSDOS Dump command or by executing the following:

10 OPEN "O",1,"file name/CMD"

20 FOR K = 1 TO N:READ A:PRINT#1, CHR\$(A)::NEXT

30 CLOSE:END

where N = number of data items (see Crosscheck program lines 200–220 in "A Basic Programmer's Best Friend," September 1985, p. 66).

MakeData accepts data of any type or length. Some Data statement formats contain integers that are longer than the numbers used with the POKE technique, for instance. Also, some POKE routines use data in hexadecimal format. If you wanted, however, you could easily modify the program to limit acceptable input to numbers, the enter key, and the backspace (left-arrow) key (see "Restricted Entry," May 1985, p. 70).

A lawyer by vocation, Pat Anderson has made computing his hobby since 1982. You can reach him through CompuServe (user number 72027,1055) or by writing to him at 36631 S.E. Fall City Road, Fall City, WA 98024.

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## A Hard Bargain

The edifying story of one Tandy 1000 owner's efforts to install a bargain-priced 10-megabyte hard disk system.

ne of the factors I weighed when considering the purchase of a Tandy 1000 was the ease with which I could upgrade the system. In the past two years, the aftermarket for MS-DOS computers has produced a great many add-ons that users can install themselves. Most that are built on 10-inch boards (or smaller ones) are compatible with the Tandy 1000.

This article describes the steps I followed in adding an external 10-megabyte hard disk drive to my Tandy 1000. Although the process wasn't as trouble-free as I might have wished, along the way I learned a lot about how the 1000 operates. More importantly, I increased the storage capacity of my system while saving a couple hundred dollars by doing it myself. Maybe you can, too.

#### Catching the Bug

About a month after I bought my 1000, I was bitten by the add-on bug. While scouring the computer offerings at a local hamfest (a flea market for amateur radio operators where one often finds bargains on computer-related components), I encountered a vendor selling an unused Western Digital hard disk controller board, along with a half-height, 5½-inch 10-megabyte drive, for under \$400 (see Photos I and 2). In spite of having no assurance that it would work with the Tandy 1000, I decided to purchase the package and install it myself.

My bargain came complete with drive, 10-inch controller board, front panel, and cables. In lieu of documentation, the vendor at the hamfest wrote out the following installation procedures:

- 1. Place a jumper on SW1-4 (switch 1, row 4).
- Boot the system from DOS in drive A.
- At the A>prompt, type DEBUG and press the enter key.
- 4. At the prompt, type G = C800:5.
- 5. At the next prompt, type Y.
- 6. After a couple of minutes, the monitor will display the message "Format successful."
- 7. At the A>prompt, type FDISK.
- 8. Next prompt, press the enter key.
- 9. Next prompt, press the enter key.
- 10. Next prompt, press the enter key.
- 11. At the A > prompt, type FORMAT C:/S and press the enter key.
- 12. At the next prompt, press any key.

He assumed I was installing the drive in an IBM PC, and I made no indication to the contrary.



Photo 1. Western Digital hard disk controller.



Photo 2. Half-height,  $5^{1}/_{4}$ -inch 10-megabyte drive.

#### **Failed Attempts**

At home, I removed the cover from the 1000's central processing unit (CPU), detached the cables from drive B, and attached the four-conductor plug in the computer to the mate in the hard drive. Setting the drive temporarily on top of the floppy drive shield in the CPU, I made the other two cable connections from the hard disk controller card to the hard drive, carefully observing polarity on each end of the cables. I then installed the jumper on SW1-4 as the hamfest vendor had instructed. After one last check of the connections, I was ready to boot up.

#### System Requirements

Model 1000

I placed the MS-DOS disk in drive A and turned on the power switch. Halfway through the boot, the drive select light for the unformatted hard disk came on—and stayed on. The boot never completed.

I began to think my purchase wasn't a bargain after all. The sight of the Tandy 1000 with its dislocated monitor and exposed wires gave me a sick feeling. I decided to clean up the mess, pack away the hard drive, and reassemble the 1000.

The following day, I called Western Digital about my problem. I learned that the controller board had an installation manual, which they would send in the mail. Within 48 hours, it was at my door, postpaid.

A study of the Western Digital manual and the Tandy 1000 technical manual produced an important discovery: I learned that the IBM PC uses interrupt number 5 to service the hard disk, while Tandy uses interrupt number 2. The controller board defaults to the former. With some minor tinkering, however, I could change the default. The manual explained exactly how. All it amounted to was cutting a trace and moving a jumper.

I made the change and again opened the 1000 and disconnected the cables from drive B. Then I installed the controller board and made the connections to the hard drive. Anxiously, I turned the power on. Again the system hung up halfway through the boot. It was back to the drawing board.

#### ing board.

A New Lead

I placed another call to Western Digital and spoke with an engineer who told me that there were two known problems installing the board in the Tandy 1000. One is the interrupt handler default (which I had already solved); the other involves the BIOS (basic input/output system) ROM on the controller board. Apparently, Western Digital had developed several ROMs for the board, but only one could be used on the Tandy 1000.

The engineer managed to track down the correct BIOS ROM and offered to mail to me free of charge. In return, I mailed him the BIOS ROM that was contained in the board I owned.

The mailman arrived with the new ROM BIOS a few days later. For the third time, I disassembled the 1000 and made

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#### Tips for Do-It-Yourselfers

If you are considering installing a hard disk drive in your Tandy 1000, make sure you first have the appropriate hardware and software. Here are some steps you should follow:

- ▶ Determine which BIOS version your computer has. When you boot the system, the version number is displayed on the first line of the screen after the memory check.
- ▶ If you have BIOS version 01.00.00, arrange with your dealer or with a repair center to install version 01.01.00. If you have a PBJ MFB-1000 expansion board in your computer, you may need to obtain a different DMA controller from PBJ Inc.
- ▶ Buy the MS-DOS hard disk utilities from your local Radio Shack. The dealer may have to order them from the factory.
- ▶ When you purchase your 10-megabyte or 20-megabyte hard disk (I recommend buying from an established vendor), be sure that it has a BIOS ROM that works with the Tandy 1000.
- ► Set up the hard disk controller board (using interrupt number 2) for operation with the particular make and model of the drive. The vendor can tell you which jumpers or switches to set.
- ► If you install an external drive, purchase a case and power supply for it. Although most of the newer hard drive assemblies will operate from the power supply in the Tandy 1000, they push the supply to the limit.
- ► If you are installing a Western Digital controller board, follow the format procedure outlined on p. 68.

-Jim Creasy

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ALPS 1502 County Road 25 Woodland Park, Colorado 80866 800-232-ALPS (Toll-Free) the necessary drive connections. This time when I turned on the power, a miracle happened: the computer booted the MS-DOS disk in drive A. I was up and running.

I ran the first format from Debug and, sure enough, the drive select light came on for the hard drive. I heard noises on the drive and noticed that the head stepper motor was moving at a slow, but precise, rate. In about three minutes, the stepper rewound and the message "Format successful" appeared on-screen.

Sure that I had cleared all hurdles, I began to partition the disk. I typed in the FDISK command and selected option 1 to create a DOS partition. Almost immediately, the system returned the message "Error reading fixed disk." Thinking I had done something wrong, I reentered the FDISK command. The error message appeared again. I began to think about giving up.

#### One More Try

Before resigning myself to ownership of a \$400 paperweight, I decided to call Tandy. My investigation yielded another crucial tidbit: the hard disk system was designed to work with direct-memory access (DMA), a standard feature on other MS-DOS computers. Although Tandy 1000s with 256K or more have direct-memory access, the feature is not programmed properly by version 01.00.00 of the BIOS. I learned, however, that Tandy had addressed the problem by producing a revised BIOS (version 01.01.00) for the 1000.

I took the 1000 to a Radio Shack repair center to have the upgrade installed. The procedure took less than an hour. Because installing the new BIOS version is considered an upgrade, not a repair, I was charged \$20.

At last, I had everything I needed to run my Tandy 1000 with a 10-megabyte hard disk. When I returned home, I installed the controller board for the fourth time. This time, the system booted from the hard drive and the C> prompt appeared on-screen. Within an hour, I created nine directories; after another hour, the hard disk was 70 percent full.

In spite of all the effort, I am convinced I now own one of the best and least expensive MS-DOS personal computers on the market. I also had the opportunity to speak with some very helpful and nice people at Western Digital (Enhanced Peripherals Division, 2445 McCabe Way, Irvine, CA 92714, 714-863-7767) and Tandy. Figuring in phone calls to Tandy and Western Digital, travel costs to the repair center, and the purchase of a Tandy 1000 Technical Reference Manual, the total cost for installing an external 10-megabyte hard disk drive was \$497-a bargain by any standard.

You can reach Jim Creasy at 517 Reeves Drive, Phoenixville, PA 19460.

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# Different Strokes

Two convenient utilities for the Model III keyboard.

The keyboard is the computer world's great equalizer. Not everybody writes device driver routines, but everybody types. ReadyKey, my Model III keyboard routine, combines two utilities that save you typing time by cutting down on keystrokes (see the Program Listing). The first utility copies text from one part of the screen to another. The second, a macro key utility, lets you enter Basic key words by pressing shifted letter keys; you can customize it with up to 26 character strings of your choice, including DOS commands or other frequently used strings.

# Do You Copy?

To use ReadyKey, type in the Listing and assemble it to disk. Type in the routine's /CMD file name from TRSDOS Ready to run it.

You can copy text when you're at DOS level, in Basic, or from a program using the following procedure: press the clear key, and a new, fast-blinking cursor appears on-screen.

Position this cursor at the beginning of the text you want to copy, press the @ key, and then hold it down. ReadyKey copies the text at the fast-blinking cursor's location to the original cursor's location. Release the @ key to stop copying; otherwise, ReadyKey will continue copying a line to its end.

If you copy more text than you intended, you have to use the minus key to delete extraneous characters, since ReadyKey disables the left-arrow key.

# Take a Letter

To use the macro keys, you simply press a shifted letter key while in Caps Lock mode and the corresponding Basic key word appears as if you had typed it in from the keyboard. The Table shows the definitions I used for the keys; some letter



# System Requirements

Model III TRSDOS 1.3 Assembly language Editor/assembler

### Program Listing, ReadyKey. 00010 00020 ORG OFAOOH; START OF THIS PROGRAM DEFL 00030 I.D HL, ORG 4411H; ADDRESS TO STORE HIMEM VALUE 00040 HIMEM DEFL 40B1H; ADRESS OF BASIC HIMEM POINTER (BHIMEM), HL 00050 BHIMEM DEFL 00060 LD 00070 LD (HIMEM), HL 00080 LD HL. NAME 00090 CALL 021BH 00100 HL, MESS 021BH LD 00110 CALL 00120 HL, MESS1 021BH LD 00130 HL, MESS2 021BH 00140 T.D CALL HL, MESS3 021BH 00160 LD CALL 00170 HL, MESS4 00180 CALL 00190 021BH HL, (4016H) (BUFF), HL 00200 BEGIN LD 00210 I.D HL, ROUTE (4016H), HL 00230 LD A, 0 (BUFF4), A 00250 LD 00270 ROUTE POP 00280 LD (BUFF2), DE 00290 LD DE, (MCADD); KEY STRING BEING SENT? 00310 OR JR Z, GET 00330 INC DE A, (DE) LD 00350 00360 NZ . MRE JR 00370 00380 MRE (MCADD), DE LD 00400 GET I.D DE, REST PUSH 00420 LD HL, (BUFF) JP BC 00440 REST PUSH PUSH 13; CARRIAGE RETURN Z, FIN 00460 00470 JR 00480 CP 2; IF CNTRL-B PRESSED SHUT OFF 00490 Z,FIX JP 00500 00510 D, A A, (BUFF4) LD 00520 NZ . CURSE 00530 JR LD A,D 31;CLEAR 00550 CP 00570 LD A, (3880H) AND 00590 T.D H, A; ADJUSTS FOR THE RIGHT SHIFT KEY 00610 OR HL, (4019H); IS CAPS LOCK IF NON O 00630 AND 00640 LD A,D NZ, MACRO 00660 FIN LD D,A A,O (BUFF4),A 00680 LD 00690 00700 EXIT POP 00710 00720 EXIT1 DE, (BUFF2) LD 00730 00740 PUSH RET 00750 LEAVE LD 00760 D, 0 LEAV1 LD 00770 DEC 00780 JR NZ, NXT 00790 DJNZ Listing continued

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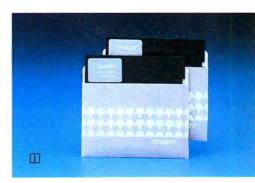












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Listing continued		
00800	LD	A, (BUFF4)
00810 00820 FOUND	JR LD	CURSE HL, (4020H); LD HL WITH ORIGINAL CURSOR ADDRESS
00830 00840	LD	(BUFF3),HL
00850	LD	(BUFF4),A
00860 00870 CURSE	LD	HL, (BUFF3)
00880 00890	CP JP	4 z,copy
00900	LD	A, (HL)
00910 00920	LD	(BUFF5),A B,O
00930 LIT 00940	LD	A,191 (HL),A
00950 00960	DJN2 LD	LIT A, (BUFF5)
00970	LD	(HL),A
00980	LD CP	A, D
01000 01010	JR LD	NZ,OTHER A,8;BACKSPACE AND DELETE
01020 01030 OTHER	JR CP	EXIT
01040	JR	31; IF CLEAR PRESSED NO MORE CURSOR COPY NZ,OK
01050 01060	LD JR	A, O FIN
01070 OK 01080	LD BIT	A, (3840H) 3, A; UP ARROW
01090 01100	JR SCF	Z, NO
01110	CCF	
01120 01130	LD SBC	BC,64 HL,BC
01140 01150	LD LD	(BUFF3),HL B,80
01160	JR	LEAVI
01170 NO 01180	JR	4,A;DOWN ARROW 2,NO1
01190 01200	LD ADD	BC,64 HL,BC
01210	LD	(BUFF3), HL
01220 01230	LD JR	B,80;LONGER DELAY FOR UP AND DOWN ARROW LEAV1
01240 NO1 01250	BIT JR	6,A;RIGHT ARROW 2,NO2
01260	INC	HL
01270 01280	JR	(BUFF3),HL LEAVE
01290 NO2 01300	AND JR	32;LEFT ARROW Z,NO3
01310 01320	DEC	HL (BUFF3), HL
01330	JR	LEAVE
01340 NO3 01350	LD CP	A,D 64;HIT @ TO COPY
01360 01370	JP LD	NZ, EXIT
01380 01390 COPY	LD LD	(BUFF4),A
C1400	INC	A, (HL) HL
01410 01420	LD	C,2 D,0
01430 01440 MORE	LD	B,A (BUFF3),HL
01450 01460	LD AND	A, (3801H)
01470	JR	NZ,GO
01480 01490	LD	A,1 (BUFF4),A
01500 01510 GO	LD DEC	A, (4021H)
01520 01530	JR DEC	NZ, MORE C
01540	JR	NZ, MORE
01550 01560	LD CP	A, (4021H) 63
01570 01580	JR LD	NZ, EX A, (4020H)
01590 01600	CP JR	255 NZ,EX
01610	LD	A,B
01620 01630	SCF	
01640 01650	LD SBC	BC,64 HL,BC
01660 01670	LD JP	(BUFF3), HL EXIT
01680 MACRO	OR	A
01690 01700	JP LD	Z,EXIT HL,KEYS
01710 01720 NCHR	LD CP	BC, TEXT (HL)
01730 01740	JR INC	Z, MAC HL
01750	SCF	
01760 01770	CCF	HL
01780 01790	SBC	HL,BC
01800	JR	NZ, NCHR
		Listing continued

Key	Definition	Key	Definition
A	AND	N	NEXT
В	None	0	OPEN
C	CHR\$(	P	POKE
D	DATA	Q	None
E	ELSE	R	RETURN
F	FOR	S	STRING\$(
G	GOSUB	T	THEN
H	None	U	USING
I	INPUT	V	VAL(
J	None	W	None
K	None	X	None
L	LEFT\$(	Y	None
M	MID\$(	Z	None

keys are undefined and will not produce a key word when shifted.

Table. ReadyKey's key assignments.

To substitute your own strings for those in the Table, you need to modify lines 2230–2580 of the Listing. You can use any ASCII sequence you want up to 255 characters. However, you can't use zeros in your strings as they mark the beginning and end of a definition.

You must begin your key definitions with a DEFM statement followed by a list of the keys you're defining. For example, if you want to define only the A, C, and D keys, you use the statement DEFM 'ACD'. The list need not be in alphabetical order.

Next, set up your list of key words (or other strings). The first string corresponds to the first letter key in your list of defined keys, and so on. Mark the end of each key definition with a DEFB 0. For example, the definition for A is DEFM 'AND' DEFB 0.

You don't need a DEFB 0 before the first definition, since the one at the end of the list of defined keys doubles as a leading zero for the first key definition.

### **Et Cetera**

Because the Model III ROM's key scan routine calls ReadyKey, it might not work with all programs. The program resides in high memory and tells TRSDOS 1.3 not to overwrite it. However, other DOSes might overwrite the program, making your computer crash. For this reason, you can turn off the keyboard routine by pressing control-B (shift/down-arrow/B).

You can write to Chris Joy at Aiglon College, 1885 Chesiers-Villars, Switzerland.

# Related Articles

Archer Jr., Rowland, "Uni-Key," September 1980, p. 76. A Model I utility that lets you enter Basic key words with one keystroke.

Rigg, Don, "Autokey," December 1982, p. 280. A Model III conversion of Uni-Key.

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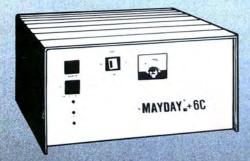
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01810	JP	EXIT	02210 INPUT	DEFS	19
01820 MAC	LD	BC, KEYS	02220	NOP	
01830	SBC	HL,BC	02230 KEYS	DEFM	'ACDEFGILMNOPRSTUV'
01840	LD	E,L	02240 TEXT	DEFB	0
01850	INC	E	02250	DEFM	'AND'
01860	CALL	FINDE	02260	DEFB	0
01870	LD	A, (HL)	02270	DEFM	'CHR\$('
01880	LD	(MCADD), HL	02280	DEFB	0
01890	JP	EXIT	02290	DEFM	'DATA'
01900 EX	LD	A,B	02300	DEFB	0
01910	JP	EXIT	02310	DEFM	'ELSE'
01920 FINDE	LD	BC, 400H	02320	DEFB	0
01930	LD	HL, TEXT	02330	DEFM	'FOR'
01940	XOR	A	02340	DEFB	0
01950 TIMES	CPIR		02350	DEFM	'GOSUB'
01960	DEC	E	02360	DEFB	0
01970	JR	NZ, TIMES	02370	DEFM	'INPUT'
01980	RET	the state of the s	02380	DEFB	0
01990 FIX	LD	HL, (BUFF)	02390	DEFM	'LEFT\$('
02000	LD	(4016H), HL	02400	DEFB	0
02010	JP	EXIT	02410	DEFM	'MID\$('
02020 NAME	DEFM	'ARROW KEY EDITOR BY CHRIS JOY'	02420	DEFB	0
02030	DEFB	13	02430	DEFM	'NEXT'
02040 MESS	DEFM	'PRESS THE CLEAR KEY TO ENTER AND	02440	DEFB	0
EXIT.'		THE THE COURT NOT TO BRIDE THE	02450	DEFM	'OPEN'
02050	DEFB	13	02460	DEFB	0
02060 MESS1	DEFM	'PRESS ARROW KEYS TO MOVE CURSOR.'	02470	DEFM	'POKE'
02070	DEFB	13	02480	DEFB	0
02080 MESS2	DEFM	'PRESS @ TO COPY.'	02490	DEFM	'RETURN'
02090	DEFB	13	02500	DEFB	0
02100 MESS3	DEFM	'PRESS SHIFT AND ANY KEY FROM A-Z,	02510	DEFM	'STRINGS('
		MODE, TO OBTAIN BASIC COMMAND.	02520	DEFB	0
02110	DEFB	13	02530	DEFM	'THEN'
02120 MESS4	DEFM	'PRESS SHIFT, DOWN ARROW, B TO DELETE	02540	DEFB	0
PROGRAM.	DULL	THE COURT TO THE TANK THE TO DELETE	02550	DEFM	'USING'
02130	DEFB	13	02560	DEFB	0
02140 MCADD	NOP	13	02570	DEFM	'VAL('
02140 MCADD	NOP		02580	DEFB	OVAL
02160 BUFF	DEFS	2	02590	END	OFA00H
02170 BUFF2	DEFS	2	02550	LIND	or troom
02170 BUFF3	DEFS	2			
02190 BUFF4	DEFS	1			
02200 BUFF5	DEFS	î			

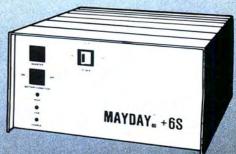
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# Making the Connection

To port files, your Tandy 1000 must have the RS-232C upgrade sold by Radio Shack (stock number 25-1006, \$99).

The null modem is an adapter that you connect to one of the computers—it crosses send and receive lines so the two machines can communicate. To build your own, you'll need male and female 25-pin D-subminiature connectors (part numbers 276-1547 and 276-1548 respectively) or the equivalent. The Table shows the wiring configuration. We tied pins 6, 8, and 20 together and the device still worked.

# System Requirements

All systems

# Male Connector

- 1 Protective ground
- 2 Transmit data
- 3 Receive data
- 4 Request to send
- 5 Clear to send
- 6 Data set ready
- 7 Signal ground
- 8 Carrier detect
- 20 Data terminal ready
- 20 Data terminal ready

### Female Connector

- 1 Protective ground
- 3 Transmit data
- 2 Receive data
- 5 Clear to send
- d December 10 School
- 4 Request to send
- 20 Data terminal ready
- 7 Signal ground
- 20 Data terminal ready
- 8 Carrier detect
- 6 Data set ready

{ other pins not required for this function }

Table. Pin configurations.

# Current Status:

Autodial Modem	No
BAUD Rate	300
Data Word Length	8 BITS
Parity	NONE
Number of Stop Bits	1 BIT
XON/XOFF Flow Control	ON
ASCII Character filter	OFF
Line Feed Filer	OFF
Echo (Half Duplex)	OFF
Redial (# of Retries)	0

Figure 1. The screen display of DeskMate protocol parameters.

Only nine pins have to be wired on each connector. Don't use ribbon cable, which is awkward for crossing connections. Use solid wire instead of stranded for better support. The wire path should be flexible so the connectors won't dislodge if the computers are accidentally bumped. Figures 1 and 2 show the protocols you should use to configure DeskMate and SETCOM. Pressing the clear and 8 keys together gives you a menu showing the COMM settings.

Dan Keen and Robert Murray can be reached at RD 1 Box 432, State Highway 83, Cape May Court House, NJ 08210.

# RS232 parameters:

Baud	= 300
Word Length	=8
Stop Bits	= 1
Parity	= NONE
Break Value	= X'03'

# Output control line status:

DTR	=OFF
RTS	=OFF

# Input control line conditions observed:

RI	= IGNORE
DSR	= IGNORE
CD	= IGNORE
CTS	= IGNORE

Figure 2. The screen display of SETCOM parameters.

### Related Articles

Dixon, Bradford N., "You Can Get There from Here," September 1985, p. 36. A tutorial on transferring files between computers.

Rowell, Dave, "Have Data, Will Travel," October 1985, p. 52. A tutorial on data file compatibility.



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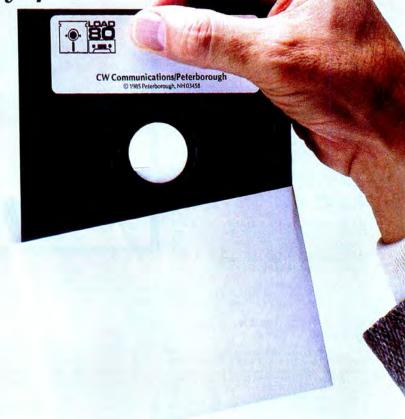
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movmem

# **Language Features**

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- Data Classes: auto, extern, static, register
- Typedef, Struct, Union, Bit Fields, Enumerations
- Structure Assignment, Passing/Returning Structures

bs	
sm	
smx	
tan	
tof	
toi	
tol	
dos	
dosx	
oios	
oiosx	
alloc	
eil	
free	
hain	
hanadan	

chmod

clearerr

clrscrn

conbuf feof conc ferror cpystr fgets fileno creat cursblk filetrap curslin find curscol floor fopen cursrow fprintf fputs fread cursoff delete free freopen drand exec execl fscanf execv ftell exitmsg fwrite getc getch

# of geteseg such as seed of get de get de get get de get get de get de

isalpha

iscnirl open isdigit outp isdowr peek isprint perror ispunct isspace poscurs isspace poscurs isupper itoa printf keypress putchar len puts log putw log10 rand longjmp read lseek readatt malloc mathtrap mid\$ writech mid\$ writech ondif realloc modfrename

**Functions** 

isascii

### outp peek perror poke right\$ rindex poscurs scanf pow printf setbufsiz setcolor setdate putc putchar settime puts putw setjmp setmem read sin readattr reach writech sound sprintf sqrt srand sscanf readdot stacksiz

### strlen strncat strncmp strncpy strsave system tolower toupper ungetc unink write writechs xmembeg xmemend xmemget xmemput xmovmem

streat

Strcpy

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# Time on Your Side

Reset the Model 4 system time and date from Basic.

A ccessing the Model 4 clock with the Basic TIME\$ and DATE\$ functions is easy enough to accomplish, but resetting the clock is inconvenient. You must return to the operating system via the System statement and wait while TRSDOS loads an overlay into memory, resets the time or date, and reloads part of Basic. As an added obstacle, TRSDOS accepts only dates that fall between January 1980 and December 1987.

These limitations can be annoying if you need to print the date and time in reports and other documents. TimeDate (Program Listing 1) simplifies matters by letting you reset the time and date to any value directly from Basic.

# Beat the Clock

TimeDate is a short subroutine you may use in any Basic program. It inserts a machine-language routine (lines 6050–6060 in Listing 1) in the storage space of a Basic variable (lines 6000–6030). When you need to reset the time or date in a program, you call the subroutine, which places the new values where TRSDOS regularly stores this information in memory. (Program Listing 2 contains the machine-language routine's source code.)

You can store TimeDate on disk and merge it with other programs as needed (see your Basic manual for instructions). Place a GOSUB 6000 call after every Clear statement. After the subroutine executes, the machine code will be properly installed. To reset the time, use the command:

## CALL TIME (X%,Y%,Z%)

in which variable X% contains the hour, Y% contains minutes, and Z% contains seconds. For the date, use:

### CALL DATE (X%,Y%,Z%)

in which the variables contain the month, day, and year respectively. The TIME\$ and DATE\$ functions will return the values you assign variables X%, Y%, and Z%. The date can be set to any value and will be updated at midnight. Program Listing 3 shows a simple example.

# System Requirements

Model 4/4P/4D Disk Basic Don't expect all this from TRSDOS, however. Any year later than 1987 will still appear incorrectly at TRSDOS Ready. You might want to type in SYSTEM (DATE = NO) to disable the date prompt that appears when you turn on your computer.

# **Time Limits**

The values for X%, Y%, and Z% must be in the usual two-digit format; for instance, 86 for the year, 03 for the hour. You may give these variables any name as in CALL TIME (HOUR, MINUTE, SEC-OND)—but they must be variables. Also, the variables must be integer variables defined either by a % after their names or by a DEFINT statement.

Finally, to save PEEKs and POKEs in the routine, I used the top eight memory addresses as a nonrelocatable buffer for the machine-language program. If you are not using filters and drivers—in most cases, even if you are—this little buffer won't give you any trouble.

Roberto Refinetti can be reached at the Dept. of Psychology, University of California, Santa Barbara, CA 93106.

# Program Listing 1. TimeDate/BAS.

```
6000 TIMEDATE$=STRING$(25,32): TIMEDATE=VARPTR(TIMEDATE$)+1
6010 TIMEDATE=PEEK(TIMEDATE}+PEEK(TIMEDATE+1)*256: RESTORE 6050
6020 FOR DATETIME=0 TO 24: READ MORETIME$
6030 POKE TIMEDATE+DATETIME, MORETIME$: NEXT DATETIME
6040 TIME=TIMEDATE: DATE=TIMEDATE+4
6050 DATA 62,19,24,2,62,18,229,213,197,33,248,255,239
6050 DATA 213,225,22,3,193,10,119,35,21,32,249,201
6070 RETURN
```

End

# Program Listing 2. Source code for TimeDate's Data statements.

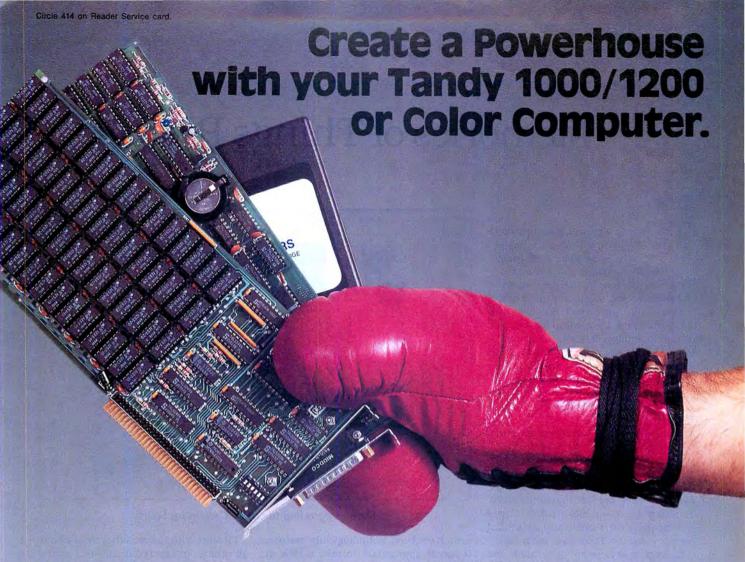
```
00100
00110 TIME
                                                                                           DUMMY ORIGIN; SELECT @TIME SVC
                                 ORG
                                                    3000H
                                                    A, 19
                                 LD
                                                                                          ;GO TO MAIN PROGRAM
;SELECT @DATE SVC
;BEGINNING OF MAIN PROGRAM
; SAVE PARAMETERS RECEIVED
00120
                                 JR
                                                    COMMON
00130 DATE
                                                    A.18
                                 PUSH
00140 COMMON
00150
                                 PUSH
                                                    DE
00160
                                  PUSH
                                                                                           FROM BASIC
SUPPLY BUFFER TO SVC AT THE
00170
00180
                                                    HL,65528
                                                                                          ;SUPPLY BUFFER TO SVC AT THE
; TOP OF MEMORY
;GET ADDRESS OF TIME$ OR DATE$
;AND PUT IT HERE
;COUNTER FOR LOOP
;GET ADDRESS OF X*, Y*, Z*
;AND FIND THEIR VALUE
;AND PUT IT INTO TIME$ OR DATE$
;NEXT SPOT IN TIME$ OR DATE$
;NEXT SPOT IN TIME$ OR DATE$
;NEXT ITEM IN THE LOOP
;IF NOT DONE, THEN REPEAT
;ELSE RETURN TO BASIC
                                 LD
                                                    28H
00190
                                 PUSH
                                                    DE
 00200
                                  POP
00210
                                 LD
                                                    D,3
BC
                                 POP
00220 LOOP
                                                    A, (BC)
(HL), A
00230
00240
                                 LD
00250
00260
                                  INC
                                                    HL
                                 DEC
00270
                                 JR
RET
                                                    NZ,LOOP
00280
00290
```

End

### Program Listing 3. Sample program using TimeDate.

```
10 CLS : CLEAR
20 GOSUB 6000
30 LINE INPUT "Enter date (MM/DD/YY): ";D$
40 MM% = VAL(LEFT$(D$,2))
50 DD% = VAL(MID$(D$,4,2))
60 YY% = VAL(RIGHT$(D$,2))
70 PRINT "Current date: ";DATE$
80 CALL DATE(MM%,DD%,YX%)
90 PRINT "Your date: ";DATE$
100 PRINT : GOTO 30
```

End



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# Memories of Things Past

This month's project is an update to the I/O-accessed memory board I discussed in the September 1985 Project 80 (p. 76). Many readers have asked how to increase the board's memory capacity, so I redesigned it to support up to 64K.

This is the last Project 80—after two and a half years, the column has reached its retirement age. To wrap things up, I'll take a brief look at the technological achievements that have made modern computers and peripherals possible.

# I/O-Accessed Memory Board Revisited

The original I/O-accessed memory board contained a single 24-pin JEDEC socket and permitted access of up to 4K of ROM or 2K of RAM. The new board allows up to 64K of memory, using eight 28-pin sockets (see Fig. 1 and the Photo). You may use fewer sockets if you need less memory; each socket supports 8K of memory (see the Table for a parts list).

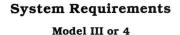
Eight chip selects are generated, one for each 28-pin memory socket. CSO/goes to the lowest-addressed socket, while CS7/goes to the highest-addressed socket. If you are using fewer than eight sockets, use CSO/first, then succeeding chip selects until all of the sockets have a chip select. You can leave unused chip selects unconnected.

Each socket has a jumper allowing selection of RAM (6264 device) or ROM (2764 device). It's OK to have any mix of RAM and ROM.

The operation of the board is the same as described in the September 1985 column, except for the increase in memory. Before accessing the board, Model III and 4 users must remember to execute an OUT 16,236 command; this allows external I/O bus access.

# Silicon Technology

My projects have used available technology as a tool to accomplish a wide variety of electronic tasks. While most of the electronic devices used in this col-



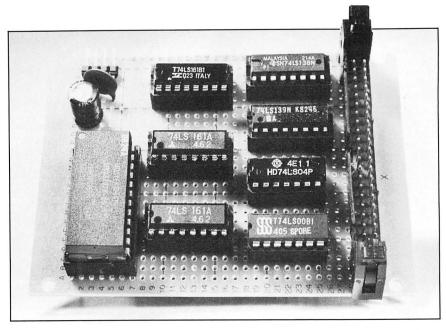


Photo. Upgrading the JEDEC memory board.

umn have been technologically mature, it seems appropriate to take a look at technological developments over the last few years.

I'll start with the area that most affects all others: integrated circuit (IC) manufacturing. IC manufacturing technology has advanced tremendously over the

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4	74LS161A 4-bit latch/counter "	74LS161	.39
1	74LS02 quad 2-input NOR gate IC (LS-TTL) ¶	74LS02	.17
1		74LS00	.16
	6264LP- $15$ 8K by 8 ( $64$ K-bit) CMOS static RAM†	HM6264LP-15	3.95
	2764 8K by 8 (64K-bit) EPROM (450 NS) ‡	2764	1.95
	47 μF/35V capacitor, electrolytic, radial		.18
9	0.1 μF/50V capacitor, ceramic disk §		.12

- If interfacing to Model III or 4, U1 should be a 7416 instead of a 74LS04.
- Make sure the 74LS161A IC has the "A" suffix.
   Required only for Model III or 4 users.
- † You can use any combination of 6264s and 2764s up to eight devices.
- ‡ If using fewer than eight RAM/ROM sockets, subtract one 0.1  $\mu$ F capacitor for each socket not used.

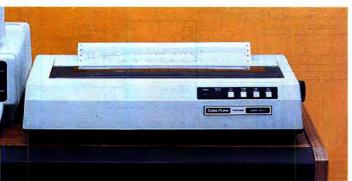
All parts distributed by JDR Microdevices, 1224~S. Bascom Ave., San Jose, CA 95128, 800-995-5430 outside CA, 800-667-6279 inside CA.

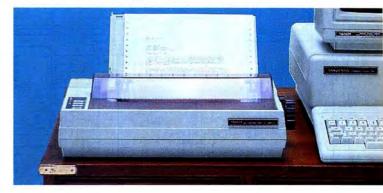
Table. Parts list for the updated I/O-accessed memory board.

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# PROJECT 80

past decade, resulting in reduced chip size, increased device speeds, and lower production costs. Other improvements include lower power consumption and, of course, higher component densities.

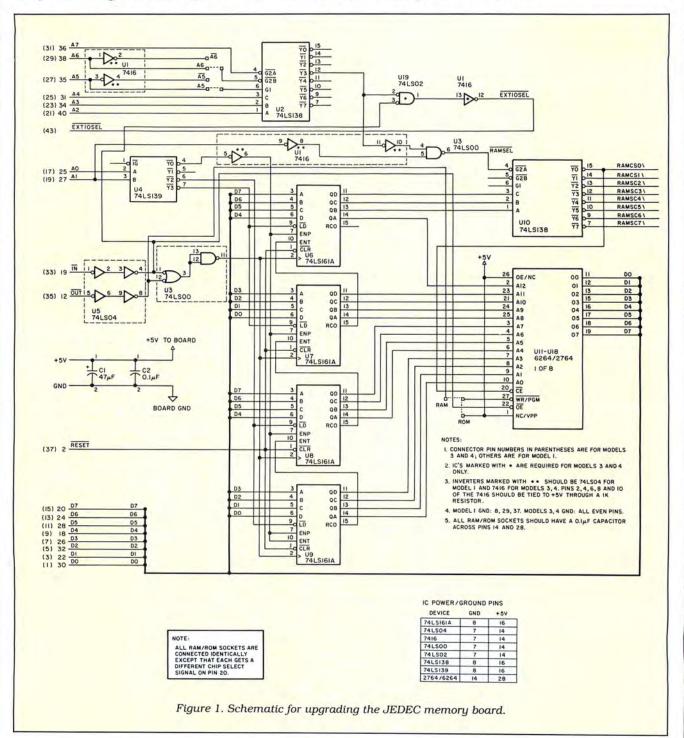
Ten years ago, you were essentially limited to standard MOS technology and a few bipolar (high-speed, high-power) technologies (TTL, RTL, DTL, and so on). The 7400-series bipolar small- and medium-scale integration (SSI and MSI) gate and interface circuit family was firmly establishing itself as a *de facto* 

standard. Complex devices like microprocessors and most memories used MOS technology, since bipolar technology, though much faster, generated too much heat. MOS technology was slow compared to bipolar but was tolerable for most applications.

CMOS, which provided very low operating power consumption, saw first light back around that time. Early CMOS devices were, however, unacceptably slow for many applications.

As time went on, the MOS and bipolar

technologies were improved regularly. Intel Corp., for example, developed the HMOS I, HMOS II, and HMOS III, each of which allowed a smaller die, faster speed, and lower power consumption than its predecessor. Low-power Schottkey (74LS-series), Advanced Low-power Schottkey (74ALS-series) and Advanced Schottkey (74AS- and 74F-series) bipolar technologies also emerged, giving designers much more flexibility and capability, and enabling development of faster systems.



# PROJECT 80

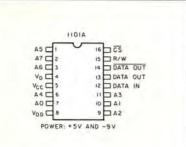


Figure 2. Intel 1101A 256-bit static RAM.

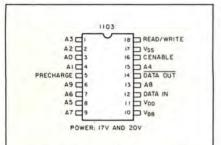


Figure 3. Intel 1103 1,024-bit dynamic RAM.

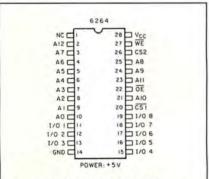


Figure 4. Hitachi 6264 64K static RAM.

Over the past three years or so, advanced CMOS technologies have given rise to the increasingly popular 74HC-series and 74HCT-series devices. These high-speed CMOS technologies have also been taking over new IC designs. CMOS's lower power consumption has allowed more densely packed components to be placed onto a chip without overheating, while at the same time improving device operating speeds. Virtually all of the new VLSI (very large scale integration) chips being developed use at least some CMOS technology in their manufacture.

### Memories

There are basically two types of RAMs (random-access memories), dynamic and

static. Static memories are easier to design with, since they retain what is written to them without additional circuitry or effort. Dynamic memories, on the other hand, require refreshing; portions of the devices must be read regularly to charge the small on-chip capacitors used for storing the bit values. This involves more circuitry and design effort, and often degrades system performance.

Why use dynamic memories, then, if they're more difficult to use than statics? As with many things, each memory type represents a tradeoff. The simpler design of dynamic memories permits more storage bits to be placed onto a chip than static memories of similar complexity. So, dynamics permit more memory for a given amount of circuit board area, and cost much less per bit than static memory.

Memory devices have led the way in higher chip component densities due to their regular architecture. Both statics and dynamics have evolved rapidly over the past few years, with the density doubling about every other year. I can remember the 1101A 256-bit static RAM (see Fig. 2) and the 1103 1024-bit dynamic RAM (see Fig. 3). Now, 64K statics (Fig. 4) and 256K dynamics (Fig. 5) are ubiquitous, while 256K statics and 1,024K (1 megabyte) dynamics are available.

The memory pinouts in Figs. 2–5 reveal another change that is now taken for granted. Most new devices require only a single +5V power supply, greatly simplifying system design. Earlier devices required multiple and/or unusual supply voltages (like the 1103 in Fig. 3), making designs more difficult; the different supply voltages often had to be sequenced (turned on or off in a specific order) during the power-up and power-down stages, further complicating designs. Modern dynamic memories also have simpler refresh requirements than their predecessors.

Read-only memories (ROMs) have also advanced rapidly. In the early days of microcomputers, the 1702A 2048-bit (256 by 8) EPROM (erasable/programmable ROM) was popular (see Fig. 6). Now 512K EPROMs are not uncommon (Fig. 7), and 1,024K chips are on the way. Again following the general IC manufacturing trends, todays EPROMs are faster and easier to use than the earlier ones and require only +5V, instead of the three supplies required by the earlier devices.

EPROM programming speed has also improved greatly. Intel's 1702A data sheet boasted "fast programming—two minutes for all 2,048 bits." Today's 128K EPROMs (27128), while having 64 times more memory on-chip, typically require only about two minutes for programming.

Another type of ROM also recently appeared. The EEPROM allows a new di-

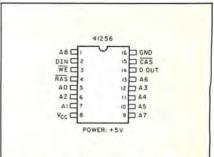


Figure 5. NEC 41256 256K dynamic RAM.

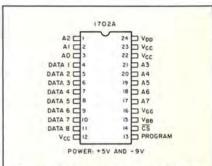


Figure 6. Intel 1702A 2048-bit EPROM.

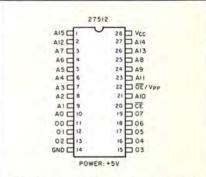


Figure 7. Intel 27512 512K EPROM.

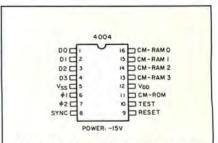


Figure 8. Intel 4004 4-bit central processing unit.

mension in ROM use, permitting information to be stored in nonvolatile ROM (not lost during power loss), while enabling in-circuit erasure and reprogramming. While EEPROMs have not seen the same acceptance level as EPROMs, they have still proven to be valuable devices.

# Microprocessors

Like memories, microprocessors have come a long way since their infancy in the early 1970s. One of the first microprocessors, the Intel 4004 (see Fig. 8), was a very simple device by today's standards. It was a 16-pin device with 45 instructions, capable of addressing a whopping 4,096 bytes of ROM and 640 bytes of RAM, and running at a headspinning 750 KHz (750 thousand cycles per second). Its minimum instruction execution time was 10.8 microseconds.

A logical comparison might be to Intel's latest processor, the 80386 (likely to appear in future IBM microcomputers). The 80386, with its on-chip memory management and virtual memory support, has a full 32-bit architecture and comes in a 132-pin package. It can access up to 4 gigabytes (4 billion bytes) of memory and operates at up to 16 MHz (16 million cycles per second), with a sustained instruction execution throughput of three to four million instructions per second.

Other 32-bit microprocessors, like the National Semiconductor 32032 and

32132 and the Motorola 68020, further verify the trend microprocessors are currently taking. Not only are microprocessors becoming more advanced, but more and more system components are being placed on the same chip as the processor.

# Programmable Logic Devices

Another family of devices has made its debut during the last few years: programmable logic devices (PLDs). These devices contain the equivalent of many logic gates (AND, OR, and INVERT) and flip-flops, and generally have small fuses for programming specific logic functions. They are programmed on a device similar to an EPROM programmer; in fact, some EPROM programmers double as PLD programmers.

A typical programmable logic device can replace seven to 10 SSI/MSI devices, allowing much more circuitry to be placed on a circuit board. The number of SSI/MSI devices replaced by a single PLD will continue to increase as more advanced PLDs are developed.

# A Look to the Future

The semiconductor industry will continue its current trends for at least several more years. Memory densities should double about every other year and microprocessor performances should increase, though not quite as fast as they have recently. Instead of higher performance, the industry will emphasize stuffing more components onto the same chip as the microprocessor.

PLDs will play an increasingly important and dominant role in system designs. They will continue to improve in speed and complexity and will probably consume less power on the average.

Although this is the final Project 80, I suspect you will see me pop up from time to time in the pages of 80 Micro. Designing, developing, and debugging my monthly projects has been an enjoyable and rewarding experience. It has been especially gratifying to see the hundreds of letters from readers all over the world. I'm interested to know how you felt about the column-please write if you have any comments.■

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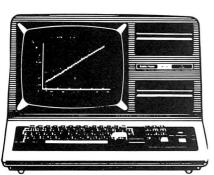


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# Mice en Scene

f you're not a dyed-in-the-wool mouse hater, you might consider trying one on your Tandy MS-DOS machine. Mice are useful as cursor movement/selecting devices for spreadsheets, graphics programs, and even word processors. A handful of programs that support mice are available, or you can write your own. I recently tried two mice on my Model 1000: Microsoft's Serial Mouse, and Tandy's Digi-Mouse.

# Into the Laboratory

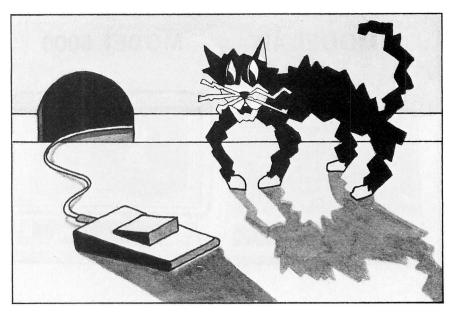
The Microsoft Serial Mouse comes with cable, driver and demonstration software, and a copy of PC Paintbrush (a color clone of Macintosh's MacPaint graphics program) for \$195. As the name implies, it plugs into a serial port, a 9-pin connector like that on an IBM PC AT or Tandy 3000. The supplied cable for 25-pin PC-type serial ports is female, so you'll need an additional adapter for the Tandy 1000: a 25-pin male-male gender changer (Inmac sells one for \$27). Microsoft also makes a bus version mouse that requires its own adapter card.

Microsoft's mouse has a quality feel, from its heavy, rubber-coated sensor ball to the screws that secure cable attachments. The screws' heads are also rubber-coated, so you can easily tighten them with your fingers. The plastic retaining circle releases the sensor ball for cleaning with a clever sideways snap. The mouse's two buttons curve over the top to the front and can be comfortably pressed from a variety of hand positions, clicking for tactile feedback.

The combination of the coated ball and three friction-reducing Teflon bottom pads makes Microsoft's mouse quiet, smooth, and responsive. It needs only a 5-inch diameter circle for operation, which is handy if your desk surface rarely sees the light of day.

The MS mouse comes with Piano, Life, and Notepad demonstration programs. Life is fun, and works well. The more ambitious Notepad has problems

> System Requirements **Tandy 1000**



on the 1000: slow typing and patchy highlighting created when you range the mouse too fast during block selection. These problems disappear on the faster Tandy 3000. PC Paintbrush (manual included) lets you create graphics images with a variety of "tools" including brushes, shapes, fills, and erasers. It's a good demonstration of how useful a mouse can be.

The mouse software also includes programs for using the mouse with WordStar, Lotus 1-2-3, and VisiCalc. Recent versions of Microsoft business software (and Flight Simulator) have builtin support for the mouse.

A set-up program guides you through installation. It puts a copy of the 72K mouse driver program on your system disk and creates the line in your CON-FIG.SYS file which sets up the driver during boot up. If you have a hard drive, the set-up program copies all the mouse software to a subdirectory.

The 222-page manual includes installation instructions; details on using the Piano, Life, and Notepad programs; and a large section on programming the mouse driver for other programs.

You can use the "Mouse Menu" language to write interfaces—similar to those provided for WordStar, 1-2-3, and VisiCalc—for existing software. This language provides cursor control and windowing menu functions. Before using an application, you run the Menu program, which interprets your interface program and converts mouse actions to keyboard input for the application. I assume Menu is memory resident and works along the lines of a keyboard macro program. You can't write an interface for programs that use graphics or already have a mouse driver.

You can also call the mouse driver from your own programs, whether they're in Assembly language, Basic, or some other high-level language. You access the

Program Listing. Ancient harmonies on the Tandy 1000.

- 100 VOICES(1) = "I.16N45N45N45I.8N45N50N42N50N42N45I.1N50"
- 100 VOICE\$(1)="L16N45N45N45N45N45N42N5UN42N45LIN5U" 110 VOICE\$(2)="L16N45N45N45L8N42N42N38N38N42N38LIN42" 120 VOICE\$(3)="L16N45N45N45N45N33N26N33N38N18N33L1N26" 125 FOR I=1 TO 3:PLAY VOICE\$(1):NEXT I 130 PLAY VOICE\$(1), VOICE\$(2), VOICE\$(3)

End

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mouse driver through software interrupt 51 (33 hexadecimal), passing four parameters in various registers. One parameter selects one of 17 mouse functions, while the meaning of the other parameters depends on the function selected. According to the manual, mice use a unit of measurement called the mickey (there are about 200 per inch).

# Poor Cousin Digi

Tandy's \$100 Digi-Mouse is a poor cousin to Microsoft's mouse. They both have two buttons and use the same software interface (interrupt 51), but the

Tandy mouse is of cruder manufacture and requires its own hardware interface: either the clock/mouse board (another \$100) or the Plus clock/mouse add-on (also \$100) for the Memory Plus expansion board. Digi-Mouse takes out one of your serial ports (Com2, hardware interrupt 3). The only software provided is the clock/mouse driver (Mouse.SYS), the Basic piano demonstration program, and two utilities for setting the battery-powered clock.

Digi-Mouse's two small buttons produce a strong click for tactile feedback, but they limit your hand to one position and aren't particularly comfortable. One Phillips head screw secures the plastic ring on the bottom that holds in the metal sensing ball. You must remove it to clean the ball. The ball isn't rubber-coated, and four smaller ball bearings let you roll the mouse around. Even when you use it on a piece of paper as recommended (to keep the sensing mechanism clean and your desk unmarred), it makes quite a racket. A 6-foot cord with a 9-pin female connector plugs into the back of the mouse adapter board.

Tandy's mouse is only half as sensitive (80 ticks per inch rolled) as the Microsoft mouse, and requires a 10-inch-square operation area.

PC Paintbrush, which comes with the MS Mouse, put Digi-Mouse to the test. It took a noticeable effort to point the arrow cursor accurately on a given pixel. Like a Russian tractor, however, it works.

Digi-Mouse itself comes with a short, 11-page manual which briefly covers plugging the mouse in, moving it, and maintaining it, along with some technical specs on the signals the mouse puts out. The main documentation comes with the clock/mouse expansion board. In addition to instructions for installing the Plus board, installing the clock/mouse driver in CONFIG.SYS, and using the clock setting programs, there are 67 pages on programming with the 3,985-byte mouse driver.

The Tandy mouse driver uses the same interrupt and function call system as Microsoft's mouse, and even the same program snippets demonstrating how to use each function. Several calls are missing: two for light pen emulation and another for double speed.

You can use Digi-Mouse and its driver with programs designed for MS Mouse. I tried Life and PC Paintbrush and noticed one minor point of incompatibility with the Microsoft Life demo. When I pointed to an empty cell and clicked to create a cell, it was only partially filled in, depending on how far the cursor arrow pointed into the cell. The program then ran normally, treating partial cells as whole.

Details are provided for using the mouse driver with 8088 Assembly language, Basic, and other high-level languages via machine-language subroutines. The 16 mouse functions let you do things like intercept button presses, set cursor bounds, and read mouse movement. As in the Microsoft manual, several cursor definition examples are provided with graphics maps.

# **Batch Catch**

I can't help it; I like batch files. Here are two that are both useful and instructive.

Barry Erick of Dallas, PA, points out how to get rid of the extra DOS prompt at

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the end of batch files (a minor irritation). His suggestion includes a little file called CAT.BAT, which produces a catalog of the files in a directory by using the wide form of the directory command (DIR/W). It's a useful command for getting a long directory in one screen when you don't care about file sizes and creation dates (shades of CP/M). Just type CAT with or without a pathname following.

To get rid of the second DOS prompt, write your batch files with EDLIN or Copy CON and put the control-Z end-of-file marker at the end of the last line, rather than on a final line of its own. Here's how you'd type in CAT.BAT with EDLIN:

Even though I ended line 2 with control-Z (and enter), I still had to get out of the editing mode in line 3 with control-C. I listed the file (with L) before saving (with E) to demonstrate an oddity. When

control-Z is listed during the creation session of EDLIN, it comes out backwards at the end of line 2. This doesn't create problems, just puzzlement.

Read.BAT is another short, sweet batch file. It takes advantage of More.COM (a filter utility on your DOS disk) to display text files one screen at a time. A filter program takes from another program standard output that is meant for display, processes it in some manner, and sends it to standard output (usually the screen). In Read.BAT, the pipe symbol (|) tells DOS to channel the output of the Type command into the More filter. Without More, Type would send the text file streaming past your eyes—unless you pressed control-S or the 1000's hold key to halt the display. Here's the program:

echo off cls echo %1 type %1|more

The %1 symbol is a variable that stands for any file name typed after Read on the command line. If you type in READ README.DOC with a DOS 2.11.22 system disk in the active drive, you'll see the file README.DOC one screen at a time; press any key to see the next screen.

## **Fanfare**

Although GW-Basic's Sound statement only produces multiple voices (harmony) with an external speaker, you can get multiple voices on the 1000's internal speaker using the Play command. Represent each musical voice as a string separated by commas after the Play statement. Three is the maximum. I wrote a small demonstration program (see the Program Listing) which first plays the three voices separately, then all together.

## Correction

I'm glad to find out I was quite wrong about there being no two-button joystick for the 1000. Both Val Manes (San Angelo, TX) and Mitch Silkotch (Bridgewater, NJ) report Tandy does indeed sell such a beast (stock number 26-3012A).



Dave Rowell is an 80 Micro technical writer specializing in MS-DOS computing. Address correspondence to him to 80 Micro, 80 Pine St., Peterborough, NH 03458.

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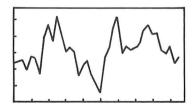
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# All Keyed Up

SuperMacro Keys from DataDesk International combines an IBM PC AT-style keyboard with Borland International's enhancer program, SuperKey.

The keyboard, which can be installed on the PC/XT/AT and compatibles, incorporates features of the advanced AT keyboard. It has a separate numeric keypad; status lights for Cap Lock, Num Lock, and Scroll Lock; extra-wide control and return; and a return key in the standard typewriter position. The Borland program lets you customize software to the new keyboard.

SuperMacro Keys costs \$129.95 and is backed by a two-year unconditional warranty. For information, contact DataDesk International, 7650 Haskell Ave., Suite A, Van Nuys, CA 91406, 818-780-1673.

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# **Quick Bucks**

Learn how to get rich quick with the PLS: Personal Learning System, a program combining investment study with speed reading. The 14-lesson course covers stocks, bonds, and other investments in an instructional system designed to increase reading speed and comprehension.

The program runs on Tandy Models III and 4 as well as MS-DOS machines, and can be combined with disks on other subjects that cost \$19.50.

The PLS sells for \$69.50 and is available from LSR Learning Associates Inc., 707 Broad Hollow Road, Farmingdale, NY 11735, 516-293-6700.

Circle 575 on Reader Service card.

# CD Encyclopedia

Activenture Corp. has announced a compact disk readonly memory (CD-ROM) hardware and software package for under \$1,000.

The Personal Information



SuperMacro Keys is a keyboard/software combination.

Package combines a CD-ROM player, controller card, connecting cables, and software to access a 540-megabyte disk containing all 21 volumes of *Grolier's Academic American Encyclopedia*. The drive can be connected to any IBM PC/XT/AT or to compatibles via the controller card. Knowledge Retrieval System software lets you search all occurrences of a topic, word, or phrase in the nine-millionword encyclopedia.

The package costs \$995. For more information, contact Activenture Corp., P.O. Box 51125, Pacific Grove, CA 93950, 408-375-2638.

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### Coldware

Mindscape's Balance of Power simulates nuclear age geopolitics on the IBM PC/XT/AT and compatibles through Microsoft's Windows interface. Players assume roles as the leaders of the United States and the Soviet Union in a fictional eight-year contest to enhance their

country's prestige while avoiding nuclear war.

Players can call upon a data base that includes facts about GNP, literacy rate, foreign aid, and political stability in 62 nations. Strategies are adapted to a constantly changing scenario revealed in news items.

Balance of Power is for one or two players and costs \$49.95. For details, contact Mindscape Inc., 3444 Dundee Road, Northbrook, IL 60062, 312-480-7667.

Circle 577 on Reader Service card.

### Laser Fare

The 1986 Laser Jet Supplies Pricing Guide from Supplysource is offered as a time-saving resource for people who order laser jet printing equipment and supplies.

The Guide features information on toner, font cartridges, specialized cables, paper, and machine-specific software. A wide range of machines is represented, including the IBM Page Printer, C.Itoh Laser Jet, Hewlett-

Packard LaserJet (Plus), Xerox 4045, Genicom Laser Printer, Digital Equipment's LN-03, and DataProduct's LZR-Z600.

Corporate users can get complimentary copies by contacting Supplysource, 175 Middlesex Turnpike, Bedford, MA 01730, 800-343-4688 (617-275-6563 in Massachusetts).

Circle 579 on Reader Service card.

# Tandy Apple

Diamond Computer Systems' Trackstar Apple II + emulation board is now available to schools. It allows MS-DOS computers to run most software written for the Apple II.

The board offers an 80-column mode, RGB and composite video output, language card features, and Apple text and graphics modes. It supports parallel and serial ports while interfacing to two floppy disk drives.

Trackstar lets Tandy 1000 owners run 90 percent of the Apple software produced by the Minnesota Educational Computing Corp. It costs \$375 plus shipping and is available to schools through Radio Shack National Bid Dept., 1400 One Tandy Center, Fort Worth, TX 76102, 817-390-3258.

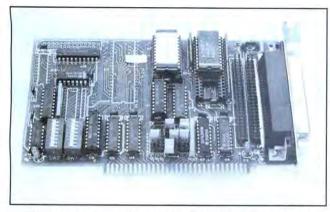
Circle 578 on Reader Service card.

# Key of C

C: A Programming Workshop employs a textbook and software to acquaint you with everything from structured software to linked lists and Assembly-language interfacing in C language.

The workshop includes an integrated editor and standard compiler, along with a test module that gives instant feedback on student-written programs. The compiler conforms to the K&R standard; source code is limited to 6,000, object code to 20,000 bytes. Floats and longs aren't included.

# MS-DOS NEW PRODUCTS



Micro Design's card lets you add up to seven peripherals to the Tandy 1000.

C: A Programming Workshop costs \$39.95 plus \$3 for handling. It is available from Wordcraft, 3827 Penniman Ave., Oakland, CA 94619. 415-534-2212.

Circle 581 on Reader Service card.

# Trump Card

Turner Hall Publishing offers a 256K RAM card with clock and software for the IBM PC/XT/AT or compatibles having at least 256K of memory. Tandy 1000s must have 384K already installed.

The Turner Hall Card contains 75 percent fewer chips than cards employing the earlier-generation 64K RAM chip and fewer clock/calendar parts. Less than 5 inches long, it fits in the short slot of Tandy MS-DOS computers.

Other features include clock software, a print spooler, and disk emulation. An illustrated manual lets novice users install the card themselves. There's a Help Hotline, one-year warranty, and 30-day money-back guarantee. The price is \$99.95.

For information, contact Turner Hall Publishing, 10201 Torre Ave., Cupertino, CA 95014, 800-556-1234 ext. 526 (800-441-2345 ext. 526 in California).

Circle 580 on Reader Service card.

# **Instant Typewriter**

Alpha Merics' typer is designed to turn an IBM PC/XT/ AT or compatible into a fullfunctioning memory typewriter. It is compatible with most printers.

Typer requires no special

installation. After inserting the self-booting disk, users are ready to do typing tasks too small or cumbersome for a regular word processor, such as dashing off a memo, typing a single envelope. completing individual forms, and so on.

The package is available at a \$44.95 introductory price from Alpha Merics Inc., 1623 South 21 St., Hollywood, FL 33020, 305-949-8318 (-8188). Circle 572 on Reader Service card.

# Hard Card

Micro Design International offers a 21-megabyte hard disk card for the Tandy 1000 based on the NCR Small Computer System Interface (SCSI) integrated circuit.

The card plugs into a single add-on slot in the 1000 and provides a path for users wishing to upgrade to hard disk storage. The host section of the card can connect up to six more internal or external peripherals.

The hard disk card is priced at \$675. For details, contact Micro Design International Inc., 6566 University Blvd., Winter Park, FL 32792, 305-677-8333.

Circle 576 on Reader Service card.

### RAM Board

The Zuckerboard Expansion Memory Board adds 512K RAM to the 128K Tandy 1000. It includes a direct memory access (DMA) chip, two banks of 256K, and a socket for installing an optional clock/calendar powered by a redundant two-

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# MS-DOS NEW PRODUCTS



The TELEcomp 2000 lets you combine color video and computer output.

battery system. The clock is accurate to plus or minus two minutes per year, and the batteries have an estimated combined life of 21 years.

The Zuckerboard sells for \$149. It is available from Advanced Transducer Devices Inc., 1287 Lawrence Station Road, Sunnyvale, CA 94089, 408-734-4631.

Circle 571 on Reader Service card.

# Videosynthesis

The TELEcomp 2000 from AVAS Corp. lets you add full-color video from a variety of sources to microcomputer output. You can then record or transmit the combined signal. No special software is required.

Window control lets you alter the shape and size of a computer or video image and place it anywhere on the screen. Opaque or transparent overlay selection and intensity control are available, as well as digital-to-analog conversion of RGB or composite video output.

The TELEcomp 2000M works with monochrome computer displays and costs \$995. The \$1,595 TELE-comp 2000C is for color computers. For details, contact AVAS Corp., 196 Holt St., Hackensack, NJ 07602, 800-631-0868 (201-487-6291 in New Jersey).

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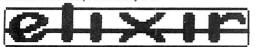
New Products listings are based on information supplied in manufacturers' press releases. 80 Micro has not tested or reviewed these products and cannot guarantee any claims.



# WORD **PROCESSOR**

Stylus is a high speed word processor that is very responsive and easy to use. There are about 90 text commands or controls for advanced users, but beginners can correct simple text expertly using only two of them. These are <1/>1 insert and <1/>2 wrap. Action repeats while any key like (W) or (I) is held down—and this saves typing! A slash command prefix key is ideal, because printed text lines exacly match video display lines.

Stylus has uniquely powerful and extensive non-text features for utilities, graphics, animations, a BASIC statement screen compiler, and screen capturing. Utility features include scrolling hex dumps, undumps, searches, and verifications. All file types can be examined or modified. Graphics can be combined with text. All graphics functions are instantly active at the same time in one mode. There is Jot Stylus pixel drawing, defined line drawing, full screen motion, and Brush Stylus drawing—set an entire screen as a complex drawing "pixel" and then rapidly draw with it. There are many other instant action keys to flip, overlay, fill, invert, etc. Doodling with a sort of electronic kaleidoscope effect is easy to do.



BASIC PROGRAM ENHANCEMENTS

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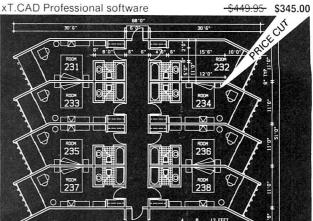
USR applications include extensive graphics, text, sound, printing, I/O for disk & screen & memory, keyboard menu control, hex utilities, capture program screens by break key, GOTO  $\,$ N, line address, animations, and more. Menu routines simplify program writing and maintenance, while speeding up the action and providing more free memory. Instant branching is by the touch of a menu <KEY>, using line and menu letter <key> lists.

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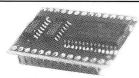


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# by Anthony Russo

# The Modular Way

In last month's column, I outlined some abuses of Basic's GOTO command and advised programmers to limit use of it to two circumstances: for directing program flow to a module and for controlling flow within a module. For the purposes of that discussion, I defined a module as a "chunk of logical functions and subroutines."

As promised, I will focus this month on the subject of modules and their usefulness in Basic programs. Let's begin by considering where modules fit in the process of writing a program.

# **Opposite Approaches**

Most Basic programs are written without much thought given to structure and overall design. Typically, programmers begin writing without an outline in front of them. As they write, they discover the need for certain functions and respond by coding subroutines and renumbering the program as necessary. Later, they may try to patch the subroutine so other parts of the program can use it.

This method leads to an excess of conditional logic and a good deal of thrashing around while writing the program. What's worse, since the programmers give little thought to the general applicability of the routines they write, they will have problems later in making variables match the ones expected in the original subroutine.

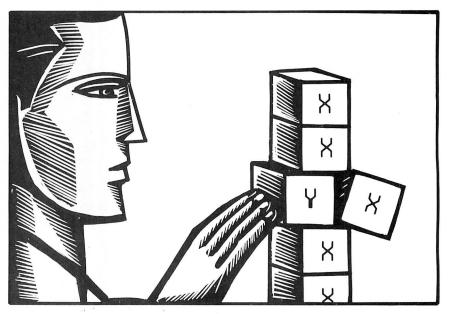
Contrast this method with what I do. When I sit down to write a program, I

give serious thought to what I want to accomplish. When I reach a section that requires a function or subroutine, I ask myself these questions:

- Is this something I'll use only once in the program? Will I need something similar in another section of the program?
- Is this function or subroutine something I'll use only once in the program? Will I need something similar in another section of the program?
- Have I written something like this in

# System Requirements

All systems Basic



the past? If so, how tricky was it to write and debug?

• Is it important that the routine run fast? Or, is the amount of memory it requires more important than speed?

If I'm sure the routine will be used only once, then I'll place it exactly where the need occurs. If, on the other hand, I think I might use a similar routine elsewhere in the program, then I study the last three points very carefully.

The first issue I consider is generality. Suppose I want to code a routine for retrieving keyboard input, where a "Y," "y," "N," or "n" would be acceptable. If the input is none of these, I want the routine to supply an error message.

Considering the matter further, I realize I could make my program smaller and easier to write if the routine returned only the uppercase form of the answer. This would require less checking and reduce the number of lines I'd have to write.

Clearly, this is something I might use repeatedly in a typical program. It's also something I have probably written before. The question is, should I code it in-line?

The answer, in many cases, is no. This routine is a perfect example of a general-purpose subroutine, which ought to be easy to remember and use. To ensure that they are, I always place general-purpose subroutines at the beginning of my programs. Routines I've written before

always go at the very beginning; routines written for the particular program go at the end of the subroutine block. This makes debugging easier, since I am more sure that routines I have tested previously will run correctly.

I also make sure that variables in general-purpose subroutines don't conflict with those in a main program. To guarantee that they will not, I always begin the subroutine variables with the letter "X" and avoid using this letter for main program variables.

In my programs, lines 10–5000 are reserved for previously written (general-purpose) subroutines and lines 5001–9999 for other subroutines. This way, when I have to renumber the program, I can begin with line 10000. All subroutines will retain the same line numbers, making them easier to remember and document permanently.

My programs begin with line 1, which defines variable types. Lines 2–8 contain DIM statements and user-defined functions. Line 9 always says GOTO 10000.

Program Listing 1 is an example of a general-purpose subroutine I might write. To call the subroutine in my program, I might write code like that in Program Listing 2.

This routine is useful if I don't need to save the answer for later use. But what if I'll need the answer later in the program? I have two options to make sure

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# THE ART of PROGRAMMING

Program Listing 1. A general-purpose input subroutine.

```
11 X$=INKEY$:IF X$<=" " THEN 11
```

12 X%=INSTR("YYNN",X\$) 13 IF X%<1 THEN PRINT"Use only Y or N!":GOTO 11

IF X%<3 THEN X%=1:ELSE X%=2

End

Program Listing 2. Code to call a general-purpose subroutine.

```
20000 GOSUB 1:ON X% GOTO 20010,20030 20010 'HANDLE X$="Y"
20020 GOTO 20040
20030 'HANDLE X$="N"
20040 'CONTINUE PROGRAM
```

End

*Program Listing 3. The subroutine in Program Listing 1,* modified to pass a character variable to the main program.

```
11 X$=INKEY$:IF X$<=" " THEN 11
12 X%=INSTR("yYnN",X$)
```

13 IF X%<1 THEN PRINT"USE only Y or N!":GOTO 11 14 IF X%<3 THEN X\$="Y":ELSE X\$="N"

15 RETURN

End

Program Listing 4. The code in Program Listing 2, modified to use the character variable in Program Listing 3.

```
20000 GOSUB 1:A$=X$:IF A$="N" THEN 20030
20010
      'HANDLE X$="Y
20020 GOTO 20040
20030 'HANDLE X$="N"
20040 'CONTINUE PROGRAM
```

End

Program Listing 5. A pared-down version of the input routine.

```
20000 A$=INKEY$:X%=INSTR(" YYnN",A$):
    IF X%<2 THEN 20000:
      ELSE IF X%<4 THEN A$="Y":
      ELSE A$="N":GOTO 20030
20010 'HANDLE X$="Y"
20020 GOTO 240
20030 'HANDLE X$="N"
20040 'CONTINUE PROGRAM
```

End

the answer is available: I can pass a character variable back to the program, or I can use the value of X% to assign a value to the variable.

Since the latter method restricts the program form I can use to call the subroutine, I'll usually use the form shown in Program Listing 3 to write the routine. The part of the program that calls the subroutine would then be written as

shown in Program Listing 4.

Only if a routine must run particularly fast will I code it directly where it will be used by the program. To improve speed, I'll pare the routine down to its essentials (see Program Listing 5).

You may have discerned that the key to using general-purpose subroutines is the ability to spot general usage. This means you must have a plan in mind when you begin to write a program. If I want to write a word processing program, I'll begin with a list of general functions the word processor must have. I'll also have a list of the things it would be nice, but not necessary, to have.

Many of you probably think I'm going to suggest using a flow chart. You're wrong. How can anyone use a flow chart and still have fun programming? I use neither a flow chart nor an outline, but I do form a clear mental picture of what I want to accomplish when I begin a program. You should do the same. If a flow chart or outline will help, then use it. What matters is that you have a plan; whether it exists on paper or in your head is not important.

# **False Conclusions**

From the foregoing, you might assume that a module is nothing more than a subroutine. Not true. A module is more encompassing than a subroutine.

Consider an inventory program. A typical inventory program performs four primary operations: finding, updating, adding, and deleting records. You might expect these operations to form four major sections of the program. In fact, they may make up four minor parts: the major actions the program performs are those that the processes of finding, updating, adding, and deleting records have in common.

For instance, the program must be able to display records regardless of which operation it is performing. Since displaying a record shouldn't depend on which action is being performed, the record display subroutine should be a module.

Furthermore, at least three of the program's four primary operations require a previous step: looking up the record. To avoid duplication, it may be necessary to look up a record before adding it. Let's sketch the series of operations you would be likely to program for the primary task of adding records:

- Ask the operator to enter the key(s) used to find the record.
- Make sure each key is a valid possible entry.
- Search for a record that matches one or more of the keys. If one of the keys does match (and if duplicate keys are forbidden), issue an appropriate error message and quit the "add record" function.
- Allow entry of additional data into the record. Again, each item must be validated.
- Write the record to the data file.
- Update the key files so the record can be retrieved.
- Return to the main program menu.

Each of these steps may require many subroutines; each subroutine might be used by other program functions, such

# **PROGRAMMING**

as "delete record" or "update record." In short, the "add a record" function is not a subroutine, but rather a collection of steps organized to accomplish a particular job in the program. That's how I define the term "module."

# **Muddled Modules**

Organization is what defines a module, not whether it is a subroutine, a user-defined function, or something else entirely. Understanding the need for organization is extremely important if you want to create useful modules.

Suppose you write a modular inventory program and discover that a particular sequence of steps occurs in several modules. To save a few bytes, you might try setting the value of a special variable. This would allow you to do a GOSUB to the relevant section of one of the modules and check the value of the variable after the section executes. If the variable has a set value, you can then return to the original module.

In the end, you'll have a module with many ways of getting into it; some will be at the beginning, others will be in the middle. You'll also have many ways of returning.

Take my advice: never write this kind of module. If you absolutely need to save those bytes, put the section at the end of your program as a separate subroutine and call it from each module that uses those steps in that order.

A good module has one entry point (at the beginning) and one exit point. Additional exits may exist for one reason only: to handle errors. The only code in a module should be code that is relevant to it.

The worst kind of program you can write is one that is "sort of" modular, with a subroutine that should be somewhere else sitting right in the middle of a module. This practice makes a program almost impossible to read, generates unnecessary GOTOs, and makes the program run slower and use more memory.

If you pay attention to what you are doing when you write modules, you'll find they can make your programs faster, easier, and less prone to error. If you can't bring yourself to write programs this way, you'd be better off with a language that forces modularity on you.



Bruce Tonkin is an independent software developer, industry critic, and author of The Creator data base manager. You can reach him at 34069 Hainesville Road, Round Lake, IL 60073, 312-223-8595.

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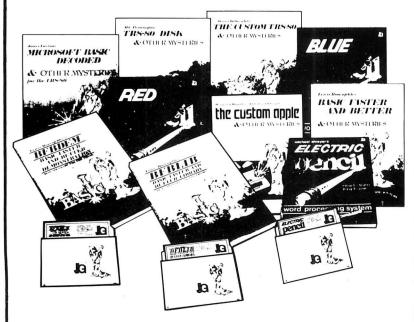
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# **Inside Information**

Problem 1: Model 4 MEMDISK has an annoying feature. When you back up your system files to the MEMDISK and then install the MEMDISK as disk zero with the System (System = ) command, your other drives are suddenly in the wrong order. What was drive zero becomes the highest-numbered drive, and the last one TRSDOS reads when it searches for files.

You can use Floppy/DCT and System to assign any logical drive number to any disk drive, but the process can become cumbersome. You should be able to swap drive numbers cleanly and efficiently.

Problem 2: I recently added a Radio Shack hard disk to my Model 4. I wanted to write a program that would "park" the head over an area with no data before I turned off the machine. The hard disk doesn't have a parking cylinder, but I decided it would be enough to move the heads over the highest-numbered cylinder, which contains data only if the drive is filled.

My dilemma was that I use many drive configurations on my Model 4. I might have a RAM disk or my hard disk as drive zero. I often use Logical Systems' diskDISK program to open "subdisks" and assign those disks to various drive numbers. A useful parking program would have to be able to decide for itself which logical drive numbers are connected to a hard disk.

Although the two problems above might sound unrelated, their solutions are similar. Unlike less sophisticated operating systems, TRSDOS 6 builds a number of special tables in memory that contain information about the present configuration of your computer.



# **System Requirements**

Model 4
TRSDOS 6.x
Basic
Assembly language
Editor/assembler



Program Listing 1. Program that reads the DCT and displays pertinent data.

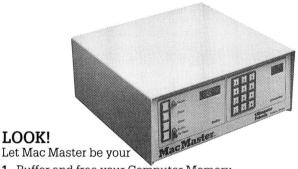
```
Demonstration program to display information stored by TRSDOS 6.x in the Drive Control Table (DCT)
2
                                                                                                          51
52
53
        This program uses the BASIC SVC routines presented
        here last April
                                                                                                        1119
792
10 DEFINT A-Z: CLS
20
    GOSUB 50100 'Initialize SVC routine
DEF FN BIT(X,Y) = ( (Y AND (2^X)) <> 0)
DEF FN PEEK.WORD(X) = CVI( CHR$(PEEK(X)) + CHR$(PEEK(X+1)) )
                                                         'Initialize SVC routines
                                                           @GTDCT Supervisory Call
    FALSE = 0: TRUE = -1
                                                                                                          103
110
        Main loop -- get information about each possible logical drive, 0 - 7
95
                                                                                                           111
100 FOR DRIVE = 0 TO 7
                                                                                                         1273
1080
        REG.C = DRIVE
REG.BC = FN REG.PAIR(0,REG.C)
REG.A = GTDCT
GOSUB 50000
110
                                                                                                         2025
1076
130
                                                          Load A with SVC number
140
                                                         'Call the SVC
     DCT.ADDR = REG.IY
GOSUB 1000
IF DRIVE <> 7 THEN PRINT
NEXT DRIVE
                                                          Get address of DCT entry
150
                                                                                                         1349
160
                                                         'Display information
165
170
                                                                                                         1810
172
175
      WHILE INKEYS = "": WEND
                                                                                                         1603
190
                                                                                                          154
     ' Display information about one drive
                                                                                                           162
995
                                                                                                           167
1000 PRINT USING "Drive #: "; DRIVE;
1005
                                                                                                           198
1010 IF PEEK (DCT.ADDR) = &HC9 THEN PRINT "Disabled": RETURN
                                                                                                         3908
1020 DRIVER.ADDR = FN PEEK.WORD(DCT.ADDR + 1)
                                                                                                        2761
1030 NAME LEN = PEEK (DRIVER. ADDR + 4)
1040 DRIVER.NAME$ = ""
1050 FOR LOOP = 1 TO NAME LEN
1060 DRIVER.NAME$ = DRIVER.NAME$ + CHR$(PEEK (DRIVER.ADDR + 4 +
        LOOP))
1070 NEXT LOOP
                                                                                                           897
```

Listing 1 continued

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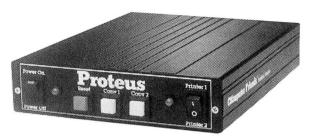
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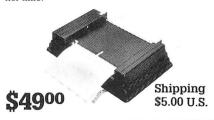


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# THE NEXT STEP

```
Listing 1 continued
 1080 PRINT"Dvr: ";DRIVER.NAME$;" at ";HEX$(DRIVER.ADDR);TAB(29);
                                                                                                                                                     4097
 1085
                                                                                                                                                     206
1770
 1090 FLAG1 = PEEK (DCT.ADDR + 3)
1100 HAG1 = PEEK(DCT.ADDR + 3)

1100 HARD = FN BIT(3,FLAG1)

1110 FLAG2 = PEEK(DCT.ADDR + 4)

1120 MAKCYL = PEEK(DCT.ADDR + 6)+1

1130 C.FIELD1 = PEEK(DCT.ADDR + 7)

1140 C.FIELD2 = PEEK(DCT.ADDR + 8)
                                                                                                                                                     1548
1765
                                                                                                                                                     1990
1956
                                                                                                                                                      1959
1150 DIRCYL = PEEK (DCT.ADDR + 9)
1160 IF HARD THEN GOSUB 3000 ELSE GOSUB 2000
                                                                                                                                                     2643
713
1994
                                                                                                                                                        215
 1995
                Information for floppy disks
                                                                                                                                                       216
217
 1996
2010 PRINT "Floppy / ";
2010 IF FN BIT(7,FLAG1) THEN PRINT " WP / ";ELSE PRINT "NWP / ";
2020 IF FN BIT(6,FLAG1) THEN PRINT"DDEN / ";ELSE PRINT"SDEN / ";
2030 IF FN BIT(5,FLAG1) THEN PRINT "8"+CHR$(34); ELSE PRINT "5"+
                                                                                                                                                      1527
3790
                                                                                                                                                      3863
                                                                                                                                                      4233
3636
 2040 IF FN BIT(4,FLAG1) THEN PRINT" / 0.5 ";ELSE PRINT" / 1.0 ";
2050 PRINT "settle": PRINT SPC(7);
2060 STPP.RATE = (-2 * FN BIT(1,FLAG1)) - FN BIT(0,FLAG1)
2070 PRINT USING "Step \\ ms / ";MID$(" 3 61015",STEP.RATE*2+1,2
                                                                                                                                                     2425
3225
                                                                                                                                                      4020
 2080
           IF FN BIT(5,FLAG2) THEN PRINT "2-side / "; ELSE PRINT "1-si de / ";
 2090
                                                                                                                                                      4416
 2100 PHYS.DRIVE = FLAG2 AND 15: PRINT USING "pd # / "; PHYS.DRIVE
                                                                                                                                                      4074
 2110 PRINT USING "### Cyl / ";MAXCYL;
2120 PRINT USING "## Sec / ";(C.FIELD1 AND 31)+1
                                                                                                                                                      2271
 2130 PRINT SPC(7);
2140 PRINT USING "## gpt / ";((C.FIELD2 AND 224) \ 16) + 1;
2150 PRINT USING "## spg / ";((C.FIELD2 AND 31)+1;
2160 PRINT USING "Dir trk ##";))RCYL;
                                                                                                                                                      1084
                                                                                                                                                      3335
2879
 2160 PRINT
2170 RETURN
                                                                                                                                                     2483
714
 2994
                                                                                                                                                       216
217
           ' Information about hard drives
 2996
                                                                                                                                                       218
                                                                                                                                                     1341
 3010 IF FN BIT(7,FLAG1) THEN PRINT" WP / ";ELSE PRINT"NWP / ";
3020 PRINT " / ";
3030 IF FN BIT(5,FLAG1) THEN PRINT "8"+CHR$(34); ELSE PRINT "5"+
                                                                                                                                                      3727
 CHR$(34);
3040 PRINT
                                                                                                                                                      4234
 3050 PRINT SPC(7);
3060 PRINT USING "Drv Cod # / ";FLAG1 AND 3;
                                                                                                                                                     628
                                                                                                                                                      2715
 3080
                                                                                                                                                       203
 3090 PRINT "DBLBIT ";: IF FN BIT(5,FLAG2) THEN PRINT " on / "; E LSE PRINT "off / ";
                                                                                                                                                      5065
LSE PRINT "OIT / ";
3100 PRINT USING "Head ## / ";FLAG2 AND 15;
3110 PRINT USING "### Cyl / ";MAXCYL;
3115 PRINT USING "# hd / ";((C.FIELD1 AND 224)/32)+1;
3120 PRINT USING "## Sec ";(C.FIELD1 AND 31)+1
                                                                                                                                                      2557
2272
                                                                                                                                                      3000
                                                                                                                                                      2691
 3130 PRINT SPC(7);

3140 PRINT USING "## gpt / ";((C.FIELD2 AND 224) \ 16) + 1;

3150 PRINT USING "## spg / ";(C.FIELD2 AND 31)+1;

3160 PRINT USING "Dir trk ##";DIRCYL;

3170 RETURN
                                                                                                                                                      1085
3336
                                                                                                                                                      2880
                                                                                                                                                      2484
                                                                                                                                                        715
  49997
                                                                                                                                                        278
  49998 'Handle an SVC call -- SVC number is in REG.A%
                                                                                                                                                        279
  49999
                                                                                                                                                        280
  50000 REG.AF% = FN REG.PAIR% (REG.A%,0)
                                                                                                                                                     2170
 50000 REG.AF* = FN REG.PAIL
50001 REGISTER*(1)=REG.AF*
50002 REGISTER*(2)=REG.BC*
50003 REGISTER*(3)=REG.DE*
50004 REGISTER*(4)=REG.HL*
50005 REGISTER*(5)=REG.IX*
                                                                                                                                                     1559
1559
                                                                                                                                                      1565
                                                                                                                                                      1593
  50006 REGISTER%(6)=REG.IY%
                                                                                                                                                      1596
1645
  50007 \text{ SVC} = \text{VARPTR}(\text{SVC} * (1))
 50000 REGISTERS = VARPTR(REGISTER%(1))
50009 CALL SVC% (REGISTERS%)
50010 REG.AF% = REGISTER%(1)
50011 REG.BC% = REGISTER%(2)
50012 REG.BC% = REGISTER%(3)
                                                                                                                                                     2483
1721
                                                                                                                                                     1623
1623
                                                                                                                                                      1629
                                                                                                                                                      1642
 50014 \text{ REG.IX} = \text{REGISTER}(5)
                                                                                                                                                      1657
50015 REG.IY% = REGISTERE(),
50016 REG.A% = REG.AF% \ 256
50017 REG.F% = REG.AF% MOD 256
50018 Z.FLAG% = ((REG.F% AND 64)=64)
50019 C.FLAG% = ((REG.F% AND 1) = 1)
                                                                                                                                                      1660
                                                                                                                                                      1532
                                                                                                                                                      1670
                                                                                                                                                      1951
                                                                                                                                                      1879
             RETURN In:
                                                                                                                                                        759
260
 50096
 50097
                      Initialize data handler
                                                                                                                                                       261
262
  50098
                      Call this section once at the beginning of the program
                                                                                                                                                     263
2910
  50099
  50100 DIM REGISTER%(6), REGISTERS%, SVC%(27), SVC%
50102 DIM REG.AF%, REG.BC%, REG.DE%, REG.HL%, REG.IX%, REG.IY%
50104 DIM REG.AF%, REG.F%, REG.B%, REG.C%, REG.D%, REG.E%, REG.H%
                                                                                                                                                      3616
              REG.L%
                                                                                                                                                      4057
  50106 DIM Z.FLAG%, C.FLAG%
50108 DEF FN REG.PAIR%(X%,Y%) = CVI(CHR$(Y%)+CHR$(X%))
                                                                                                                                                      1497
                                                                                                                                                      3056
                                                                                                                                                     1108
885
717
 50110 RESTORE 50130
50112 COUNT% = 1
  50114 READ O%
 50114 KEAD Q$
50116 WHILE Q$ <> 1
50118 SVC*(COUNT*) = Q$
50120 READ Q$
50122 COUNT* = COUNT* + 1
                                                                                                                                                     1047
1378
                                                                                                                                                        778
                                                                                                                                                      1487
                                                                                                                                                       586
                                                                                                                                Listing 1 continued
```

Those tables are easily available via supervisory calls (SVCs). Once you understand how the tables are organized, you can write programs to read or change the information in them.

All three demonstration programs this month use TRSDOS 6's drive control table (DCT), which contains a wealth of information about your system's disk drives crammed into 80 bytes. Several TRSDOS commands and utilities use the DCT; programs can also access it directly to read or change information.

# Inside the DCT

The DCT holds eight 10-byte records. The first record has information about drive zero, the second about drive 1, and the last about drive 7. When TRSDOS searches your disks for a file, it looks at logical drive zero first and then moves through the DCT, one drive at a time, until it finds the file. The physical order of drives, and the control program for each, is unimportant. The order of entries in the DCT determines which physical device is associated with which logical drive number.

The easiest way to find entries in the DCT table is with the @GTDCT supervisory call, which will point the IY register pair to the record associated with any drive number. From that point on, your program must be able to decipher the information in the DCT for itself. The organization of the DCT is explained in both the Model 4 Technical Reference Manual and Roy Soltoff's Programmer's Guide to LDOS/TRSDOS Version 6 (now out of print).

The information in the DCT for 5-inch floppy drives is easy to understand and use. TRSDOS contains the low-level routines that read and write to floppy drives; you can depend on the DCT entries for floppy drives to be consistent.

However, TRSDOS does not contain the necessary routines for low-level access of hard drives. If you purchase a hard disk drive, you must also buy and install the necessary software to run it. Some of the fields in the DCT entries for hard disks are left to the discretion of the author of the low-level software. Program Listings 1 and 3 assume that you are using Radio Shack's hard disk software; you might have to modify the programs somewhat if your hard disk and/or its software were supplied by a third-party vendor.

Listing 1 is a short Basic program that reads the DCT and displays much of the information it contains. It uses the Basic SVC handler that I presented here last April to find the DCT entries for each logical disk drive. To get as much information as possible onto the screen, I needed to use several abbreviations.

# THE NEXT STEP

# **Only Logical**

The program begins by determining whether each logical drive is active. If it finds an inactive drive, it displays the word "Disabled" and then looks for the next drive.

If a drive is enabled, the program displays the module name of the software that runs the drive and the address (given in hexadecimal notation) of the entry point into that software. All normal floppy drives are run by a routine called \$FD; the address of the routine depends on which version of TRSDOS 6 you are using.

Next, the program determines whether the logical disk is connected with a floppy or hard disk drive. Because this is indicated by a single bit, drives that are neither hard nor floppy (MEM-DISKs, diskDISK disks, etc.) must decide how they want to be known to the system. Most select to reset the bit so that TRSDOS recognizes them as floppy disk drives.

The program then reads the write-protect bit. If that bit is set, the logical disk is software write-protected and "WP" is displayed. Otherwise, the program displays "NWP" to show that the drive is not software write-protected.

Floppy drives can hold either singleor double-density disks. The density bit will be set according to the last successful disk access on a particular drive. The program displays the status of that bit only for floppy drives; the question of density is meaningless for hard disks, which always use the recording density that the physical hard drive and its controller were designed for.

Whenever your computer accesses a floppy drive, the software has to wait for the drive to come up to speed and the head to settle. The low-level floppy disk software in TRSDOS can allow either one or one-half second for this settling time.

Listing 1 displays this settling time as the last item on the first line of each drive specification. Although a settling time is also shown for memory disks, the MEM-DISK software is smart enough to ignore that figure and immediately access the "disk" in memory.

The information on the second display line for each drive depends on whether the DCT record is associated with a hard or floppy drive. For floppy drives, the first piece of information is the drive step rate (assuming that you have the system clock set to fast, or 4 MHz). Next is a description of whether the disk has one or two sides, and the physical drive number (abbreviated "pd") for that drive.

The disk controller in a Model 4 can

```
Listing 1 continued

50126 RETURN
50128 ' * 256
50130 DATA 9086, 28518, -6695, 8661, 0, -11803, 14835, -1575 '* 2976
50132 DATA -15887, -7727, -7715, -7683, -5159, -5319, -1031 '* 2931
50134 DATA -4135, -5159, -1549, -9749, -6659, -6691, -10779 '* 2947
50136 DATA -2619, -1575, -11781, -9759, 201 '* 2196
50138 DATA 1, 'Dummy value to mark end of list '* 696
```

Program Listing 2. Program for swapping any two logical drive assign-

```
00100 ;
                  Model 4 -- Logical Drive Swap Utility
00110
00120
                  Use with TRSDOS 6.2
00130
00140
00150
00160
          SVC's used:
00170
00180
00190 @KEYIN
00200 @DSPLY
                             09H
                  EOU
                             OAH
00210 @EXIT
                             16H
00220 @GTDCT
                  FOIL
00230 @CLS
                             69H
                  EQU
00240
00250 ETX
00260 LF
                  FOII
                             03H
00270 CR
                  EOU
00290
           Macro commands
00300
00310 SVC
                  MACRO
                             A,#NUM
28H
00320
                  LD
                  RST
00330
00340
                  ENDM
00350
00360 PRINT
                  MACRO
                             #ADDR
                             HL, #ADDR
00370
                  SVC
00380
                             @DSPLY
00400
00410 RANGE
00420
                             #LOW, #HIGH, #NO
                  MACRO
                  CP
                             C. #NO
00430
                  .TR
                              #HTGH+1
00450
                  JR
                             NC, #NO
                  ENDM
00470
00480 GET1
                  MACRO
                             HL, KEYBUF
                   LD
00490
                                                   ;B=2, C=0
00500
                   T.D
                             BC.2<8+0
00510
                   SVC
                                                   :Key to A
00520
                  T.D
                             A. (HL)
00540
 00550
00560 ;
 00570
                   ORG
                              3000H
 00580 START
                   SVC
                                                   :Log-in message & prompt
 00590
                   PRINT
                              HELLO
                                                   ;Storage for drive number
;Ask for first drive
;Get first drive
;Leave on <Break>
 00600
                   PRINT
 00610 GETA
                              PROMPT1
                   GET1
 00620
                              C, LEAVE
 00630
                   JR
                                                   ;Legitimate response?
;Save in message
;ASCII to binary
                   RANGE
                              (DRVA),A
 00650
                   LD
                   SUB
                              101
 00660
 00670
                   I.D
                              (TX).A
                                                   :And save
                                                   ;Show second prompt
;Get drive number
 00680 GETB
                   PRINT
                              PROMPT2
 00690
                   GET1
                                                   ;Leave on <Break>
;Test range of answer
;Save in message
                              C, LEAVE
                   JR
 00700
 00710
                   RANGE
                              (DRVB),A
                                                   Convert to binary; Same as first?; No -- go; Else display 'no dups'
                   SUB
 00730
                               0
                   CP
                              (IX)
                              NZ, SWAP
 00750
                   JR
 00760
00770
                   PRINT
                              DIIPI.
                                                    ;And start again
                   JR
 00780
                                                    ;Show 'no error';And go
                              @EXIT
                   SVC
 00800
           2 valid replies, swap entries in DCT
 00820 :
 00830
                                                    ;Drive 2 stored in C
;Get DCT address
 00840 SWAP
                              C,A
                              @GTDCT
 00850
                   SVC
                                                    ;Save address
;Get drive l in C
;IY==> drv l address
                              IY
C,(IX)
                    PUSH
 00870
                    LD
                    SVC
                                                                                      Listing 2 continued
```

# THE NEXT STEP

```
Listing 2 continued
                                                                    ;IX==> drv 2 address
    00890
                           POP
   00900
                           I.D
                                         B,10
                                                                    ;Swap 10 bytes
;Get byte from one DCT
                                         A, (IX)
D, (IY)
(IX),D
   00910 S10
                           LD
   00920
                           T.D
                                                                         and byte from other DCT
   00930
                                                                    ;Switch bytes
                           LD
                                         (IY),A
   00940
                           T.D
                                                                    ;Bump both pointers
   00960
                           TNC
   00970
                           DJNZ
                                         S10
                                                                    ;Repeat 10 times
   00980 ;
   00990
                           PRINT
                                         SUCCESS
                                                                    ;Report success
;And back to TRSDOS
   01000
                                         LEAVE
   01010
   01020
01030
                  Messages
                                        'TRSDOS 6.2 drive-swap utility',LF,LF
'Enter numbers of two logical drives to swap.',CR
LF,'First drive ==> ',ETX
LF,'Second drive ==> ',ETX
LF,LF,'You must specify two different drives',CR
LF,'Drive '
'0.successfully exchanged with Drive '
   01040 HELLO
                           DB
   01050
                           DB
    01060 PROMPTI DR
    01070 PROMPT2 DB
01080 DUPL DB
                           DB
    01090 SUCCESS DB
01100 DRVA DB
    01110 DRVB
    01120
    01130 HOLD
01140 KEYBUF
                           DS
DS
    01150
    01160
                                         START
                                                                                                                                 End
```

### Program Listing 3. Disk park utility. 00100 00110 00120 Hard disk PARK utility for TRSDOS 6.2 00130 Note: This program is meant to work with drives 00140 that are partitioned by head only. 00150 If your hard disk is partitioned by cylinder, you will need to modify this program before using it. 00170 00180 00190 00200 00210 SVC's used: 00220 00230 **ØKEY** 00240 @DSPLY EOII DAH @RDSEC 00260 EOU 31H 00270 00280 @GTDCT 00290 00300 ETX EOU 03H EQU OAH 00310 CR FOIL 00320 00330 Macro commands 00340 ; 00350 svc MACRO #NIIM A, #NUM 28H 00360 LD RST 00370 00380 ENDM 00390 ; 00400 PRINT MACRO #ADDR 00410 HL, #ADDR SVC @DSPLY 00430 00440 ENDM 00450 00460 00470 ORG 3000H 00480 START PRINT ;Log on and ask permission ;Get yes/no response ;If Yes -- find hard drive ;Else show 'No Error' 00490 CALL YESNO 00500 Z,FINDRV OUT 00510 LD 00520 SVC @EXIT NODRY PRINT 00540 NOFTND Report no hard drive found 00550 00560 ERROUT HL,-1 @EXIT :Show error on exit SVC 00570 00580 FINDRY ;Start with drive 0 ;Test for end of drive list ;Are we there? ; Yes -- leave ;Else IY==> drive cntrl table ;Get active/inactive status LD C, 0 00590 F1 LD CP A, 8 C Z, NODRV 00610 JR 00620 00630 SVC @GTDCT A, (IY+0) LD CP JR 00640 ;Is this drive active? NZ,F2 :No -- go 3, (IY+3) NZ, MOVHEAD 00660 BIT Test FLAG1 for hard disk ;If hard, then go ;Else get next drive # ;And loop back 00680 F2 TNC 00690

The Model 4
disk controller
can handle
up to four
physical floppy
disk drives.

handle up to four physical floppy disk drives, known to the system as numbers 1, 2, 4, and 8. These numbers are associated with the control lines used to access the drives and do not necessarily bear any relationship to the logical drive numbers (zero to 7) that are associated with the drives.

Following the physical drive number for each floppy drive is a count of the number of cylinders (or tracks) on the drive and the number of sectors per cylinder.

For hard disks, the second line of information begins with a drive code, which is the number of the hard drive unit. The first hard drive is unit zero; if you use non-Radio Shack hard drive software, this number might be incorrect.

Following the drive code is a field which either says ''DBLBIT on'' or ''DBLBIT off.'' TRSDOS's directory structure allows a maximum of 203 cylinders (or tracks) per disk. Some high-capacity hard disks, however, have more than 203 physical cylinders. If the DBLBIT flag in the DCT is on, it is a signal to the low-level hard disk software that each of the logical cylinders must be mapped onto two physical tracks. Using DBLBIT, hard disks with up to 406 cylinders per logical drive can be used.

Following the DBLBIT flag is the number of the starting drive head for this logical drive, followed by the number of logical cylinders, the number of drive heads used for this drive, and the number of sectors per cylinder. The starting head and the number of heads might be incorrect for non-Radio Shack hard drive software.

The last line of information for each drive is exactly the same for both floppy and hard disks. The first field shows the number of granules allocated for each track (GPT) on the disk; the second field shows the number of disk sectors for each granule (SPG). A granule is simply the smallest possible allocation unit on a disk. If you multiply the sectors per granule by 256, you can calculate the minimum number of bytes that can be allocated to a file. TRSDOS uses the number of granules per track to determine which track and sector should be

Listing 3 continued

read to find a particular file.

The last piece of information is the logical number of the track or cylinder that contains the disk directory. That information is also stored in the first (or boot) sector of each disk. When TRSDOS logs in a new disk, it stores the directory sector number in the last byte of that disk's DCT.

The Listing 1 program is straightforward. It begins by defining two user functions that make the rest of the program easier to understand. The first tests a bit in a given byte and returns a value of true (or -1) if that byte is set or on. The second is a 2-byte PEEK function that appears to read an entire 16-bit word from memory and return its value in an integer variable.

The information that Listing 1 displays might be interesting, since you can otherwise get that much information about your system's drives only by using a number of utilities plus some deductive reasoning and a set of calculations. The program shows what kind of information is available in the DCT and how it can be found.

# Swap Talk

Listing 2 is somewhat more useful. It lets you swap any two logical drive assignments. It works by exchanging the 10-byte records of any two drives in the DCT. After the records have been swapped, the drive numbers that are used to access those drives will also have been traded.

This program solves the problem of misordered disk drives with MEMDISK. Assume that you have a two-drive 128K Model 4. If you install a MEMDISK and make it your system disk, your normal drive zero will be drive 2. To put your drives back in a logical order, you could swap drives 1 and 2, leaving you with the MEMDISK as drive zero, the bottom (or left) floppy as drive 1, and the top floppy as drive 2.

The drive-swap program holds one danger. Drive zero must contain the TRSDOS system files. If it doesn't, the computer is likely to hang up in a series of error messages. If you use Listing 2 to establish a new drive zero, be sure that the new drive contains all the system files that you will need.

The last program this month, Listing 3, is a disk park utility that moves a hard disk's heads to the inside of the disk and then enters an endless loop. After you run Park, you will need to reboot your computer to use it again.

Listing 3 assumes that you have configured your hard disk as either one single logical drive, or that you have partitioned it according to drive heads. It will work with the Radio Shack hard

```
Listing 3 continued
00700
                                HL, SECBUF
00710 MOVHEAD LD
                                                       ;HL==> Buffer for sector
00720
                    CALL
                                HISEC
                                                       ;Get top sector in E
                                                       ;D = # of last track
;Read that sector
;Go if everything okay
                    LD
                                D, (IY+6)
                    SVC
00740
                                PRDSEC
                    JR
                                Z, HOLD
                                                               print message
00760
                    PRINT
                                BADSEC
00770
                    JR
                                                       :And leave
00780
00790 HOLD
                    PRINT
                                DONE
                                                       ;Report success
00800
                    DI
                                                       ; No interrupts during pause
00810 TOOP
                    JR
                                LOOP
                                                       ;Stay here forever
00820 ;
              Yes/No routine
00830
00840
                    PRINT
00850 YESNO
                                VN
                                                       ;Display Y/N prompt
;Wait for keystroke
                    SVC
                                @KEY
                                                       ;Force to uppercase
;Was it 'Y'es ?
00870
                    AND
                                ODFH
00000
00890
                    RET
                                                       ; Z-flag set on Yes
00900
00910
                Find number of last sector per logical track
00920
00930 HISEC
                    LD
                                A, (IY+7)
                                                       ;Pick up Config byte 1 ;Strip head info
00940
                    AND
                                1 FH
00950
                    LD
BIT
                                E.A
                                                               in E
                                                       :Save
                               3, (IY+4)
Z
                                                       ;Is DBLBIT on?
;No -- return
00960
00970
                    RET
00980
                                E
                    INC
                                                       ;Make count relative to 1
00990
                    SLA
01000
                                E
                                                       :Make count relative to 0
                    DEC
01010
                    RET
01020
01030
              Messages
01040
                                'Hard Disk PARK Utility', LF, LF
'This program will move the hard disk heads to the inner', LF
'track and then "freeze" the computer. After running this', LF
'program, you will not be able to use the computer without', LF
'rebooting.', LF, LF, 'Do you wish to continue ', ETX
01050 HELLO
                    DB
01060
01070
                    DB
01080
01090
                    DB
01100
                    DB
                                '(y/n)? ',ETX
01120
01130 NOFIND
                    DB
                                'Could not find a hard drive in the system.',LF 'Program aborted.',CR
01140
                    DB
01150
                                'Sector read error.',LF
'Program aborted.',CR
01160 BADSEC
                    DB
01170
                    DB
01180
                               LF, LF, 'Hard drive heads are parked.', LF 'Turn off system or reboot.', CR
01190 DONE
                    DB
01200
                    DB
01210 ;
01220 SECBUF
                    DS
                                256
                    END
                                START
01240
                                                                                                                  End
```

disk software drivers for the Model 4.

However, if you have partitioned your hard disk by cylinders, the program will not perform a legitimate parking operation. How you modify the program to work with your system will depend on the hard disk configuration that you have created. You will probably want to move the heads to the highest-numbered track of the innermost cylinder in the hard drive. To do so will require either that the program know ahead of time how you have configured your system or that it prompt you for the number of the logical drive that uses the highest-numbered physical cylinders.

## A Final Note

When your programs start tweaking the bits in the DCT, they are working at a very low level in TRSDOS. One small bug in your program can potentially destroy all the directory or data on an entire disk.

If you decide to assemble Listings 2 and 3 for yourself, I strongly suggest that you take some sensible precautions. If

you have a hard disk, turn it off or disconnect it from your Model 4 before you run your program for the first time. Use floppies that contain unimportant data. Once you are convinced that a program is working correctly, then you can turn everything back on for a final check.

These programs work properly on my system, a 500K Model 4 with a 15-meg hard disk run by Radio Shack's hard disk software and three (at the moment) floppy disk drives. Please make sure that they work correctly on your system before you entrust your important data and programs to them.



Write Hardin Brothers at 280 N. Campus Ave., Upland, CA 91786. Enclose a stamped, self-addressed envelope for a reply. You can also contact Hardin on CompuServe's WESIG (PCS-117).

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# How to Use 80 Micro Program Listings

Basic program listings in 80 Micro now include a checksum value at the end of each line. This value is the sum of the ASCII values of all characters and spaces in the line, excluding remarks. With our Checksum program, you can use these values to test the accuracy of your typing after you copy listings from the magazine. Also, for easy reading, listings are formatted so that each new program line is set off on the left.

To check your typing, follow these steps:

- Type in program code *exactly* as listed, omitting the indentations when program lines continue to a second or third magazine line, the '\* characters and checksum values, and any comments after a program statement.
- Save the program in ASCII format with the command SAVE "file name", A.
- Load and run Checksum (see the Program Listing). The program will prompt you for the name of the file to be verified and give you the option of sending the

line numbers and checksum values to the printer or to the screen. Enter 1 for printer, 2 for screen.

• Compare the displayed line numbers and checksum values with the check-

sums shown in the listing. Find and correct errors in lines having checksum values that don't match.

—Beverly Woodbury Technical Editor

```
Program Listing. Checksum.
10 'CHECKSUM/BAS by Beverly Woodbury -- 2/7/86
20 CLEAR 1000 :CLS:PRINTel40, "VERIFY CHECKSUMS ON PROGRAM"
30 PRINT:PRINT:INPUT "Enter name of File to verify";F$
40 PRINT:PRINT TERINT "List Checksums to:"
50 PRINT TAB(10) "1. Printer":PRINT TAB(10) "2. Screen"
60 PRINT:PRINT:PRINT TAB(30);:INPUT C
70 OPEN "1",1,F$
80 IF EOF(1) THEN CLOSE:END
90 LINEINPUT#1,L$:L=VAL(LEFT$(L$,6))
100 A=VARPTR(L$):GOSUB 210 :Q=PEEK(A)
110 LS=PEEK(A+1):MS=PEEK(A+2):A=MS*256+LS:GOSUB 210
120 FOR K=1 TO 0.P=PEEK(A):CS=CS+1.A=A+1.NEXT K
                                                                                                                                                                                                                                                                                       97
3746
                                                                                                                                                                                                                                                                                       4278
                                                                                                                                                                                                                                                                                        3638
2484
                                                                                                                                                                                                                                                                                       857
1673
                                                                                                                                                                                                                                                                                       2202
2299
                                                                                                                                                                                                                                                                                        3170
 110 LOSPERN (AT1): MSSEREE (AT2): ASMS*256+LS: GOSUB

120 FOR K=1 TO Q: JP=PEEK (A): CS=CS+P: A=A+1: NEXT K

130 IF CS=0 OR L=0 THEN 80

140 IF CS<10000 THEN DS="-"

150 IF CS<10000 THEN DS="-"

160 IF CS<1000 THEN DS="-"

170 IF CS<1000 THEN DS="-"
                                                                                                                                                                                                                                                                                        1500
                                                                                                                                                                                                                                                                                        1485
1470
                                                                                                                                                                                                                                                                                        1455
2693
  180 IF C=1 THEN LPRINT "Line";L;D$;CS:CS=0
190 IF C=2 THEN PRINT "Line";L;D$;CS:CS=0
  200 GOTO 80
210 IF A>32767 THEN A=(65536-A)*-1
                                                                                                                                                                                                                                                                                        1831
  220 RETURN
```

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В.	On a scale of 1 (no interest) to 5 types of programs published in1. Business applications2. Science/math applicatio3. Home management app	80 Micro:		anagement applications
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Continued from p. 34

can load your program and then turn it off. In fact, I used rechargeable batteries in the drive and found them to have sufficient life in spite of a power capacity of approximately one-fourth the life of alkalines per charge.

# A Skimpy DOS

The Tandy drive doesn't come with a full disk operating system (DOS). Only seven commands—Files (directory), Load, Save, Backup, Kill, Name, and Format—are provided. You enable them by running a 3K machine-language program and invoke them with the function keys. You can use these commands only through the program provided. Calling them from within your own Basic or machine-language programs would require special programming effort and a knowledge of the Tandy operating system.

If you aren't familiar with  $3\frac{1}{2}$ -inch disks, you'll be pleasantly surprised. Unlike fragile  $5\frac{1}{4}$ -inch floppies,  $3\frac{1}{2}$ -inch disks are enclosed in hard plastic and have a metal hub. A metal shutter closes over and protects the disk surface when it is out of the drive.

The manual is easy to read and to the point. It describes the drive, the disks, installation, and system setup. A section on the file management program explains the start-up procedures and commands. A third section explains the error messages and what they mean. The appendices contain specifications and a wiring diagram. It would have been nice if Tandy had included a memory map of routines so programmers could utilize and access the program from other applications.

Using the Portable Disk Drive is a pleasure. The drive is connected solidly to the computer's RS-232 interface by a small 3-foot cord. I preferred using battery power even at home, since the computer's power supply, the drive's power supply, and the drive cable create a jumble of wires. In a hotel room or elsewhere on the road, wall outlets can be in short supply, so I'd recommend carrying an extension cord for the power supplies.

## Conclusion

While the Tandy drive has only a barebones operating system, third-party software developers are already planning enhancements. With more powerful software, the drive could help rejuvenate the Model 100 market.

Even without enhancements, though, the disk drive is a winner. Its low price has already attracted users who recognize a bargain, and Tandy has had problems keeping up with the demand. This is the peripheral that Model 100/200 owners have been waiting for.

# Inner Space by Hardin Brothers

\*\*\*

**Superdisk** runs on the Models I, III (48K), and 4 (64K and 128K) and requires one disk drive. Intellitech Corp., 21 Campbell Drive, Dix Hills, NY 11746. 516-462-6970. \$49.95.

If you use NEWDOS/80, you may have envied the memory extension boards and RAM disk programs that run under TRSDOS 6.x and LDOS 5.x. With Intellitech's Superdisk program, you no longer have to choose between working with a restricted 64K computer and changing operating systems. Superdisk lets NEWDOS/80 users allocate all banked memory in the computer or any part of it to a very fast RAM disk.

Until you have used a RAM disk, it's difficult to imagine how much more powerful your computer will seem when it can load and save files almost instantaneously. You won't have to wait for system overlays to load before library commands are executed, or for Basic to load its overlays while it is running a program.

# A Bit Confusing

At first, Superdisk seemed to be very easy to use. Once I copied the program onto my normal system disk, a single Superdisk command promptly created a 448K RAM disk in the banked memory of my 512K Model 4. It took only a couple of seconds to format this new disk with the NEWDOS Format routine, a minute or two longer to back up all of the files from my system disk to the RAM disk. Then, following the instruction manual, I ran Superdisk once again to make the RAM disk my system disk.

Next, I decided to move the programs from another disk into the RAM drive. NEWDOS/80 started to copy the files correctly but soon stopped and reported that the RAM disk directory was full. I went back through the Superdisk manual and boot-up procedure more carefully, and realized that I had a 448K disk with only 64 directory slots. Suddenly, the RAM disk did not seem nearly so useful.

I read back through Superdisk's 10-page manual several times, looking for instructions about how to increase the size of the directory. The manual is generally very clear, but it only hints that it's possible to establish PDRIVE settings for the RAM disk; it never explicitly describes how to do so.

I then went back to my NEWDOS/80 manual to find the problem. After some study and further experimentation, I finally solved the puzzle and was able to create a RAM disk with 224 directory slots.

Superdisk lets NEWDOS/80 users allocate all banked memory to a fast RAM disk.

If I used NEWDOS/80 more frequently, I would probably have realized quickly how to change the RAM disk directory size. However, a less experienced user might not even realize that it's possible to specify directory size.

A 448K RAM disk (or 960K RAM disk in a 1-megabyte computer) certainly needs more than 64 directory slots. Superdisk automatically optimizes all the PDRIVE settings for a RAM disk, except DDGA (directory size)-an unfortunate omission. You must set that parameter explicitly to make a useful RAM disk, a fact the manual doesn't mention. If you are already using four disk drives with NEWDOS/80 2.1, you will have to give up one of the drives when you use Superdisk. But that's a flaw in NEWDOS, rather than in Superdisk. With NEWDOS 2.5, the RAM disk can become any of the eight possible logical disk drives.

You can use Superdisk even if your computer has only the standard 48K or 64K of main memory. In such a configuration, Superdisk creates a small RAM disk in main memory. For special purposes, a main-memory RAM disk might be useful, but both the remaining main memory and the RAM disk will probably be too small to be used on a regular basis.

## Conclusion

Superdisk seems to work fine with NEWDOS/80 2.1 and is supposed to be compatible with version 2.5 (a feature I was not able to test). It should work with any program that respects the HIMEM setting (you can place the main Superdisk module anywhere in memory) except for those few programs that bypass the DOS and directly access the physical floppy drives. One of Superdisk's nice features is that it can recover the RAM disk data after a reboot.

If you enjoy using NEWDOS/80, you should seriously consider adding Superdisk and a memory board to your computer. Any thoughts that you may have had about switching to a more powerful computer will soon disappear.

# sues

July 1984: Guide to Disk Operating Systems, GW-Basic, and a Machine-language minimizer.

August 1984: Games issue, Model 4 ED-TASM, dBase II, Scripsit extras, and quality sales reports.

September 1984: Disk drive repair and maintenance and a guide to Editor/Assemblers.

October 1984: Bar codes, educational programs for teachers and speech synthesis.

November 1984: Special utilities issue, cassette Basic enhancements, and a hybrid text editor.

December 1984: Gift guide, football strategy game, wind chill calculator, and an easy data base manager.

January 1985: Basic compiler, Scripsit enhancements, custom graphics characters, and TRSDOS 1.3 patches.

February 1985: Line and bar graph program, GW-Basic, and easy Assembly-language programming.

March 1985: Tandy's 1200 HD reviewed, fathom disk error messages and salvage flawed disks, and a deluxe graphics editor. April 1985: Hi-res line and bar graphs, Tandy's 1000, and a Model 4 disk zap utility.

May 1985: Tandy's DeskMate reviewed, combat simulator, quide to surge protectors, and restricted input entry program. June 1985: Tandy 1000 tips and hints,

added strength for your DOS, more workspace with SuperScripsit, and Critical Path Scheduling.

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# **REVIEWS**

# A Reasonable Facsimile

# by John B. Harrell III

# \* \* \*

**CPEmulator** runs on the Tandy 1000/1200/2000 and requires 256K, MS-DOS 2.x, and one disk drive. GTEK Inc., P.O. Box 289, Waveland, MS 39576. \$199.95.

hile many observers see the CP/M market as dead, there are still good reasons to run CP/M. You can find certain programs that don't exist in MS-DOS versions, and the amount of public-domain CP/M software is overwhelming.

CPEmulator and Speed Kit are a software/hardware package that lets you run many CP/M programs on an MS-DOS computer. CPEmulator is a software Z80 emulator that runs on IBM PC compatibles (including the Tandy 1000/1200/3000) and on the Tandy 2000. Speed Kit, for 8088-based computers only, provides a NEC V20 replacement CPU (central processing unit) and an 8080 software emulator based on the V20.

The package works as advertised and is easy to use, but, depending on your computer, you can pay a heavy performance penalty to run CP/M software on a non-CP/M machine.

# **How It Works**

The package comes with only 24 looseleaf pages of documentation. Of these, six pages cover the Speed Kit, including replacing the 8088 chip with the V20.

The CPEmulator program is a snap to install: its files are contained on an MS-DOS disk and you simply copy them to a work disk or hard disk. Unlike other such programs, CPEmulator binds the emulator to the Z-80.COM file. You can use any CP/M program just as you would a regular MS-DOS program. This is the beauty of CPEmulator.

The first step is to transfer your CP/M operating system and all of its associated files to your MS-DOS disk format. The disk provided with CPEmulator contains a utility, COPYCPM, that transfers files to or from your MS-DOS disks, but it does it on the host machine. You simply invoke the utility and tell it what you want to copy.

With COPYCPM, you can specify files by name or use a wild card, as with the DOS Copy command. CP/M files with the .COM extension are copied to an MS-DOS equivalent with the .B80 extension. This prevents you from executing the program file until you have completed the next step. COPYCPM shows you di-

rectories of the target and source disks while you are setting up.

The next step is to bind the emulator software to the CP/M operating system, which is now in the .B80 file. This operation requires only one command for each CP/M program to be converted.

CPEmulator, like other CP/M systems, emulates its own version of terminal support, and you have to install your software properly for the new CP/M system. If you have never done this, it could be a considerable project. CPEmulator does give you the best of both worlds: it provides an emulated terminal and it lets you use extended video and keyboard control codes (ANSI.SYS) that can be passed directly to the DOS driver. A judicious mixture of these codes generally accomplishes the job.

# **How Compatible?**

First of all, you have to realize you're not operating a CP/M system. The usual resident CP/M commands (DIR, REN, etc.) are not present; they're replaced by their MS-DOS counterparts. For other functions, you can easily use DOS commands in lieu of the corresponding CP/M commands.

You can't use Submit files with CPEmulator—you have to convert them to equivalent MS-DOS batch files. Similarly, the CP/M file user structure is not supported. The MS-DOS equivalent program treats all files as if they are in user number zero. There are no equivalents of a read-only or system file, and you won't get the dreaded read-only disk problems that occur with regular frequency on a CP/M system after switching disks.

The standard CP/M BDOS (basic disk operating system) function calls are supported by direct conversion to their MS-DOS equivalents or by a modest change to the way MS-DOS handles the corresponding call. The exception involves manipulation of the disk parameters, allocation vectors, and other CP/M disk related functions. These functions either return dummy values or do nothing.

The CP/M BIOS (basic input/output system) functions are handled differently. Where these functions relate to peripheral devices such as the console or printers, they are converted to their direct MS-DOS equivalent as are the BDOS functions. Disk related functions are illegal and will cause termination of the program.

One design limitation is that the Z80 N and V flags aren't supported. GTEK states in the documentation that they made this and other sacrifices of accuracy in order to gain speed. That's unfortunate, since this means some good Z80 programs won't run. For example, the

KAMAS outline processor uses the V overflow flag to detect if it is executing on a Z80. The program terminates immediately after informing you that you must use a Z80 CPU.

### **Performance**

CPEmulator won't win any prizes for speed. On my fast Tandy 2000, CP/M programs running under the emulator execute approximately four to five times slower than in native CP/M mode on a Model 4. Tandy 1000 and 1200 users can expect programs to run another two to three times slower than on the Tandy 2000.

Performance would be even slower without the Speed Kit, which replaces an 8088 CPU chip with the V20, a speedier processor that can mimic the 8088. The speed increase was from 10 to 20 percent depending on the 8088 instruction mix.

The real benefit of using Speed Kit is the special 8080 version of the emulator supplied with the kit. This emulator is only for an 8080 CP/M system and makes special use of the V20's instruction set to emulate the 8080 hardware. If your CP/M software does not require a Z80, you'll do well to make this modification.

### Conclusion

I have mixed emotions about this package. On the plus side, CP/Emulator is simple to use. The COPYCPM utility is an excellent feature. Conversion of some of my treasured CP/M software was relatively painless. And the program runs on the Tandy 2000 as is.

However, CPEmulator and Speed Kit have some serious drawbacks. Unless your software is for an 8080, the converted program's performance is miserable. It takes a supercharged Tandy 2000 to get performance comparable to that on a 1 MHz Z80.

Because the documentation is limited, you have to discover many of CPEmulator's features on your own. COPYCPM has no supporting documentation. The help information is excellent, but the novice still might feel lost.

Software converted using Speed Kit didn't like memory-resident packages, especially SideKick. When the NEC V20 chip is shifted into the hardware-emulate mode, apparently it no longer thinks like a PC. This means the processor can't properly handle interrupts, which resident programs depend on.

I give CPEmulator a qualified recommendation. It isn't something that everyone needs, but if you must use CP/M software on an MS-DOS computer, it does the job. The Speedkit documentation is equally slight. If you don't feel comfortable pulling your 8088 CPU out of your machine, then don't bother with the V20. ■

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# From Basic To 8086/8088 Assembly Language

\*

From Basic to 8086/8088 Assembly Language. Harley Templeton. Softcover, 181 pp., Woodware Publishing Inc., P.O. Box 1747, Plano TX 75074. ISBN 0-915381-51-6. \$12.95.

Occasionally a book is published that should have never made it through a publisher's technical review. From Basic to Assembly Language is just such a book. Author Harley Templeton takes the position that Assembly language can be taught by translating Basic statements into their Assembly-language equivalents. If the author were successful, then this would indeed be a novel approach. However, he falls short of his goals.

Templeton makes many erroneous statements. For example, in the first chapter he says, "The 8088 Assembly-language instruction set includes instructions that are unique to the computer and do not relate directly to any Basic statement." Obviously, he has forgotten the similarity between the Assembly-language Call instruction and the Basic GOSUB statement.

He makes another absurd statement: "Basic sometimes requires two operations to perform an operation that only has to be done once." He is referring to operations requiring one Assembly-language statement as opposed to two or more Basic statements. Templeton seems to forget that a single Basic statement when interpreted can cause the execution of hundreds or perhaps thousands of machine instructions.

The book is also full of technical errors and false assumptions: "In Basic, when you enter a GOTO or an IF THEN ELSE statement, you use a line number to tell the interpreter where the next statement to be interpreted is." Here, Templeton demonstrates his lack of knowledge of the Basic language. For example, I could use the If. . . Then. . . Else structure as follows:

10 A = 10

20 IF A = 5 THEN PRINT "A EQUALS FIVE" ELSE PRINT "A EQUALS TEN" 30 END

I didn't use a line number to inform the interpreter where to find the next line.

Most notably absent from the text is a chapter introducing the 8088 architecture. An Assembly-language programmer would be hard pressed to exploit any microprocessor without a full knowledge of its architecture.

The Templeton book fails both to teach Assembly language adequately and to prove that Assembly language has any Whether you think Rambo was a heroic cartoon or a witless insult, the computer game is a disappointment.

type of advantage over Basic or other high-level languages. I also found the lack of any reference material, such as a table of the 8088's instruction set, to be a most unfortunate omission. Its poor organization, technical inaccuracies, and absurd premises make this book a candidate for the dog of the year award.

-Gary A. Shade

# Rambo: First Blood Part II



Rambo: First Blood Part II runs on the Tandy 1000/1200/3000 (256K) and requires one disk drive. Mindscape Inc., 3444 Dundee Road, Northbrook, IL 60062. \$29.95.

Ever since the publication of Zork and Deadline, Infocom has owned the market for text adventure games. Some companies trying to challenge Infocom have strived to develop better command parsers or more clever plots. Mindscape, on the other hand, has slapped together games based on three commercial properties: bogeyman Stephen King's *The Mist*, the disastrous James Bond film *A View to a Kill*, and *Rambo*.

As a text program, Rambo loses the primary appeal of Sylvester Stallone's Vietnam vendetta: the sight of Stallone's mighty physique photographed against spectacular explosions. But it's considerably more realistic because Rambo can get killed in any number of ways—"There is a sudden flash of light, and then the terrible agony of hundreds of steel balls ripping into your right side. Bloody bits of your flesh cover the forest floor."

There's some appeal in portraying the homicidal hunk out rescuing POWs with only a bow, gun, knife, and a bag of salt against legions of rotten Reds. But Mindscape's software is as smart as Stallone's dialogue. Saving games is a disk-swapping chore, you can't string commands together, and some responses are simply wrong. For instance, while sightseeing with Co and Kinh, I typed "Give camera"

to Kinh" and Co said "Thank you."

Inferior to Infocom games at anticipating moves and providing complex puzzles, Rambo rarely springs traps that can't be discovered in a cautious survey of the area. Reactions to dumb moves are occasionally witty ("I knew you had a limited vocabulary, Rambo, but you're really getting much worse."), but the writing is generally as flat and lurid as the bits-of-flesh sequence above, which might make you think twice about letting children play.

Whether you think the movie was a heroic cartoon or a witless insult to the struggle in Vietnam, the computer game Rambo is a disappointment.

—Eric Grevstad

# Modem80

\*\*\*

**Modem80** runs on the Model 4 (64K) and requires one disk drive. Alternate Choice, 9505 W. Brown Deer Road, Milwaukee, WI 53224, 414-355-4544. \$79.95.

Modem 80 is a Model 4 telecommunications program that delivers enough power for the average user and yet is simple to use. In addition to the usual gamut of telecommunications commands, Modem 80 contains a host program allowing remote access to your computer.

All action takes place from the system menu, which puts you in terminal mode, ready to connect with a host system. From there you can send single lines of a file to the host (much as a telecommunications macro works), transmit or receive ASCII files, and control your printer.

From Modem80's main menu, you can change the UART parameters to match those of the host you're calling, perform DOS commands, and send and receive files using ASCII or XMODEM protocols.

The menu system is clear and easy to understand. While other Model 4 programs may offer more features, Modem-80's simplicity is hard to beat. Using the program, I called several BBSes, CompuServe, and our corporate email system, changing UART parameters on the fly for each system as needed. I received mail and sent files using ASCII and XMODEM utilities with no problems.

Modem80's rudimentary host program, Host1, allows callers access to your computer if your modem is set to the answer mode. This can be handy if you need to read a file while you're away from your computer. Host1 isn't menu driven; you're greeted with nothing more than the message "Host1." From there, you can receive or send files using two programs, Type/CMD and Save/CMD, included in the Modem80 package. Also,

# **EXPRESS CHECKOUTS**

since Host1 resides higher in memory than Basic, you can load and run Basic programs from a remote computer just as if you were sitting at the keyboard.

Although the documentation looks unimpressive—staple-bound sheets punched for a three-ring binder—its explanations are complete. Tables and illustrations will help new users find their way through the program.

If you're new to telecommunications and don't want to spend a lot of time or money on a full-blown, complicated package, Modem80 is worth looking into.

—Bradford N. Dixon

# Mask Maker

# \*\*\*\*

**Mask Maker** runs on the Model 4 (64K) and requires TRSDOS 6.2 and one disk drive. Strachan Holdings Ltd., RR #8, Site #10, Comp #13, Prince George, BC V2N 4M6, 604-963-7927. \$49.95.

Creating attractive and functional screen displays consumes a great deal of program development time. That's why video display worksheets are so useful: they let you work out the screen's design before coding a program. Mask Maker takes the worksheet idea one step further by providing what is essentially an electronic video display worksheet. With Mask Maker's full screen editor, you can quickly design as many as 18 screen displays per program. A special blockgraphics editing mode allows you to spice up displays with graphics borders.

Mask Maker will convert completed displays into one of six types of program code: a standard Assembly-language source file that uses the TRSDOS 6.2 @DSPLY SVC, a compressed Assembly-language source file that uses a special video driver and a 1920-byte screen buffer, a Basic source file that uses the Print command, a self-relocating highmemory module that can be called from either a machine-language or Basic program, a high-memory module that can be called from a machine-language program, or a high-memory module that can be called from a Basic program.

While Mask Maker is fairly simple to use, the manual's poor organization greatly hinders learning about the program's finer points. To be fair, the manual does contain an adequate explanation for all of Mask Maker's functions and features. It's just that finding a particular topic is easier said than done.

Although the manual needs a good going over, Mask Maker performs superbly and is an excellent product. Anyone who develops Model 4 programs could benefit from using it.

-Mark D. Goodwin





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# HOT CoCo for the Color Computer **Table of Contents** 122. Piece Work by Wayne McArthur 125. Look Both Ways by Jeff Grainger 132. Doctor ASCII by Richard E. Esposito, Richard W. Libra, and Raymond W. Rowe 136. Color Monitor by Scott Norman

# Piece Work

# by Wayne McArthur



Photo 1. Picture 3 prior to scrambling.

If you enjoy jigsaw puzzles but have frequently been frustrated by missing pieces, perhaps you should try the computerized variety. Jigsaw, my Basic jigsaw puzzle generator, will get you started (see the Program Listing).

Although the puzzle pieces are uniform blocks, rearranging them is still challenging. You can choose from two difficulty levels, testing your skill with five pictures. To add an element of competition, I've included a timing option that keeps track of the hours, minutes, and seconds required to complete a puzzle.

### Piecing It Together

When you run Jigsaw, the opening screen explains the function keys and prompts you to choose a picture number from 1 to 5. You must then select the level of difficulty: a level 1 puzzle contains 56 pieces; a level 2 puzzle has 224 pieces. Finally, you must decide whether you want to time your performance.

After a short delay, Jigsaw displays the

picture you have chosen and breaks the image into the appropriate number of segments, distributing the pieces randomly on the screen. Photos 1 and 2 show picture 3 before and after scrambling.

A blinking cursor then appears in the upper-left corner of the scrambled picture. To position the piece marked by the cursor, use the left- and right-arrow keys to move to the correct spot, pressing the space bar to drop the piece into place.

Moving a piece that is not in the upperleft corner requires multiple steps. First, position the cursor over the piece you want to pick up. When you press the space bar, Jigsaw transfers the piece to the upper-left corner. You can relocate the piece on the screen using the arrow keys and the space bar.

If you want to check your progress, press the enter key. A large cursor moves through the puzzle piece by piece, pointing out any pieces that are misplaced. If you are stumped, press H (help) to get Jigsaw to show where the piece in the upper-left corner belongs.

When you successfully complete your picture, Jigsaw displays a "Puzzle complete" message and tells you how long reconstruction took (if you answered Y in response to the timer prompt).

# System Requirements

16K RAM
Extended Color Basic or
Disk Extended Color Basic



Photo 2. Picture 3 after scrambling (level 1).

# Variations on a Theme

For a further challenge, you can replace the pictures with other graphics routines (see the Table for an outline of program structure). Be sure to start each picture routine with:

IFQ>picture number

and end with a Return statement. You should also exercise caution in choosing your routines' variables: Jigsaw uses V\$, E, F, G, H, I, J, K, L, M, T(Z), and U(Z) to set up the program and move puzzle pieces.

If, like many puzzle fanciers, you view help as a form of cheating, you can eliminate Jigsaw's help option by deleting line 60 and removing ORA\$="H" from line 230. You'll then be totally on your own to solve the puzzle.■

Write to Wayne McArthur, 1105-204 Fairmont Drive, Saskatoon, Saskatchewan S7M 4P5.

# Program Listing. Jigsaw.

```
/2)=5THENPRESET(X+J/2,Y+K/2):PP=
1
2Ø IFTIMER>6ØØØØTHENTI=TI+(('TI
MER/6Ø)/6Ø)/6Ø):TIMER=Ø
21Ø IFAS="THENIDØELSEIFPP=ITHEN
PP=Ø:PSET(X+J/2,Y+K/2)
22Ø A=ASC(AS):IFA=32GOSUB32Ø:GOTO
19Ø
23Ø IFA=13ORAS="H"GOSUB32Ø:GOTO
18Ø
24Ø GET(X,Y)-(X+J,Y+K),B
25Ø PUT(X,Y)-(X+J,Y+K),B
25Ø PUT(X,Y)-(X+J,Y+K),C
26Ø IFA=9THENX=X+H ELSEIFA=8THEN
X=X-H
27Ø IFA=94THENY=Y-I ELSEIFA=1ØTH
ENY=Y+1
28Ø IFX<ØTHENX=L ELSEIFX>L THENX
=Ø
```

29Ø =Ø	IFY<@THENY=M ELSEIFY>M THENY	
388	GET(X,Y)-(X+J,Y+K),C	
310	PUT(X,Y)-(X+J,Y+K),8:GOTO19Ø	
	IFX+Y=ØTHENGET( $\emptyset$ , $\emptyset$ )-( $\emptyset$ +J, $\emptyset$ +K	
),C		
	PUT(X,Y)-(X+J,Y+K),B	
	PUT(Ø,Ø)-(Ø+J,Ø+K),C	
35Ø	Z=(Y/I)*F+(X/H)	
360	$XX=T(\emptyset):YY=U(\emptyset)$	
370	$T(\emptyset) = T(Z) : U(\emptyset) = U(Z)$	
380	T(Z)=XX:U(Z)=YY	
390	X=Ø:Y=Ø:RETURN	
400	$X = \emptyset : Y = \emptyset : Z = \emptyset$	
410	XY=RND(F)-1:YX=RND(G)-1	
	ZZ=YX*F+XY:XX=T(Z):YY=U(Z)	

Listing continued



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# The Monitor Adapter - \$25.95

This universal driver works with all monochrome monitors, and is easily installed without clips, jumpers or soldering (except in some later CoCo 2s with soldered-in video chips). Here's crisp, clear, flicker-free monitor output with all the reliability you've come to expect from HJL Products.

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# Listing continued 43Ø T(Z)=T(ZZ):U(Z)=U(ZZ) 44Ø T(ZZ)=XX:U(ZZ)=YY 44p T(2x)=XX:U(2X)=YY 45p X=X\*H:Y=Y\*I:XY=XY\*H:YX=YX\*I 46p GET(X,Y)-(X+J,Y+K),B 47p GET(XY,YX)-(XY+J,YX)+K),C 48p PUT(X,Y)-(XY+J,YK)+K),B 5pp X=X/H:Y=Y/I:XY=XY/H:YX=YX/I 51p X=XH:Y=Y/I:XY=XY/H:YX=YX/I 51p X=XH:Y=Y-THENY-A 51Ø X=X+1:IFX=F THENX=Ø:Y=Y+1 52Ø Z=Y\*F+X:IFZ<E THEN41ØELSEX=Ø :Y=Ø:RETURN 53Ø IFQ>lTHEN56ØELSEPMODE4,1:PCL 54Ø FORZ=1T015ØSTEP1Ø:CIRCLE(128 96), 2, Ø: NEXT: PAINT(123,55), Ø, Ø: PAINT(21Ø,44), Ø, Ø 55Ø SCREEN1,1: RETURN 56Ø IFQ>2THEN74ØELSEPMODE3,1:PCL 50 570 CIRCLE(130,5),60,5,1,.11,.4 580 CIRCLE(126,120),90,5 590 CIRCLE(126,125),45,5,2 600 CIRCLE(150,125),45,5,2 610 CIRCLE(110,125),45,5,2 620 PAINT(1,1),1,5 63Ø DRAW"BM12Ø, 4Ø; C2R15U4ØH2G4H5 64Ø PAINT(124,24),2,2 65Ø DRAW"BM9Ø,9Ø;C2G2ØR4ØH2Ø 66Ø PAINT(92,94),1,2 67Ø DRAW"BM+7Ø,Ø;C2G2ØR4ØH2Ø 070 DRAW BM+70,0;22G2ØR49H2Ø 68Ø PAINT(162,94),1,2 69Ø DRAW"BM-35,+3Ø;C2G2ØR4ØH2Ø 7ØØ PAINT(127,124),1,2 71Ø DRAW"BM7Ø,15Ø;C2F2ØR3ØU1ØR1Ø D1ØR3ØE2ØL3ØD1ØL1ØU1ØL3ØD1ØL1ØU1 ar. 3 a 72Ø PAINT(9Ø,16Ø),1,2:SCREEN1,1 73Ø COLOR5,2:RETURN 74Ø IFQ>3THEN83ØELSEPMODE3,1:PCL 75Ø DRAW"BM118,46;C2L1ØE2ØF2ØL1Ø F32L18F38L26F44L16ØE44L24E38L18E 76Ø CIRCLE(128,13Ø),11Ø,2,.4,.13 .39:PAINT(2,2),3,2:PAINT(128,36,1,3 7,1,3 77Ø DRAW"BM124,185;C4R1ØU1ØL1ØD1 ØC2":PAINT(128,18Ø),4,4 78Ø FORZ=ØTO255STEP4:PSET(Z,19Ø) 78% FORZ=\$70225STEP4.PSET(Z,19%): PSET(2+2,188): PSET(Z,186): PSET(Z,RND(18%)): NEXT 79% CIRCLE(18%,5%),11%,2,1,.14,. 32:CIRCLE(128,2%),8,4 8%% CIRCLE(185,4%),75,4,1,.12,.3 2:CIRCLE(128,2%),4,2:COLOR%,1 81% CIRCLE(11%,3%),45,3,1,1,.32 :CIRCLE(116,14),32,2,1,.14,.3 82% FORZ=5%TO21%STEP4.D=RND(18%) \*C=1+RND(3): LPPPOINT(Z,D)=50PPPO ozp FORZ=JPIOZIØSIEF4: D=RND(160) :C=1+RND(3):IFPPOINT(Z,D)=50RPPO INT(Z,D)=1THENCIRCLE(Z,D),4,C:NE XTELSENEXT:SCREEN1,Ø:RETURN ASB IFQ24THEN1Ø4ØELSEPMODE4,1:PC LS1:SCREEN1,1:B=1ØØ:X=.6 84Ø IFX<2.5THENX=X+.1 85Ø FORZ=12TO4ØSTEP2:PRESET(255-Z,B+RND(1+X)):PRESET(1+Z,B+RND(1 +X)):NEXT:B=B+X:IFB<178THEN84ØEL

86Ø GET(Z,1Ø1)-(Z+16,18Ø),B

```
87Ø Z=Z+16:PUT(Z+15,1Ø1)-(Z+31,1
  8Ø),3:1FZ<192THEN86Ø
88Ø DRAW"BM25,14Ø;CØU3R2E5R4U25H
2U5E2U6E2R8F2D6F2D5G2D25R6F2R1D1
  F2G1L5G1L4H1L4G1L2H1L4G2L6H1
89Ø DRAW"BM2ØØ,145;E4F4G1H4F4G1H
4G2D1ØG3E3U1ØL8D3L65F1ØR75L75H15
9MW DRAW"E2509E21R4F3UH314D14F1
7U5F12L12D5U5L17D5U5L21D5U5L25
91Ø FORZ=1T09:PAINT(4Ø+Z,125+Z),
Ø,Ø:PAINT(16Ø+Z,148+Z),Ø,Ø:PAINT
(16Ø+Z,13Ø+Z),Ø,Ø:NEXT
92Ø FORZ=1T0243ST5P2:LINE(1+Z,1
2)-(1+Z,1ØØ),PRESET:PSET(2ØØ-RND
(65),158+RND(2Ø)):PSET(135+RND(6
5),178-RND(2Ø)):NEXT
93Ø FORZ=1ØØTO2ØØSTEP2:X=RND(1Ø)
94Ø PSET(5Ø-RND(15),135+RND(45))
95Ø PSET(35+RND(15),18Ø-RND(45))
  96Ø CIRCLE(Z,5Ø+X),Z/1Ø,Ø,1,.1,.
97Ø CIRCLE(Z,54+X),Z/1Ø,1,.4,.1,
 98Ø FORZ=ØTO54STEP1.5:CIRCLE(8Ø,
99Ø DRAW"BM45,95;Clu2ElD6Hlu2L6D
2Glu6FlD2R6
1000 FORZ=1TO48STEP8:PSET(RND(25
 5),RND(85)):PSET(145+Z,15Ø)
1010 CIRCLE(88,45),2/8,1:LINE(50,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(100,95)-(1
1Ø5Ø CIRCLE(14,11),1Ø,Ø:DRAW"BM1
Ø.15:CØU8F2E2F2E2D8L8
1Ø6Ø GET(Ø,Ø)-(24,24),B:PAINT(12,12),Ø,Ø:GET(Ø,Ø)-(24,24),C
1070 PCLS:COLORI,0
1080 FORZ=0T0255STEP31.875:LINE(
Z,0)-(Z,191),PSET:NEXT
1090 FORZ=0T0191STEP23.875:LINE(
0,z)-(255,z),PSET:NEXT:X=1:Y=12
Ø,z)-(255,Z),PSET:NEXT:X=1:1=12
1100 FORZ=X TO8STEP2:ZZ=Z*31.875
111Ø PAINT(ZZ,Y),1,1
112Ø IFY<8ØTHENPUT(ZZ-8,Y-11)-(Z
Z+9,Y+1Ø),B
113Ø IFY>13ØTHENPUT(ZZ-8,Y-11)-(
ZZ+9,Y+1Ø),C
114Ø MEXT:IFx=lTHENX=2ELSEX=1
115Ø Y=Y+24:IFY<191THEN11ØØ
116Ø DRAW"BMØ,Ø;CØD191R255U191L2
 1170 X=0:Y=0:SCREEN1,1:RETURN
118\emptyset X=\emptyset:Y=\emptyset:V=\emptyset
119\emptyset FORZ=\emptysetTOE-1:IFT(Z)><X OR U(
119p FORZ=p10p-1:F1(2)>X OR U(
2)>Y THEN122p
12pp X=X+1:IFX=F THENX=9:Y=Y+1
121p NEXT:X=9:Y=9:IFV>pTHEN19pEL
SE1310
                    R=X*H:S=Y*I:V=V+1
123Ø GET(R,S)-(R+J,S+K),C
```

Line(s)	Description
20-60	Information page.
70-90	Menu choices.
110	Variables for a level 1 puzzle.
120	Variables for a level 2 puzzle.
130	Cursor for the Help and Check sections.
140-160	Initial values set for T(O)–T(E) and U(O)–U(E).
190-310	Movement of puzzle
320-390	Exchange of piece
400-520	positions. Initial scrambling of puzzle
530-550	Picture 1.
560-730	Picture 2.
740-820	Picture 3.
830-1030	Picture 4.
1040-1170	Picture 5.
1180–1260	Check for misplaced pieces.
1270-1300	Help checks for the first misplaced piece and shows where it belongs.
1310–1370	Game ends. Time readout Prompt for a new game.

Table. Program structure.

124# PUT(R,S)-(R+J,S+K),D
125# SOUND25#-Z,1
126# PUT(R,S)-(R+J,S+K),C:IFA\$><
"H\*THEN12##
127# R=T(Z)\*H:S=U(Z)\*I
128# GET(R,S)-(R+J,S+K),C:PUT(R,S)-(R+J,S+K)

HO=FIX(TI):SE=(TI-HO)\*6Ø:MI=FIX(SE):SE=(SE-MI)\*6Ø:SE=FIX(SE)
133Ø IFVS="\"THENPRINTQ16Ø,"TIME
TO COMPLETE PUZZLE WAS":FRINTQ1
91,HO"HOURS'ELSE135Ø
134Ø PRINTQ223,MI"MINUTES":PRINT
Q255,SE"SECONDS"
135Ø PRINTQ448,"";:INPUT"TRY ANO
THER PUZZLE <Y/N>";Y\$:IFYS="Y"TH
ENCLEAR:GOTO2Ø
136Ø SCREENI,1
137Ø AS=INKEYS:IFAS=""THEN137ØEL
SECLEAR:GOTO2Ø

End

# Look Both Ways

by Jeff Grainger

# System Requirements

64K RAM Disk or Extended Color Basic Macro-80C editor/assembler Basic's List command is virtually useless as a programming tool. The problem is that when you invoke List, your program lines scroll off the screen so rapidly that it's impossible to read the listing. While you can freeze the screen by pressing shift-@ or set param-

eters to display particular program lines, you have no control over scrolling speed. And you can't back up if you press shift-@ too late.

To overcome these restrictions, I wrote Scroll, an Assembly-language utility that gives you control over a Basic pro-

# HOT CoCo

				Pı	rograi	n Listii	ng. Scroll.	
	0001	0E00			ORG	\$7000		
	0002	01E9		BUF	EQU	\$1E9	EQU ADDR. TABLE	
		01EB 01ED		BUFF	EQU	\$1EB \$1ED		
		Oler		SCOUNT CHK	EQU	\$1EF \$1F1		
	0006 0007			CHK1	EQU	\$1F5		
	0008			BU CURSOR	EQU	\$1F7 \$88		
	0009	0000		*THIS I	ROUTIN	E SETS S	SOME OF THE STARTING POINTS*	
	0010	7000	OF6F	*TO TH	E PROG CLR	RAM \$6F	SET OUTPUT TO SCREEN	
	0011	7002	BDA928	START	JSR	\$A928	CLEAR THE SCREEN	
			108E01F7 10BF01F7		LDY	#\$1F7 BU	SET ADDR. TABLE BEGINNING KEEP TRACK OF IT FOR NOW	
	0014	7000	9E19		LDX	\$19	GET START OF BASIC PROGRAM	
		700F 7011	10270089		LDD	,X EXIT	CHECK FOR VALID LINE NUMBER GET OUT IF NO PROGRAM	
			BF01E9 1700B9		STX LBSR	BUF	KEEP TRACK OF THE START GO UNCRUN SOME LINES	
					IS THE	ROUTINE	TO POLL FOR A KEY PRESS*	
			AD9FA000 108EFFFF	BEGIN	JSR LDY	[\$A000] #\$FFFF	CHECK FOR A KEY CLEAR ROLLOVER TABLE	
	0021	7023	10BF0155		CTV	\$155	TO CAUSE AUTO KEY DEDEAT	
		7027 7029			BEQ CMPA	BEGIN #S5E	IF NO KEY LOOK AGAIN IS IT THE UP ARROW IF SO GO DO IT IS IT THE DOWN ARROW IF SO GO DO IT IS THE BREAK KEY PRESSED IF SO GOTO BASIC IS THE CLEAR KEY PRESSED IF SO START OVER AGAIN	
	0024	702B	270E		BEQ CMPA BEQ CMPA	UP	IF SO GO DO IT	
	0026	702b 702F	2774		BEQ	DOWN	IF SO GO DO IT	
		7031 7033			CMPA	#3	IS THE BREAK KEY PRESSED	
	0029	7035	810C		BEQ CMPA	#\$0C	IS THE CLEAR KEY PRESSED	
		7037 7039			BEQ	START BEGIN	IF SO START OVER AGAIN IF WRONG KEY GO LOOK AGAIN	
					IS THE	ROUTINE	THAT LOOKS FOR THE ADDR. OF*	
							OR TO THE FIRST ONE ON THE * TO THE MAIN ROUTINE *	
	0022	7020	10000100	*THIS	ALLOWS	FOR THE	SCROLL UP *	
			10BE01F9 10BF01E9	UP	LDY	\$1F9 BUF	GET THE TOP LINE NO. KEEP TRACK OF IT FOR NOW	
	0034	7043 7045	AEA4	A @	LDX	,Y NLX	GET THE NEXT ONE TO FOLLOW IF IT = 0 THEN GOTO NEW LINE	
	0036	7047	BF01F1		BEQ	CHK		
	0037	704A	BC01E9 2716		CMPX BEQ		IS IT THE SAME AS THE TOP IF SO STORE IT FOR USE	
	0039	704F	10AE84		LDY	,X NLY	IF NOT LOOK AT THE NEXT LINE	
			272A 10BF01F5		BEQ	NLY CHK1 BUF	IF IT = 0 THEN GOTO NEW LINE OTHERWISE KEEP TRACK OF IT	
		7058 705C	10BC01E9	D@	CMPY		IS IT THE SAME AS THE TOP IF SO STORE IT FOR USE	
		705E			BEQ	A@	LOOP BACK AND LOOK TILL YOU	
	0045	7060	BF01E9	* STOREX	STX	BUF	FIND A MATCH STORE THE ADDR. FOR USE IN	
	0046	7063			BRA	B@	THE MAIN ROUTINE	
	0048	7069	2000	STOREY	BRA	BUF B@		
		706B 706D	8D19 8E0400	B@	BSR	BUMP #\$400	GO UPDATE THE TABLE RESET THE CURSOR LOCATION	
		7070 7072	9F88		STX	CURSOR		
	0053	7074	2050		BSR	UNCRUN CLEAR	GO UNCRUNCH AND PRINT LINE CLEAR THE REST OF THE SCREEN	
		7076	9E19 10BE01F1	NLX	LDX	CLEAR \$19 CHK	RESET THE LOCATE ROUTINE BACK	
	0056	707C	20CC		LDY	CHK C@	TO THE BEGINNING FOR IT TO START LOOKING FROM THERE IF	
			109E19 BE01F5	NLY	LDX	\$19 CHK1	NO MATCH HAS BEEN FOUND	
		7084		+====	BRA	D@		
				*WHAT I	JINES !	ARE ON T	S THE TABLE SO THAT WE KNOW * "HE SCREEN. THE FIRST AND LAST*	
	0060	7086	8E01F9	*ARE THE	LDX	Y IMPORT #\$1F9	ANT ONES * GET ADDR. OF TABLE	
	0061	7089	108E01FB ECA1		LDY	#\$1FB	GET NEXT ADDR. OF TABLE	
	0062	708b	ECA1 ED81	9A	LDD	,Y++ ,X++	GET THE NEXT ADDR. PUT NEXT IN THE FIRST	
	0064		10830000		CMPD BNE	#0000	IS THE LAST ONE CLEANED UP	
	0066	7097	8E01F7		LDX	A@ #\$1F7	ARE WE DONE IF NOT GO AGAIN RESET THE TABLE TO THE BEGIN	
		709A 709D	BF01F7		STX	BU	GO DO THE JOB NOW	
	0069	709E	7F02DD	EXIT	CLR	\$2DD	GET OUT OF HERE	
	0070	70A1	7F02DE 39		CLR RTS	\$2DE		
				*THIS I	S THE	ROUTINE BE SUR	TO SCROLL DOWN THE LIST* E A LINE WAS PRINTED *	
			AE9F01F7 BF01F1	DOWN	LDX	[BU]	GET THE ADDR. OF LAST LINE	
	0074	70A9	8DD8 8E0400		STX	CHK BUMP	KEEP TRACK OF IT FOR NOW UP DATE THE ADDR. TABLE	
	0075	70AE 70B1	8E0400 9F88		LDX	#\$400 CURSOR	RESET CURSOR TO TOP LEFT	
	0077	70B3	BE01F9		LDX	\$1F9	GET THE NEXT ADDR.	
		70B6 70B9	BF01E9 8D19		STX	BUF UNCRUN	KEEP TRACK OF IT FOR NOW	
	0080	70BB	AE9F01F7		LDX	[BU]	WAS A LINE PRINTED	
	0082	70C2			CMPX BNE	CLEAR	IF SO CLEAR THE REST OF THE SCREE	N
	0083	70C4	20DF	*THIS F	BRA	DOWN E IS TO	IF NOT GO DO IT AGAIN CLEAN UP THE REMAINING PART OF*	
				*THE SC	CREEN S	SO THAT	GARBAGE OR DOUBLE IMAGING IS *	
	0084	70C6	9E88	*NOT LE	LDX		TOM * GET THE CURSOR POSITION	
	0085	70C8	8660		LDA	#\$60	GET A BLANK	
ı							Listing continued on	n 140

Function
Store the addresses of Basic
lines in memory. Store the length of Basic lines after uncrunching.
Used by the Up routine to check for the previous line.
Keeps track of the table of line addresses.
Stores the current location of the cursor.

gram's line-by-line display (see the Program Listing). Scroll lets you move forward and backward through the listing at your own speed; you can return to the beginning of the listing or exit to Basic with a single keystroke.

# Scroll 'Em

After assembling the Listing, load the Basic program you want to list, then load Scroll into memory at address 7000 hexadecimal. If you have less than 64K of RAM (random-access memory), you must offset-load Scroll to accommodate your system.

Touse Scroll, type in EXEC. The up- and down-arrow keys move you up and down within the program. The listing wraps in both directions, displaying the first line directly after the last and vice versa. Press the clear key to return to the beginning of the program; to edit a line, press the break key to exit to Basic. Once you have made the necessary editing changes, type in EXEC to call up Scroll again.

At the beginning of the program, Scroll equates labels with addresses used for short-term storage (see the Table). The remainder of the program is documented with remarks to assist you in following program logic.

If you are familiar with Assembly-language programming, you might want to add other features, such as a page routine that scrolls forward (or backward) one screen at a time. You could also add a routine that returns you to your previous location when you reexecute Scroll after editing a line from Basic.

Jeff Grainger welcomes your questions or comments on his program. Write to him at Box 2235, Bracebridge, Ontario POB 1CO.

Listing continued on p. 140

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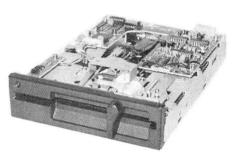
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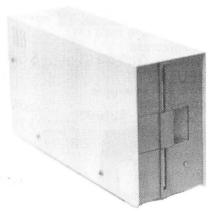
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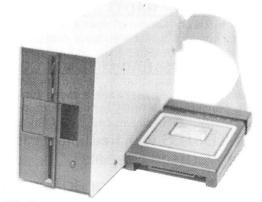


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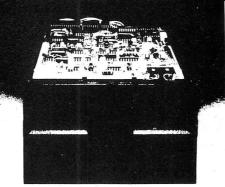
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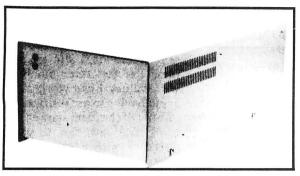
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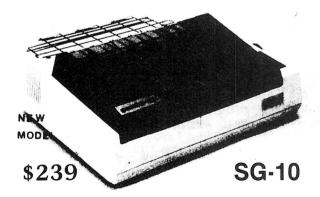
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# by Richard E. Esposito, Richard W. Libra, and Raymond W. Rowe

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Is there a CGP-220 Jet Printer dump I can use with CoCo Max? Also, many BBSes here in San Diego are going to 1,200 or 2,400 baud. Other than price, what should I look for in a high-speed modem, and where can I get one? (Gary Bradbury, Fallbrook, CA)

The only high-resolution screen dump I know of for your printer is Radio Shack's Color Screen Print Utility (catalog number 26-3121, \$9.95).

If price is no object and you want a real Cadillac terminal for your CoCo, get a Hayes-compatible modem; PBJ's 80-column card, Word-Pak (P.O. Box 813, N. Bergen, NJ 07047, 201-523-8663); or Cer-Comp's terminal software, Data Pak II (5566 Ricochet Ave., Las Vegas, NV 89110, 702-452-0632). Check the ads in 80 Micro or Computer Shopper, a monthly newspaper with lots of ads.

•I can't seem to load Basic programs typed in from Scripsit. What am I doing wrong? (Kelly Butler, Mebane, NC)

• Scripsit saves files in a continouum; Basic saves them as discrete records. To get around the problem, use option 2 of Scripsit's print menu to create a spool file, which stores the program in ASCII format.

I have a 64K CoCo 2 with Extended Color Basic and a Radio Shack disk drive. I need as much free memory as possible for a voice buffer. Can you supply a memory map of POKE addresses and a description of the map in all-RAM mode? (Stephen Sabulak, Farmington, CT)

Spectral Associates (3418 S. 90th St., Tacoma, WA 98409, 206-581-6938) markets a series of manuals containing the disassemblies of Color Basic, Extended Color Basic, and Disk Extended Color Basic as well as the empty RAM spaces. The complete set is \$32.95; in-

```
Program Listing. Tapefix.
10 GOTO480
20 CLS
30 PRINT@0, STRING$ (32, "*")
40 PRINT@32, "*"+STRING$(30,"")+"*"
50 PRINT@64,"* MACHINE LANGUAGE CASSETTE TO
60 PRINT@96,"* DISK UTILITY
70 PRINT@128,"*
80 PRINT@160,"*
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                                   RICHARD E. ESPOSITO
90 PRINT@192,"*
                                   & RALPH RAMHOFF << 32K RAM >>
                                                                   * "
100 PRINT@224,"*
110 PRINT @256,"* DISK COLOR BAS
120 PRINT@288,"*"+STRING$(30,"")+"*
                               DISK COLOR BASIC 1.0
120 PRINTE288,""+5TRING$(30,"")+"*"
130 PRINT@320,STRING$(32,"*")
140 PRINT"IS TAPE READY?"
150 A$=INKEY$;IF A$="" THEN 150
160 IF LEFT$(A$,1)<>"Y" THEN PRINT "READY THE TAPE, THEN RUN AGAIN":END
170 INPUT"NAME OF TAPE FILE CONTAINING PROGRAM"; F$ 180 IF LEN(F$)>8 THEN PRINT"too big": GOTO 170
190 CLOADMF$, &H2000
200 SL=PEEK (487) *256+PEEK (488)
210 EN=PEEK (126) *256+PEEK (127)-1
220 EX=PEEK (157) *256+PEEK (158)-&H2000
230 NN=EN+42: XX=EN+1
240 FOR I=EN+1 TO NN
250 READX$: X=VAL("&H"+X$)
260 POKEI,X
270 NEXT I
280 ST=SL+H2000
290 S1=INT(SL/256): S2=SL-S1*256
300 N7=EN+27:POKEN7,S1: N8=EN+28:POKEN8,S2
 310 EL=EN-&H2000
320 S3=INT(ST/256): S4=ST-S3*256
330 POKEEN+23,S3: POKEEN+24,S4
340 E3=INT(EN/256): E4=EN-E3*256
350 POKEEN+34,E3: POKEEN+35,E4
360 X1=INT(EX/256): X2=EX-X1*256
370 POKEEN+41, X1: POKEEN+42, X2
380 INPUT"NAME OF FILE ON DISK";F$
390 IF LEN(F$)>8 THEN PRINT"too big";GOTO380
400 SAVEMF$,ST,NN,XX
410 SOUND125,3:PRINT"READY":END
420 DATA4F, B7, FF, 40, 86, 34, B7, FF
 430 DATA03,8E,04,00,86,80,A7,80
 440 DATA8C, 06, 00, 2D, F9, 8E, 26, 00
450 DATA10, 8E, 06, 00, A6, 80, A7, A0
460 DATA8C, 47, 10, 2D, F7, 0F, 71, 7E
470 DATA18.38
480 PCLEAR1: GOTO20
```

dividual manuals are \$14.95 (prices don't include shipping and handling). If you need a lot of extra memory, consider J&R Electronics' 512K Banker (P.O. Box 2572, Columbia, MD 21045, 301-987-9067 or 301-788-0861). The bare board (etched and drilled) is \$34.95; an assembled and tested version is \$149.95.

• Can I reduce blank spaces in Basic programs to minimize memory use? (Ricky Sutpin, Henry, VA)

• With the exception of the spaces that appear after line numbers when you invoke the List command,

each space in a Basic program consumes 1 byte, so reducing spaces can save memory. However, since each new line uses 7 extra bytes, the best way to compact a program is to eliminate line numbers by creating multi-statement lines.

• I like my Star SG-10 printer, but I can't get the download character set or sample program in the SG-10 manual to work. I have a 64K upgraded E board (fall of 1981) and a Botek serial-to-parallel interface. Because the Botek has a jumper for 7-bit and 8-bit modes, I put in a switch so that I can print out text

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and graphics. Can you help me overcome the problem? (Daniel Jameson, Hollywood, CA)

• If you are still running Color Ba-• sic 1.0 (type in EXEC 41175 to find out), get Color Basic 1.1 or 1.2; your printer will then work in 8-bit mode with text and graphics. Version 1.0 has only a 7-bit nongraphics printer driver.

• My friend and I are having trou-• ble with CoCo I's (with the original "chiclet" keyboard) that have been upgraded to 64K. Both machines have begun to freeze up or print garbage on the screen.

The trouble isn't related to the length of time they've been on. If we press the reset button, the problem clears up, but memory has been corrupted. Dennis Kitsz' RAM test routine gives them a clean bill of health. Do you know what the problem might be? (Chris Rogers, Oakville, Ontario)

• Tandy has issued a service bul-•letin on the problem. You can have Tandy fix it or order the bulletin and parts from Radio Shack National Parts (900 E. Northside Drive, Fort Worth, TX 76102). Ask for Technical Bulletin CC:20 and the Final Fix Kit,

which includes a 26-3003B logic board AX-7089, SN74LS12 triple-input NAND open collector IC, and SN74LS393 dual 4-bit binary counter. "Final Fix" (HOT CoCo, February 1986, p. 32) offers an alternative that involves drilling holes in the CoCo's cover to vent heat from the pass transistor.

 My gray CoCo behaves as if it has a bad PIA chip: keystrokes won't register in columns A, B, and C, even when I change the keyboard.

I have a basic understanding of electronics, but I'm not familiar with digital circuitry. What should I check to find out if the problem is something other than the PIAs? I don't know the board version, but the model number is 26-3004A. What schematic should I request?

Also, I've been thinking about upgrading my CoCo with The Banker or Thunder RAM. Are there any differences between them?

Are they compatible with peripherals and Radio Shack software? Someone from Radio Shack said the upgrade might overheat my CPU. Is this true? (Pete Vitale, Riverside, NJ)

The manual for your machine, TM 26-3004A, is available from

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Radio Shack National Parts (see address above). Pay close attention to the circuitry that interacts with the keyboard when you check for problems.

I use J&R Electronics' The Banker. It doesn't require connections to the cartridge port or test points. You establish connections by removing the SAM chip, plugging the Banker board into its socket, and replacing the 64K chips with prewired 256K chips.

None of the CoCos, except the newest Korean models, require soldering or installation; however, you must run wires to pin 1 of each 256K RAM chip. If you call J&R for support, you'll talk to a person, not to an answering machine. All software, including the OS-9 RAM disk, is included at no extra charge.

Spectrum Projects' Thunder RAM is currently available for the original CoCo only. Its OS-9 RAM disk costs extra and its built-in ROM can create compatibility problems with standard CoCo software.

Overheating should not be a problem: the 256K chips draw less power, so your CoCo should run cooler.

 Like Milagros Rivera Diaz (HOT) • CoCo, August 1985, p. 15), I had a problem with the Gorilla Banana

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# HOT CoCo

printer when I typed in PRINT #-2. To set things right, I got the correct serial cable (#4109, \$18 plus \$2 shipping and handling) and replacement chip (free) from DAK Industries (8200 Remmet Ave., Canoga Park, CA 91304, 800-325-0800). The chip and DIP switch settings are important because they coordinate the baud rate (600) between the computer and printer.

A Thanks for the information.

• In the January 1985 issue of HOT • CoCo, your column (p. 78) had a program for accessing the full 64K RAM. I have a disk drive with a J&M controller (JDOS version 1.06). Whenever I typed in a command, I got a syntax error, but when I ran the program under Extended Color Basic, it worked. What can I do to use the program with JDOS?

Remove the JDOS ROM and replace it with a Radio Shack ROM—a lot of software won't run without it. Howard Medical Computers (Box 2, Chicago, IL 60690, 800-443-1444) sells the Radio Shack DOS ROM for \$20.

• Back issues are no longer available for the September 1983 issue of HOT CoCo. I would like a copy of your Tapefix program so that I can convert my cassettes to disk. (SFC Frank Hoegler, APO, NY)

A • See the Program Listing on • p. 132 for a reprint of Tapefix. ■

# Color Monitor

# by Scott Norman

Regular readers of this column know I'm intrigued by integrated programs that share information and let me skip back and forth between tasks. Large personal computers have had this ability for some time; I use integrated programs with the 512K Macintosh in my office every day. The real problems begin when you try cramming all the necessary features into 64K or less.

Nevertheless, people are trying, including Tandy. DeskMate is their attempt to bring software integration to the Color Computer. To take advantage of the CoCo's graphics abilities, DeskMate leans heavily on Macintosh-like video icons to represent programs and data files. It also lets you enter commands via a joystick or mouse instead of the keyboard. You start an application or call a data file by moving the cursor to the directory location with the mouse and pushing the button twice.

# **Multiple Personalities**

DeskMate consists of six major programs plus auxiliary routines. The major ones are Text Editor, Calendar, Index Cards (a simple data manager), Paint, Ledger (a spreadsheet), and Telecom. Subsidiary routines include utilities for setting printer and display parameters, along with a video representation of a four-function calculator.

Like the Tandy-sanctioned Dynacalc spreadsheet I described last month, DeskMate comes with a somewhat watered-down copy of the OS-9 operating system. Most of the commands you need are there, hidden behind the icons and menus. I would have liked more choices

for communicating with the printer (only 600 and 1,200 baud are available now), and the option of specifying faster stepping rates for disk drives.

It's understandable that Tandy would want to isolate newcomers from details of the operating system, but I'm not sure why they chose a unique file format. Other OS-9 applications can't read Desk-Mate data and vice versa, which might bother someone trying to graduate to more advanced software.

DeskMate components are also limited in their ability to exchange information. About all you can do is save portions of a Ledger spreadsheet as files for merging with Text Editor material, or cut and paste material from one Paint picture to another.

DeskMate routines don't really function as parts of an integrated product, despite first appearances; they're more like standalone programs on the same disk sharing a consistent user interface. A menu bar at the top of the screen lets you scroll the display, direct the opening and closing of files, call for Help menus, and summon desk accessories. Although details of program commands differ on the pull-down menus, the programs all have a similar feel.

### **Product Information**

Tandy Corporation One Tandy Center Fort Worth, TX 76102 DeskMate requires 64K RAM and one disk drive; it sells for \$99.95.

# Writer's Block

Considering the amount of writing I do, it was only natural that I tried Text Editor first. The program is OK for correspondence and other short pieces (I used it to take about 1,500 words worth of notes for this column), but its deficiencies make it impossible to take Text Editor seriously as a full-fledged word processor.

As in other DeskMate routines, Text Editor uses software to generate an upper- and lowercase font. The 22 lines of 32 characters each that will fit on the screen aren't enough for serious writing. The font looks uneven, as well: lowercase letters don't all appear to be the same size.

You can use keyboard commands instead of a mouse to move the cursor. Arrow keys are much more convenient than the mouse for short moves. (The manual describes these commands in terms of the alternate and control keys, and acknowledges that "some Color Computers" may use @ and clear instead—further support for the rumor of a Super CoCo with an expanded keyboard.)

A combination of cursor movements and block menu commands lets you select chunks of text for moving or deletion. To move a block, you must copy it, insert it, and then delete it from its original spot. That's how Cognitec's Telewriter-64 works if you haven't added the Telepatch modification. The whole procedure is tiresome.

Text Editor has some amenities, including a seemingly unbeatable keyboard buffer that prevents speedy typists from losing material, and a fast-working Find Text option. The program fails in several



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respects, though. It can't print headers, footers, or page numbers and there's no way to send control codes to a printer for boldface or italics. Also, a bug appears to exist in the print formatting routine: when I printed my notes, the first line of every page after the first one blithely ignored the left margin setting and turned up seven to 10 spaces too far to the left.

Text Editor files can be transmitted by the Telecom application. Unfortunately, the DeskMate manual doesn't say how large a file you can transmit.

# **Organizers**

The Calendar program is one of Desk-Mate's best components. Its display consists of a calendar page for the current month, a large readout of the current day and date, and space for typing appointments and reminders. You can use the keyboard or a mouse to scroll through the calendar, while the Find Date and Find Text commands let you jump around.

The text area has no predefined slots, so you can organize notes however you like. Although you can see only eight 20-character lines at a time, up to 400 characters can be stored for a given day. The program will handle only 31 maximum-size entries, but you can beat the limit by using multiple date files.



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# 80Micro

Back Issue Order Dept. 80 Pine Street Peterborough, NH 03458 You can print out data for a given day, week, or month, or everything in the calendar file. The listing comes out in a simple columnar format without the graphics.

Index Cards has the makings of a nice general-purpose filing system. It is based on "cards" of data fields that you define and label on the screen. You have to dig information out of the manual to use the program effectively, however.

The introductory part of the manual implies that only a single 18-character line can be devoted to each field. That's not true. You can reserve additional 30-character lines when laying out a card, but this important point is buried in the reference section at the back of the book. Material for each of the DeskMate routines is divided this way, presumably to keep rookies from getting bogged down in details. It's a poor split.

Each card will hold up to 22 lines. Keying in large sections of text is a test of endurance; the screen is *very* slow to catch up to input.

There are compensations. You can specify up to five fields for sorting, and the program will automatically put your file into the corresponding order and keep it there when you add or delete data cards. Other amenities include a versatile Find function with wildcard characters and both equality and inequality comparisons.

This flexibility allows you to select cards for printing in a report or to omit individual fields from a printout. The report format resembles the layout of an individual card, except that multi-line fields are displayed on longer lines without wordwrap. The program doesn't distinguish between alphabetical and numerical data, so you can't calculate totals.

# **Designs and Figures**

The Paint program holds drawing tools for creating video displays. Almost all of the screen is available for drawing, since you access the tools from pull-down menus, not from a permanent menu on-screen.

Unfortunately, Paint doesn't play as smoothly as some of its competitors. Colorware's CoCo Max, in particular, gives you more control over images. Circles and rectangles created in Paint's high-resolution mode always seem to have gaps in their borders. Attempting to "paint" them often results in the pattern leaking out over the screen, and you usually have to touch up the borders by hand.

Paint lacks an image-scrolling feature, so it can't make drawings larger than the CoCo's screen. Its ability to mix text and graphics is also very limited, and only one type font is available.

There are three optional sizes for black-and-white screen printouts, and you can

allegedly get color prints from an ink jet printer. These routines didn't work with my Epson FX-80, perhaps because of oddball switch settings in the printer. I'm skeptical, though; the machine works with a lot of other software, including graphics drivers.

Ledger, a 99-row, 99-column spreadsheet, is another of DeskMate's better components. While lacking functions for scientific calculations and advanced financial work, it features automatic summation and row and column averaging.

Ledger makes it convenient to format a spreadsheet and copy a formula from one cell to another, adjusting address references in the process. You can even set up a formula that prompts you to enter a value from the keyboard for a recalculation. This possibly unique feature can be convenient for the "what if" games spreadsheet fans like to play.

You can insert portions of one spreadsheet into another, and save part of a sheet in text format for merging with a Text Editor document.

I haven't had the opportunity to use Telecom, DeskMate's telecommunications routine; it requires Tandy's Multi-Pak (or a similar interface) and an RS-232 Program Pak, neither of which I have. The program looks fairly straightforward, with one major screen for setting parameters, a second for establishing the communications link, and a third for viewing the contents of the RAM file containing the transmitted or received information. Incoming material is saved as a Text Editor file for further processing.

# Irreconcilable Differences

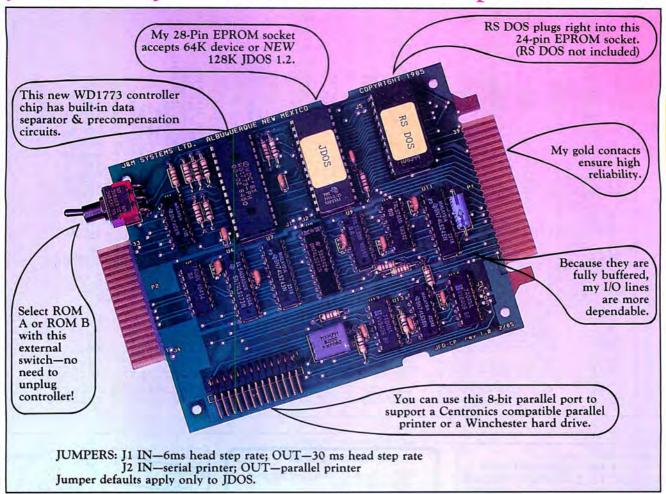
The CoCo DeskMate's applications are presumably geared to computer novices. Note, for example, that the electronic mail function of other DeskMates was replaced with Paint. Some functions are too simplified for heavy-duty use, but as an "official" Radio Shack product, DeskMate is likely to attract a lot of attention.

I'm disappointed in Text Editor and Paint, though. While Paint is entertaining, it contributes little to the package; you can't splice its images into a Text Editor document or an index card, among other things.

I've already mentioned my objections to Text Editor. Any word processor that can't access features offered by modern printers is shortchanging its users. If it was too hard to build in that ability to transmit embedded commands, Tandy could have at least given us a program that can print page numbers.

Scott Norman is the manager of solidstate science at GTE Laboratories in Waltham, MA. Write to him at 8 Doris Road, Framingham, MA 01701.

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GO UNCRUNCH THE NEXT LINE GET THE RIGHT ADDR. TO GET THE ADDR. OF THE NEXT LINE UNCRUNCH TO GET THE END OF LINE ADD ENOUGH TO COMPENSATE FOR THE

SUBD COUNT STD COUNT LENGTH OF THE LINE PART FINDS OUT #\$600 LDD SUBD CURSOR GET THE SPACE LEFT CMPD COUNT WILL THE LINE FIT PRINT IF SO GO PRINT IT BHT IF NOT GO CHECK FOR A KEY

RTS \*THIS ROUTINE PRINTS TO THE \*SCREEN. IT DOES THIS IN TWO PARTS \*THIS PART PRINTS THE LINE NUMBER PRINT LDY BUFF GET THE LINE ADDR.

LDD 2, Y GET THE LINE NUMBER JSR AND PRINT IT SBDCC LDA #\$60 PUT A SPACE AFTER IT STA [CURSOR

\$89 INC

PRINTS THE LINE\* \*THIS PART

LDX BUFF GET THE CURRENT LINE BACK KEPTRK GO KEEP TRACK OF THE LINES BSR \$B7C5 DO THE ACTUAL UNCRUNCHING JSR LDU #\$2DD GET ADDR. OF THE FIRST CHAR. LDA . U+ STORE IT FOR PRINTING

ENDBUF IS IT THE LAST ONE BEQ JSR \$A282 IF NOT GO PRINT IT BRA A@ GO GET ANOTHER ONE

BRA UNCRUN \*THIS ROUTINE KEEPS \*THE SCREEN AT ANY ONE TIME

TRACK OF THE LINES ON\* KEPTRK LDY BU

LEAY 2,Y

STX , Y STY BU RTS END

GET THE FIRST TABLE ADDR. BUMP IT FOR THE REAL ONE STORE THE FIRST ADDR. STORE TABLE ADDR. FOR NEXT GO FINISH THE JOB

BRA EXIT DO OUR RTS BUF MAKE THE NEXT CURRENT STX \*THIS ROUTINE CHECKS TO SEE IF THE NEW LINE WILL\* BUFF

STORE IT ON THE SCREEN

IF NOT GO DO IT AGAIN

GO START ALL OVER AGAIN

GET THE LINE TO UNCRUN

GET THE ADDR. OF NEXT LINE

CARRY ON IF GOOD LINE NUMBER

THIS CHECKS TO MAKE SURE WE

IS THE ADDR. NONEXISTENT

IF NOT RESET TO BEGINNING

ARE NOT PRINTING THE SAME

LINE TWICE ON THE SCREEN

KEEP IT SAFE FOR NOW

KEEP IT SAFE FOR NOW

ARE WE DONE

\*THIS IS THE MAIN ROUTINE FOR BOTH UP AND DOWN\*

\*IT DOES MOST OF THE ERROR CHECKING AND CHECKS\*

\*TO SEE IF LINES WILL FIT AS WELL AS DOING THE\*

\*UNCRUNCHING AND PRINTING TO THE SCREEN

\*FIT ON THE SCREEN \*THIS PART GETS THE LDX JSR \$B7C5 LDD #\$2DD GET THE BEGINNING OF THE LINE KEEP TRACK OF IT FOR NOW STD COUNT TFR Y,D TFR TO PRESERVE THE Y REG. ADDD #37

CARRIAGE RETURN DO THE SUBTRACTING TO GET THE

HOW MUCH SPACE THERE IS\* GET THE END OF SCREEN

AND BUMP THE CURSOR

A@ ENDBUF JSR \$B95C DO A CARRIAGE RETURN

STA

CMPX

BNE Be

LBRA

STY

LDX

CMPX

BNE

LDD

STD

T.DX

CMPX BUF

BEO

BRA

LEAS

UNCRUN LDY

CHECK

, X+

#\$600

BEGIN

BUF

#00

\$19

BUF

Be

2,5

S1F9

HNCRHN

AR

BUFF

Listing continued from p. 126

0086 70CA A780 0087 70CC 8C0600 0088 70CF 26F9 0089 70D1 16FF47

0090 70D4 10BE01E9

0091 70D8 10BF01EB

0092 70DC AEA4

0094 70E1 2613

0095 70E3 DC19

0093 70DE 8C0000

0096 70E5 FD01E9

0097 70E8 BE01F9

0098 70EB BC01E9

0099 70EE 2702

0100 70F0 20E2

0101 70F2 3262

0102 70F4 20A8

0103 70F6 BF01E9

0104 70F9 BE01EB

0106 70FF CC02DD

0107 7102 FD01ED

0109 7107 C30025

0110 710A B301ED

0111 710D FD01ED

0112 7110 CC0600

0114 7115 10B301ED

0117 711C 10BE01EB

0121 7127 A79F0088

0123 712D BE01EB

0113 7113 9388

0115 7119 2201

0118 7120 EC22

0120 7125 8660

0122 712B 0C89

0124 7130 8D14

0127 7138 A6C0

0128 713A 2705

0130 713F 20F7

0132 7144 208E

0134 714A 3122

0135 714C AFA4

NO ERRORS FOUND

0137 7152 39

0138 7153

0125 7132 BDB7C5

0126 7135 CE02DD

0129 713C BDA282

0131 7141 BDB95C

0133 7146 10BE01F7

0136 714E 10BF01F7

0119 7122 BDBDCC

0116 711B 39

0108 7105 1F20

70FC BDB7C5

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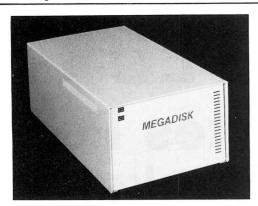
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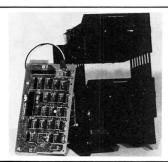


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Juki Office Machine Corp. offers the Juki 5510-Color dot-matrix printer. Unlike the Juki 5510, which uses a black ribbon and must be converted to support the color option, the 5510-Color has the color option already installed.

Maximum print speed for the Juki 5510-Color is 180 characters per second (cps) for draft quality and 30 cps for near-letter quality. It provides 96 ASCII characters, 96 italic characters, and 11 international character sets. The 5510-Color can produce seven colors from its four-color ribbon and features several printing modes, including double-emphasized.

The printer has a built-in tractor for a smooth friction feed and a 3K buffer memory (expandable to 15K). It also comes with a Centronics 8-bit parallel interface or an optional RS-232C serial interface and is available with either IBM or Epson printer software compatibility.

The Juki 5510-Color costs \$650. For more information, contact Juki Office Machine Corp., Printer Division, 20437 South Western Ave., Torrance, CA 90501, 800-325-6134.

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#### Looking Ahead

MatheGraphics Software announces Multivariate Regression Analysis, a forecasting tool for businesses and research organizations. The program determines the most likely relationship among as many as 11 variables. Users can apply the relationship predictively to any set of data values they want to examine.

The program is available on tape or disk for the Color Computer and on disk for the Models III and 4. The cost for either version is \$30.

For more information, contact Sheldon P. Gordon,



The Juki 5510-Color dot-matrix printer.

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#### **Better Bets**

Someday soon, you might strike it rich with The Lotto Program from Soft-Byte Computer Programs. The software keeps track of winning numbers in state lotteries and helps you select winning combinations based on the laws of probability.

The program includes formats for all major state lotto games and a tutorial to help you get started. According to Byte Computer Programs, the program has produced several winning tickets.

The Lotto Program runs on the Models III and 4 and costs \$19.95. For more details, contact Soft-Byte Computer Programs, P.O. Box 5701, Dayton, OH 45405, 513-278-8044.

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#### CP/M Booster

Out-Think is an outline processor for CP/M computers, including systems with the 8080, 8085, and Z80 microprocessors. The software allows you to prepare and edit text in outline form.

In addition to a full-screen outline editor with collapse and expand features, Out-Think offers a full-screen text editor for inserting and editing text. You can copy and move text within and between outlines and mark titles for copying, printing, or deleting.

The software includes more than 20 formatting parameters for such features as writing headers and footers, page numbers, section numbers, and tables of contents. Additional features include a built-in file manager, information retrieval by key word, date and time stamping, and password security on outline files.

Out-Think requires 48K RAM and an 80-column by 24-line screen. The program costs \$49.95 including shipping. For more information, contact KAMASOFT Inc., 2525 SW 224th Ave., Aloha, OR 97007, 503-649-3765.

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#### **Smart Talk**

The Visionary 1200XT, a 1,200-/300-baud intelligent modem from Visionary Electronics, contains its own battery backed-up memory for sending, receiving, and storing messages (including TELEX and TWX) even if the host computer is turned off.

Incorporating a Bell 212A modem and an Intel 8085 microprocessor, the Hayes-compatible unit operates in originate and answer modes and transmits in either half or full duplex. It attaches to any personal computer through an RS-232C connection.

The Visionary 1200XT features call-progress detection, automatic log-on, and automatic data capture/retrieval. Messages can be directed to the unit's printer port for simultaneous printing during reception. With its built-in clock and calendar, you can control when messages are to be sent and when they can be received. Your computer can also use the clock to run programs at preset intervals, or to put a date and time stamp on documents it is printing out.

The Visionary1200XT is available with 8K RAM for \$495. You can purchase additional RAM in 8K increments for \$20. A full 48K system retails for \$595.

For more details, contact Visionary Electronics, 141 Parker Ave., San Francisco, CA 94118, 415-751-8811. Circle 565 on Reader Service card.

#### Fortran Feats

Cleydale Engineering offers utilities to complement the Microsoft Fortran-80 compiler that runs under CP/M-80. Fortran-80 Utilities consists of an optimized scientific subroutine library, FORLIB.REL math additions, an escape sequence and control character generator for controlling peripheral devices, and three Fortran programming tools.

The package provides subroutines for linear and nonlinear regression analysis, statistics, matrix operations, equation roots, graphics, celestial mechanics, and other calculations. Programming tools include a utility for renumbering the numeric labels and line references of a Fortran-80 program; a high-performance, resynchronous ASCII file comparison program; and a file-scrolling utility.

The package costs \$49. For more information, contact Cleydale Engineering, Route 1 Box 217-B, Blacksburg, VA 24060

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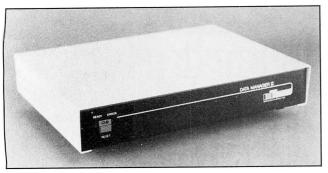
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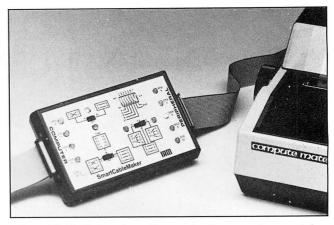
#### **Shared Service**

Belkin Components' Data Manager Spooler allows five computers to send data simultaneously to one printer, thus lowering printer costs for individual workstations. The spooler handles each incoming printer independently and processes data on a FIFO (first-in, first-out) basis.

Data Manager interfaces personal computers with the Hewlett-Packard LaserJet and other high-cost serial printers. No operator switching or setup is necessary. The spooler contains the Z80A microprocessor with six serial RS-232C ports (five input and one output). It also has a 64K buffer.

For pricing and other information, contact Steve Bellow, Belkin Components, 4718 W. Rosecrans Ave., Hawthorne, CA 90250, 213-644-3184.

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SmartCableMaker does the work of connecting peripheral devices.

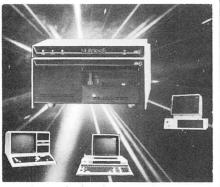
#### **Making Connections**

The SmartCableMaker from IAM is an intelligent RS-232 interface that sets handshaking protocols between computers and peripherals automatically. It connects terminals, printers, modems, bar code readers, digitizers, or any other device that utilizes an RS-232 port.

To attach peripherals, all you do is plug in the SmartCableMaker and flip its three control switches. The device figures out what signals are on each line and sets the handshaking protocol. It also provides a graphics display of the interface configuration. For nonstandard applications, the SmartCableMaker

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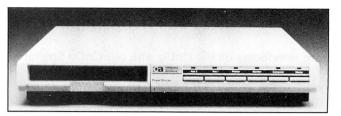
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#### Modem Media

Novice and experienced modem users can find answers to their questions in a new brochure from US Robotics, 24 Questions & Answers About 2400-BPS Modems. The six-page, color brochure gives detailed answers to questions about the compati-

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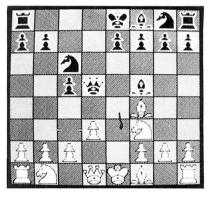
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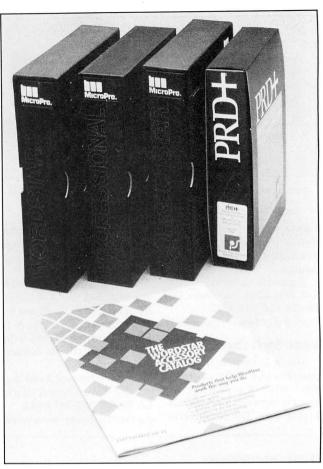
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The WordStar Accessory Catalog available from Broad-Reach.

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For a free copy, contact US Robotics Inc., 8100 Mc-Cormick Blvd., Skokie, IL 60076, 800-342-5877.

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#### WordStar Wares

Shopping for WordStar add-ons and enhancements is made easier with *The Word-Star Accessory Catalog* offered by BroadReach, a directmail marketing firm based in Seattle. The catalog lists WordStar add-on items from a variety of manufacturers.

Catalog offerings include WordStar utilities for laser printer support, automatic footnotes and file management, software and publications for WordStar customization, an on-line thesaurus, software for merging text and graphics, and keyboard productivity software.

To obtain copies of the catalog, contact BroadReach, 534 Industry Drive, Seattle, WA 98188, 800-641-1116. Circle 552 on Reader Service card.

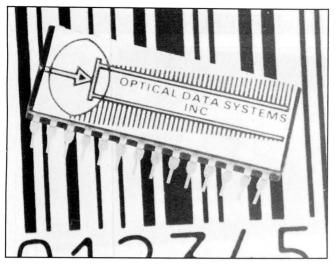
#### Bar Scanner

Optical Data Systems Inc. announces BAR + , a low-power CMOS ROM chip that reads and prints the formats of many industry-standard bar codes, including LOG-MARS (the military standard); HIBC (the health industry standard); AIAG (the automotive industry standard); and UPC (the grocery industry standard).

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keypad, special optical filter, and user manual come with the package, The single-unit price for BAR + is \$195. Quantity discounts are available for corporate users.

For further details, contact Sam Smith, product manager, Optical Data Systems Inc., P.O. Box 1987, Escondido, CA 92025, 619-745-6563.

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#### Juiced Up

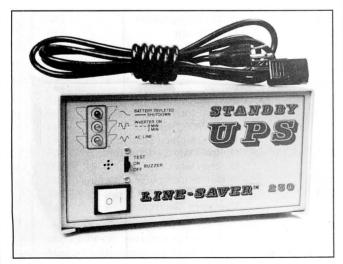
Line-Saver (Model LS250) is a standby, uninterruptible power system from Kalglo Electronics Co. that is designed to keep you on-line even if the lights go off.

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Line-Saver costs \$549. For more information, contact Kalglo Electronics Co. Inc., Dept. CP, 6584 Ruch Road-E Allen Twp., Bethlehem, PA 18017, 215-837-0700.

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For more information about the dispenser and cleaners, contact Screen Data Corp., 80 South Jefferson Road, Whippany, NJ 07981, 800-248-1212.

Circle 562 on Reader Service card.

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New Products listings are based on information supplied in manufacturers' press releases. 80 Micro has not tested or reviewed these products and cannot guarantee any claims.

# THE SETTION

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6

## **Unlisted Numbers**

80 Micro's Department of Judgment picked two winners of its Basic black book contest. (Too many good two-line telephone/address programs vied for third place to select three.) Both winners add and delete entries, and both bring up any entry by name, just like any good two-line data base. A combination of relative power and simple use separate the winners from the rest of the field.

#### **Artfully Simple**

Neither entry uses fancy tricks, just good planning and cramming—a trick in itself. Herbert Perkins (Thomaston, ME) has won an 80 Micro T-shirt (they're in) for his Model III random-access Rolodex (Program Listing 1). Perkins' program provides a one-line menu that at all times proclaims its five functions: add, inquire, change, delete, and exit. Type the function number (1-5), press the enter key, then answer another prompt specific to that function.

The powerful search function pulls up any and all records containing the search string you enter. Matching records appear one at a time as you page with the enter key. The search string can be anywhere in a record. You can, for example, bring up all records containing a particular zip code or the name Smith. If you press the enter key at the search string prompt, all records display.

Each record contains four 24-byte fields. The length of the one-line menu shows maximum field length. Records aren't sorted, but they're numbered (a fifth field). You specify the displayed record number when you delete or change an entry.

To add a record, you enter four lines of information, pressing the enter key to go to the next numbered line. Commas are OK. Changing a record replaces an existing record completely; after specifying the record's number, you type in four lines of new information.

Because Perkins' program uses a nonstandard record length (96 bytes), you must specify variable-length records when you enter Basic. When you see the "How Many Files?" prompt, type in 3V. Also, the first time you use the program, you must create an empty file as a starter data file. Follow these instructions:

- 1. Run the program (first time) and choose option 1 (add). You'll get the error message "Internal error in 1."
- 2. In command mode, type in LSET X\$ = MKI\$(1):PUT 1.1:RUN.

3. Add some records, and you're in business.

When typing in the program, remember to use the edit mode to finish the long program lines (for example, EDIT 1).

Brian P. Murphy (Paterson, NJ) earned his 80 Micro bumper sticker with an address book (Program Listing 2) for Color Computer Disk Extended Color Basic. It also runs on the Model III. Murphy's entry adds and deletes entries to a sequential file; each entry may be a record of up to 255 characters. The file is kept in memory and sorted as you add or delete entries. A search function lets you call up all records beginning with the search key you enter. Added entries should start with the search key. On the Model III, you can get fancy with linefeeds (down arrow) and have multiple-line, formatted records (commas included).

A nice feature of Murphy's program is its simple user interface. When it's run, you see the > prompt. Entering a plus sign (+) brings up the data entry (>>) prompt so that you can enter new records. Typing in a minus sign (-) deletes the last record displayed. (If no record has been displayed with the search function, then the first record is deleted.) Typing in an "at" sign (@) ends the program and saves the file to disk if any changes have been made. If no changes are made, the disk file isn't updated (and you receive a harmless error message).

Any other string you enter is considered a search key, and all records starting with that key are displayed. Pressing the enter key displays the whole file.

Like Perkins' program, you must cre-

ate a data file before you first use it. Type in the line OPEN"O",1,"DIR":CLOSE: RUN after you type in the program. The program is set up for a maximum of 99 entries (variable M in line 1) with an average length of 100 characters (CLEAR 10000). You can adjust M and the amount of string space in the Clear statement to fit your needs or memory size.

#### Statistically Significant

This month's challenge is highly improbable: squeezing a useful statistics package in (you guessed it) two significant lines of Basic. Sure, you can make yours do means and standard deviations, but what else can it do? Here are the rules:

- 1. Owners of all TRS-80 and Tandy systems with the exception of the Pocket Computers are eligible. We'll consider degree of difficulty when comparing solutions created on different machines.
- 2. The deadline will always be the 15th of the issue month. Thus, this month's deadline is June 15. We realize that this doesn't give everyone the same amount of time to come up with entries (we apologize to our overseas readers especially), but postponing the deadline any longer would add another month to our publishing the answers.
- 3. Speaking of the answers, they'll appear three issues from the issue in which the problem appears. Thus, this month's winners will make their appearance in the September 1986 issue.
- 4. Employees of CW Communications are not eligible.
- 5. Send your entry to *80 Micro*, Fine Lines, *80 Pine St.*, Peterborough, NH 03458. We will not, unfortunately, be able to return entries.
- 6. Specify your T-shirt size.

#### Program Listing 1. Herbert Perkins' Model III address filer.

1 IFI>5CLS:INPUT"lAdd 2Inq 3Chg 4De1 5Xit";1:GET1,1:R=CVI(X\$):C=1:GOTOIELSEIFI=5CM
D"S"ELSEIFI=1FORX=1T04:PRINTX;:LINEINPUTF\$:LSETF\$(X)=F\$:NEXT:PUT1,R+1:LSETX\$=MKI\$(
R+C):PUT1,lELSEIFI>2N=R:INPUT"#";R:IFI=4GET1,N:PUT1,R+1:LSETX\$=MKI\$(N-1):PUT1,1ELS
EC=N-R

LE-W-R 2 IFI=2I=6:LINEINPUT"FIND: ";F\$:FORX=2TOR:GET1,X:FORZ=1T04:IFINSTR(F\$(Z),F\$)PRINT@ 196,X-1:FORY=1T04:PRINTF\$(Y):NEXT:INPUTX:NEXTX:GOTO1ELSENEXT:NEXT:GOTO1ELSEIFI=0OP EN"R",1,"A",96:FORX=0T03:FIELD1,X\*24ASX\$,24ASF\$(X+1):NEXT:I=6:GOT01ELSEI=6+5\*(I=3)

End

Program Listing 2. Brian Murphy's Color Computer address book works on the Model III.

1 CLEAR10000; M=99:DIMLS(M): K=1:F\$="DIR":OPEN"I",1,F\$:FORL=1TOM+1:IFNOTEOF(1)THENLI NEINPUT#1,L\$(L): N=L:NEXTELSENEXT:CLOSE:FORQ=0TO2:LINEINPUT">";A\$:IFA\$="-"THENN=N-1:FORL=K TON:L\$(L):L\$(L): NEXT:C=1ELSEIFA\$="@"THENOPEN"O",C,F\$:FORL=C TON\*C:PRINT#C.LS(L)

Q=0:IFA\$="@"THENNEXT:CLEAR200:ENDELSEIFA\$="+"ANDN<M THENLINEINPUT">>";L\$:N=N+1:F ORL=N TOISTEP-1:IFL\$>L\$(L-1)THENL\$(L)=L\$:L=0:NEXT:C=1:NEXTELSEL\$(L)=L\$(L-1):NEXT:N EXTELSEFORL=1TON:IFA\$=LEFT\$(L\$(L),LEN(A\$))THENPRINTL\$(L):K=L:NEXT:NEXTELSENEXT:NEX

End

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   Automatically records recurring charges
   Reports Include: Aged Trial Balance, On-Line En-quiry, Batch Proof, Accounts Distribution Report, Customer Statements, Customer Lists, Invoice & Cash Batch Proof, General Ledger Update
   Optional dunning letters

#### THE Order Entry:

- Processes invoices singly or in batches
   Up to 99 lines items per order
   Held (unshipped) items are marked on the Order

- THE O/E system automatically shows customer
- THE O/E system automatically shows customer credit rating
   Each invoice depletes THE Inventory automatically
   Sends accounting transactions to THE Accounts Receivable
   Assign separate line item amounts to independent sales and receivables accounts
   Checks stock quantities in THE Inventory and notifies you when back orders are required
   Stock depletions will be automatically reported in THE Inventory
   Detailed invoice information

- Detailed invoice information
  The Order Report provides urgent information on

#### **THE Inventory:**

- Perfectly suited to retail environment
   Simple transactions for: addition, deletion, altera-
- tion and examination

- tion and examination Complete current statistics on each inventory item Activity statistics for current or to-date period Instant on-line inquiries Optional hard copy record of all inventory transactions for auditing 13 digit, user-definable alphanumeric part number 30 character description field Reports include: Activity Report, Valuation Report, Auditability Proof, Reorder Report, Item List, and Item File Print

#### THE Payroll:

- Handles any combination of weekly, biweekly, semimonthly & monthly pay schedules
   Define up to 20 earning or deduction categories for
- all employees
  Assign any 8 categories for each employee
  Accountants can perform after-the-fact payroll

- processing Prints information for government reports Salary expenses can be distributed to different departments, branches or profit centers System includes safeguards and verification

- System includes safeguards and verification procedures
  Reports Include: Company History, Pay Transaction Proof, Calculations Proof, Employee History, Employee Master List, Check Register, Payroll Journal, Vacation report, 940 & 941 Reports, W2 Forms, & Prints Checks
  Of course, THE Payroll calculates payroll including Federal & State taxes, prints checks, allows hand written checks, lets user maintain tax tables and keeps an extensive employee payroll history

## THE Name & Address

- Create name & address files
  Print mailing labels
  Sort files by up to 4 items
  Search or sort by match or range
  Print a report of a NAD file
  Merge files
  88 character open reference field
  Sort by any character in reference field
  10 number zip code

#### THE Spreadsheet:

- On-line tutorial
  Cut & paste multiple spreadsheets
  Format: Global, Column, Row, Entry
  Arrays: Copy, Replicate, Move, Insert, Delete, Blank
  Labels: centered, right or left justified
  Variable cell width

- variable cell width
  2 Windows to view separate areas of worksheet
  20 special math functions
  Manual or automatic recalculation
  Complete glossary of spreadsheet terms
  Maximum spreadsheet size: 255 Rows x 64
  Columns Maximum spreadsheet size: 255 Rows x 64
  Columns
  Variable print formatting options
  Simple editing functions
  Status on contents of any cell
  Set hold on any row or column to prevent srolling
  On-line help

#### THE Wordprocessor:

- On-line help
  Powerful editing: Erase, Copy or Cut & Paste characters, words, sentences, lines, paragraphs, pages, or user-defined blocks of text
  Automatic word wrap-around (may be turned off)
  User-defined page breaks, soft hyphen, tab, indent and margin settings
  Proportional & justified printing
  Global Search & Replace, Automatic & Examine
  Optional command character viewing
  Superscript and subscript
  Phrase files for boilerplate
  Print bold, centered, underline
  Edit ASCII files
  Right or left justification
  Hyphenation

#### THE Mailmerge:

- Integrates THE Wordprocessor & THE Name & Address System
  Mass mailings
  Specialized mailings to select groups in your Name & Address System.
  Can read A/R customer file, A/P vendor file and payroll employee file so you may send customized Wordprocessor letters

#### WindowMaster:

Our windowing system lets you integrate your application programs. You can run up to 7 applications simultaneously. Run THE Payroll and print checks while you are using THE Wordprocessor. Or enter orders with THE Order Entry while THE Spreadsheet performs a lengthy calculation and THE Mailmerge prints letters for a mass mailing. The simple interwindow transfer feature allows you to pass data from one application to another. The powerful keyboard enhancer lets you program keys on your keyboard to perform special functions which would otherwise require many keystrokes. You can also redefine keys. WindowMaster integrates your IRE applications and enhances your computer.

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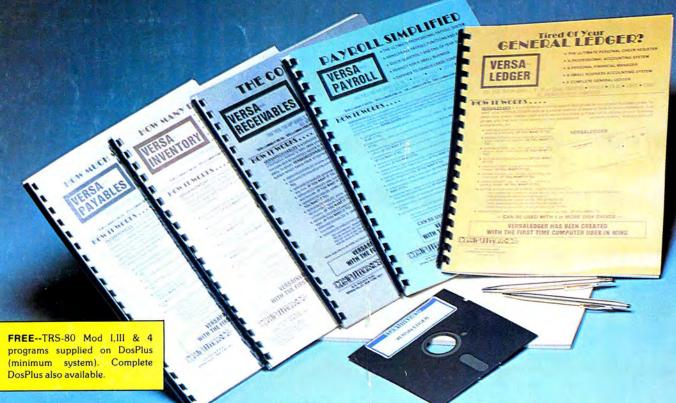
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