

# 80 micro

the magazine for TRS-80\* users

DECEMBER 1985  
USA \$4.00  
CANADA \$4.50  
A CWC/I PUBLICATION

Reviewed in This Issue:

Hyperzap

Typitall

MULTIDOS 80/64

GBasic 3.0

The Money Decision Series

## THE ABCs OF C

Including  
YOUR OWN C  
INTERPRETER

## TABLE TOPICS

How to Use  
Multiplan's  
Lookup Function

## HOOP HOOPLA

The Ultimate  
Basketball  
Stats Program

## WINDOWS IN BASIC!

The Hi-Res Board  
Makes It Simple



```
if (argc != 1)
    printf("Usage: FIND -x -n pattern\n");
else
    while (getline(line, MAXLINE) > 0)
        lineno++;
```

# "Boy Am I Glad I Found You!"

People say this to us all the time. In fact, we'll go so far as to bet that if you spend a couple of minutes reading this article, you'll say the same thing.

Applied Creative Technology Inc. applies technology creatively. We produce machines that most computer dealers wouldn't *dare* tell you about... machines that deliver even *more* than what is expected of them (customers often tell us this too)... machines that can save you lots of money and headaches. Chances are if you do much computing at all, and use a printer or modem, you would benefit from having one of our products.

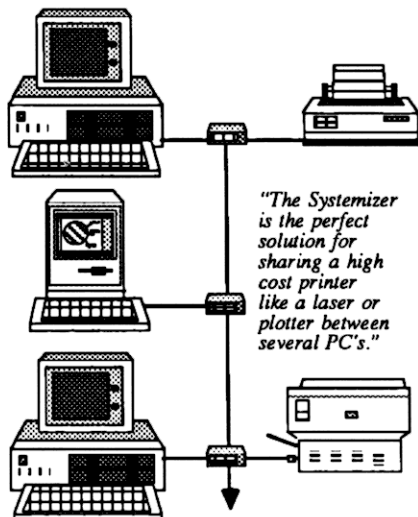
Enough of the promises... let's get to the facts.

**"The Printer Optimizer has increased the performance of our system by 6000%, saving us thousands of dollars a year."**

Our product line covers a myriad of applications. One product, the Printer Optimizer, is a *printer and modem control center*. It offers data **spooling** (using a 64K to 1 Meg buffer), the ability to connect several printers or modems to a single computer — without extra adaptors or software, and even the ability to modify or filter out data passing through it. A fellow from McDonnell Douglas told us: *"Every computer department ought to have a Printer Optimizer in their bag of tricks. It's great!"*.

The Printer Optimizer is also particularly useful to owners of laser printers. When you call for info, tell us if you have a laser printer — and if you do own a laser, you *should* call.

Another product, the Systemizer, allows several PC's or CRT's to share one or more printers.



Businesses ranging from small law firms to almost 100 of the *Fortune 500* are using Systemizers to save big dollars by eliminating printers and the office space and service costs associated with them. Now you can afford to own better printers like laser printers and plotters.

**"The Systemizer is all the network many PC users need."**

*Jim Seymour, PC Week*

The Systemizer is indeed the best solution for sharing printers you'll find. That's a bold statement, so we suggest you get a copy of our article *"The Wasted Buck Stops Here"* and see if you don't agree.

**"Now that the Systemizer is available, buying a LAN to share printers is like buying an aircraft carrier to go water skiing!"**

**"Your 1 Megabyte printer buffer is a dream come true."**

We also make a complete line of printer buffers and full fledged spoolers, with buffer capacities ranging from 64K to 1 Megabyte. Our latest creation is the **Buffer Box**. It's the lowest cost full-feature printer buffer available. Anybody who owns a printer should at least have one of these little wonders.

**"Printing from a micro without a printer buffer is like trying to drain Hoover Dam with a soda straw."**

You know, we hear the same refrain over and over: *"Geez! I wish I'd known about you before I bought..."*. In addition to the products mentioned, we also make a computer adapter for IBM Electronic Typewriters and some amazing boxes that adapt the Hewlett Packard LaserJet to various computers and word processing systems. Call us *now* before you waste any more time or money. You'll be glad you did.

**Applied  
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# Did you know? Only one spelling checker:

- works with both Scripsit and Superscriptsit.
- 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.
- offers integrated Hyphenation Option and Grammar & Style checker.

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**SPELLING CHECKER • AUTO-HYPHENATION • GRAMMAR CHECKER**

**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.

**Verifies Corrections:** If you think you know the correct spelling of a word, EW will check it for you before making the corrections.

**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.

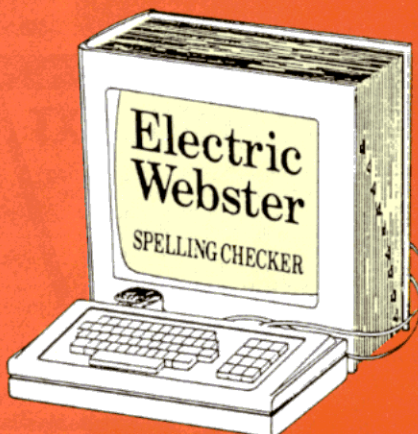
**50,000 Word Dictionary:** Uses only 2½ bytes per word; add as many words as you wish.

**Fast Correcting:** In as little as 30 seconds, Electric Webster can return you to your Word Processing program, with your text fully corrected and on your screen.

**Integrates:** with WordStar, Deskmate, Spellbinder, Volkswriter, Open Access, Allwrite, Newsprint, Lazy Writer, Superscriptsit, 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." *CIN-TUG, 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 Dictionary or their successors.

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:

**F**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.

### LOW PRICES:

TRS-80, Model I/III or IV	\$ 89.95
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Grammar & Style Checker	\$ 49.95

CP/M, PC/DOS, Model 1000/2000	
Electric Webster,	
w/Correcting Feature,	\$169.95
Hyphenation, and Grammar	



Circle 45 on Reader Service card.

# Cornucopia Software

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



## GREAT PROGRAMS, AND FREE SHIPPING TOO!

We've still got our very popular T/Maker and Word Processor deals continuing this month, as well as a new addition of T/Maker for the Tandy 1000 and other MSDOS machines. Since you'll probably be reading this as the holiday season begins to approach (at least for the retail business), I'm sure you'll want to consider us for that hard-to-please TRS-80 user on your gift list. And if you plan on giving an Infocom game, better get 'em soon because Infocom has discontinued production for the TRS-80 computers... it's a "while supplies last" basis from now on. I've run out of room now, so I'll leave you with this prediction: if Cadbury ever comes out with a computer, they'll probably use chocolate chips.

### PASCAL-80

Easiest version of Pascal to learn! Editor and Compiler are already in memory. Nearly complete subset of standard PASCAL. Offers also many extensions to Pascal, including calls to machine language, screen control, random access files and more!

Models I/III (List \$79) ..... \$59.50

### PRONTO

Specifically designed for the 128K TRS-80 Model 4/4P. Window controller program with many applications. Includes calculator, calendar, a sort utility, terminal facility, address cards, on-line help facility, and much more. "Sidekick" for the Model 4!

Models 4/4P ..... \$54.50

### POWERDOT II

"The best high-resolution bit-image graphics program on the market for the TRS-80." Screen becomes a window on large full-page drawing board. AUTODRAW feature for lines and circles. POWERDOT II is 100% Machine Language. (Specify printer!)

MODELS I/III ..... \$29.50

### PUBLIC DOMAIN DISKS

A fine collection of software from The Alternate Source!

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Public Domain Package #1-#6 ..... \$49.50

Public Domain Package #7-#12 ..... \$49.50

Public Domain Package #1-#12 ..... \$89.50

### EDAS/PRO-CREATE

One of MisoSys' most popular utilities. Both a Full Screen Text Editor as well as a powerful Macro Assembler. Assembler supports nested macros, includes, and conditionals. Works excellently under most DOSes.

Models I/III and 4 ..... \$69.50

### SUPER UTILITY

"The indispensable first-aid kit for the TRS-80 users..." Contains over 60 different utilities for repairing, reviving dead files, reformatting, manipulation of files, and lots more!

Super Utility Plus (Models I & III) ..... \$59.50

Super Utility 4/4P & MSDOS ..... \$69.50

### PACKAGE DEAL!

\*\*\* MTERM \*\*\*

\*\*\* MSCRIPT \*\*\*

\*\*\* DOSPLUS IVa \*\*\*

A complete operating system has just become very affordable! This new deal offers an operating system that is much faster and easier to use than TRSDOS. Not only is DOSPLUS IVa itself very user-friendly, it also offers a built-in menu driving system, and of course, GREATLY enhanced BASIC. Other included features of DOSPLUS IVa are: Text Editor, Linker, Assembler; Directory Verification/Repair, Disk Mapping, and File & Disk Editing. As if that is not enough, you now also get MSCRIPT with your purchase of DOSPLUS IVa. That's right, one of the easiest and most convenient to use word processors goes with your purchase. Also, MTERM Smart Terminal (one of the best full featured TRS-80 terminal programs available) is included in this deal. In addition to all of the remarkable features of MTERM, it will also enable you to log on to local Bulletin Boards and tell your friends about this fantastic deal!

DOSPLUS IVa / MSCRIPT / MTERM Package Deal

Models 4/4P (List \$329.85) ..... \$159.50

### SUPERCROSS XT

Designed specifically for transferring data and program files between TRS-80 disks and those of other computers

Models I/III or 4 ..... \$94.50  
with Convert Basic option ..... \$112.50



• WORD PROCESSOR • SPREAD SHEET • GRAPHICS •  
• DATA BASE • & MORE!

This integrated software package for the Models 4/4P, as well as for MSDOS, combines many functions to become one of the best software deals available for any computer. Included are Word Processing, Spread Sheet Analysis (which provide a full range of mathematical functions), Relational Database Management (allows merging, multiple selection criteria, restructure of DataBase, Multiple Sorting etc.), Spelling Checker (55,000 word dictionary, correction feature, ability to create personal and professional dictionaries), Bar Chart Graphics (created directly from Spreadsheet data and supported on any printer), and finally, Data Encryption. If you are worried about learning T-Maker, worry no longer. It has excellent documentation and comes equipped with a Tutorial on the disk. Not only is it a great program, but it is also at a great price!!!

Model 4/4P (List \$299) ..... \$194.50

MSDOS version (List \$450) ..... \$294.50

### LE SCRIPT

Great printer support, full Model 4 support and much more! On a 128K Model 4, you can have over 90K of text buffer for use on a single file. Model 4 features available while running in Model III mode. By far LeScript is our most popular program!

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W.P. Package (List \$279.90) ..... \$199.50

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Includes 50,000 word dictionary. Features fast checking, interactive correcting and personal dictionary expansion. (Specify computer and word processor when ordering)

Electric Webster (Models I/III or 4)  
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Grammar or Hyphenation options  
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## APPLICATIONS/BUSINESS

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Powerdof II	\$ 29.50
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POWERMAIL PLUS w/Txt Merge	\$128.50
LESCRIPT	\$ 94.50
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Electric Pencil w / Spell Check	\$139.50
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TEXTPRESS	\$ 39.50
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PowerDraw	\$ 34.50
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Howe's System Diagnostic	\$ 89.50
J & M's Disk Drive Analyzer - I	\$ 84.50
J & M's Disk Drive Analyzer - III	\$ 74.50
ENBASE Data Base Manager	\$ 64.50
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Home Accountant (Model III)	\$ 59.50
VersaLedger II (Models I/III)	\$134.50
Versa Series (Models I/III)	each \$ 89.50
TAS's ZMAIL Mail List	\$ 24.50
PowerMail Plus	\$ 98.50
Macro Typing Tutor	\$ 24.50
Lazycomm Terminal	\$ 29.50
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MTERM Smart Terminal	\$ 59.50
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Using Super Utility	\$14.50
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The C Programming Language	\$17.50
Programmer's Guide to TRSDOS 6	\$14.50
TRS-80 Disk and Other Mysteries	\$16.50
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The Custom TRS-80	\$23.50
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DFBLIB or BFBDEM Disks	each \$17.50
Basic Disk I/O	\$23.50
DFBLOAD Disk	\$23.50

## INFOCOM

Better be careful out there... Infocom's latest adventure seems to be the phasing out of their TRS-80 line. We will do our best to keep these popular games in stock, but once they run out, they are gone for good. Hitchhiker's Guide is our first casualty!

"Standard Level"	Each \$34.50
PLANET FALL	WITNESS
ENCHANTER	CUTTHROATS
"Intermediate Level"	Each \$39.50
ZORK II	ZORK III
SORCERER	INFIDEL
"Very Difficult Level"	Each \$42.50
DEADLINE	STARCROSS
SUSPENDED	

## UTILITIES

Alcor C Compiler	\$ 84.50
Alcor Multi-Basic Compiler	\$ 84.50
Super Utility 4/4P	\$ 69.50
Super Utility 3.2	\$ 59.50
Super Utility MSDOS	\$ 69.50
Supercross XT	\$ 94.50
Supercross XT w/CnvBasic	\$112.50
Autoloader	\$ 34.50
PRONTO (Model 4/4P)	\$ 54.50
Other MISOSYS Utilities	each \$ 23.50
Edas / PRO-CREATE	\$ 69.50
DSMBLR III / PRO-DUCE	\$ 23.50
Edas/Dsmbler Combo	\$ 89.50
DIS' n' DATA I/III	\$ 37.50
DIS' n' DATA (Model 4/4P)	\$ 46.50
TASMON Monitor (Models I/III/4)	\$ 34.50
Howe's Monitor #5	\$ 19.50
CNVBASIC (Models I/III/4)	\$ 27.50
Model 4 TOOLBELT	\$ 39.50
TOOLBOX for LDOS	\$ 39.50
TRACROSS (Mod I)	\$ 19.50
TRACROSS (Mod III)	\$ 24.50
PRO-ESP Utility Set (Model 4/4P)	\$ 23.50
6.2 Plus Enhancements	\$ 36.50
Impact Utility	\$ 29.50
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ALE - Assembly Language Editor	\$ 39.50
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Mumford's Instant Assembler	\$ 44.50
Instant Assembler (Model 4/4P)	\$ 59.50
ZEN Assembler	\$ 34.50
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PASCAL 80 for CP/M	\$ 36.50
LC / PRO-LC Compiler	\$114.50
SBE Compiler	\$ 46.50
ACCEL 3/4 Compiler	\$ 44.50
ZBASIC Compiler	\$ 84.50
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Backrest Utility	\$ 84.50
MULTIDOS Version 1.7	\$ 79.50
MULTIDOS (Model 4/4P)	\$ 89.50

## ELECTRONIC NOTEBOOKS

### KSOFT

SUPERLOG 4	\$99.50
SUPERLOG 3 (I/III)	\$99.50
LOG (Model I)	\$44.50
LOG (Model III)	\$44.50

## MONTHLY SPOT LIGHT

### ZBASIC 3.0

This long-awaited basic compiler is finally here! Enhancements included on this program include Device Independent Graphics, up to 54 digit numeric accuracy, a built-in interactive Editor and Compiler, structured Programming Constructs, and of course that is only scratching the surface. The nicest thing about ZBASIC is that the commands stay the same no matter what computer brand you use! Probably the best basic compiler around for any computer!

\$84.50

## CONVERSION PROGRAMS

BASIC 3 TO 4 CONVERT	
Model 4/4P ONLY (list \$49.95)	\$39.50
BASIC 4 TO 3 CONVERT	
Model I/III (list \$49.95)	\$39.50
BASIC GW CONVERT	
Model 4/4P ONLY (list \$99.95)	\$89.50
CONVERT BASIC	
Models I/III and 4 (list \$29.95)	\$27.50

## OUR GUARANTEE:

We sell only top-quality software. If, however you are unsatisfied with a product, you may return it within 10 days (in good condition) for a refund, less \$2.50 handling charge for programs under \$50 (\$5 for programs over \$50). We also ask for a letter stating the reason for your return.

We will also beat any competitor's price by \$1.00 (same conditions as competition, ie. shipping charges etc.) if you tell us where they advertise their price.

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We accept orders by phone or mail. Specify your TRS-80 Model, exact program(s) wanted, and method of payment. We accept VISA, MasterCard, Check, and Money Orders (C.O.D. orders add \$2.50 and Gov't Purchase Orders add \$5.00). Electric Webster orders please specify Word Processor. Free shipping to continental U.S. and Canada. All prices are in U.S. Funds. Prices subject to change without notice.

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# PowerSoft NewsFlash #2

Advertisement

Thank you for reading our newest installment of *PowerSoft's NewsFlash*. This is a mini-version of our *PowerSoft Newsletter* that will contain information that doesn't really fit into regular ad-type format. Please let us know your comments. We appreciate hearing from you. If you are a brand new TRS-80™ owner, then congratulations and welcome! You've come to the right place!

Not only is PowerSoft still here supporting the TRS-80 after six years, but we are now supporting the newer "standards" with our *Super Utility/PC* for PC/MS-DOS™ and *SuperCross/XT*, the state-of-the-art transfer utility recently raved about in *80-MICRO*. If you have a TRS-80 and a PC of some type, like a Model 1000, you'll definitely want to order this program. See our ad elsewhere in this issue for more details.

There are LOTS of new Mod 4 and 4P owners in our ranks now, thanks to TANDY's drastic price reductions earlier this year. A great time to pick up a new computer and super buy, if you want the latest in TRS-80 technology, other than the new 4D (still a great buy at \$1199, when compared to what most of us had sunk into Mod I's III's and 4/4P's before the prices were slashed). We're looking at the Model 4D to continue for some time to come. And we will be here to support it.


Speaking of the 4D, all of our Model 4 products have always support double-sided operation, so no update will be necessary if you buy a 4D or add double-sided drives.

By the way, TRSDOS 6.2 will already support double-sided operation! You do not need to obtain the rumored TRSDOS 6.2.1 just for this. Type: `FORMAT :1 (SIDES=2) <ENTER>` and everything else is automatic. Just thought we'd mention this, since many didn't know... Also, use LDOS for Model III mode on the 4D, as this system also already allows double-sided operation in the III mode (same method) and is media compatible with TRSDOS 6.

Ok, what's new this month?

## AFM - the Auto File Manager.

A new generation of truly relational data-base for the TRS-80 from PowerSoft.

 Special Introductory price on this new item!

Only \$99.95!+ \$3 s/h

A new generation of data base systems. Works on Model III, 4(III) or MAX-80. Works with most popular TRS-80™ operating systems. At least one disk drive required - two is better. Hard drive is great! AFM will work on a Mod I, but double-density, LDOS, & lower case are required.

You may think we're crazy, but we have a new data-base system. Why would we do that NOW? There is (or was) PROFILE™, PROFILE+™, MAXI MANAGER™, ENBASE™, etc., etc., etc. Well, when we got our first Model I, the concept of what a data base manager could do was definitely exciting. We bought or looked at all of them as they came out and never really stuck with ANY of them for anything serious. (We ended up writing *PowerMAIL+* to keep our product registrations on). None of them were what that we had pictured. They didn't have any "magic" to them. None of them handled information in an easy way to enter, look up, and print out that was logical, efficient, and flexible. YES. The keyword here is FLEXIBLE. You see, most data bases do allow you the flexibility to "design" your screen, field lengths, etc, but once you had that entered, and were adding names, you were stuck with it. If it was changeable, at all it certainly wasn't changeable from name to name! Another reason is that the TRS-80™ needs a new database manager! Why? There are millions of the machines out there that can get some real work done for you! You don't need a PC to do complicated relational reports from your stored data. (or even simple ones) Just program the computer properly is all!

This project has been in work for over two years now. We did a special beta offer to our registered customers last year and had them use the system and get back to us with what they like, what they didn't like, and what they would like to see in the system. One year later - the new AFM is ready. It contains every feature from everybody's "wish list" that made sense or was possible. Then, we put THAT version into local beta-testing. AFM is what every computer owner WANTS to do with their computer. AFM makes maximum use of the TRS-80™ and competes favorably with many available for PC type computers! It can only be compared to *DBASE III™* or *R:BASE 5000™*, as far as concepts and power. AFM is a language that you can program your database in! Contains a "template" where you may simply fill in your options in plain English. AFM is a free-form entry system, which means that you can enter your data in any manner you want! You are not limited to a particular screen format. In fact, each record can have its own individual display format! Really!! You would have to go to a PC to get this kind of power otherwise!

On-line help, advice, answers and ordering.  
Visit the PowerSoft SIG on CompuServe™.

Type 60 PCS-56 from any menu prompt!

By the time you read this, we should have a brand new catalog ready to go! If you are not on our mailing list and would like to receive a copy, please drop us a note or call and ask for one.

Read through our other ads elsewhere in this issue and see if there is anything of interest to you. If you have been one of our customers for years, THANK YOU! We have several new additions, some price reductions, and some great specials. We're here to help you, so if you have ANY questions please write or call. If you can recommend our products to your friends or associates, please do! There are TOO MANY TRS-80 owners out there who still haven't heard of us or even 80-MICRO! Help us and help your friends. Give them our address or phone number and suggest they ask us for a catalog, ok? Thanks.

Happy Holidays! Please drive safely.

**POWERSOFT**

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Peter Hutchinson

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Eric Maloney

MANAGING EDITOR  
Peter E. McKie

SENIOR EDITOR  
Penelope Hamblin

REVIEW EDITOR  
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TECHNICAL EDITORS  
Mare-Anne Jarvela  
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The left bracket, [ , replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in *80 Micro*, you should make this change.

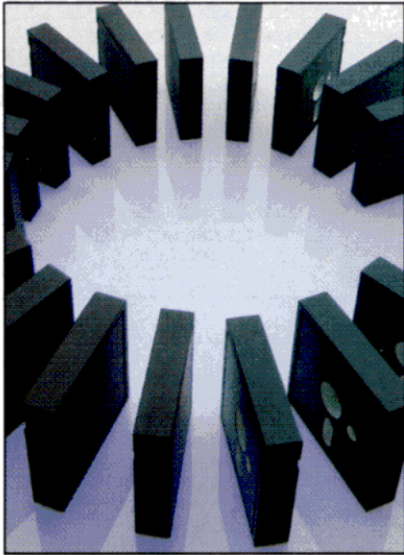
80 formats its program listings to run 64-characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

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

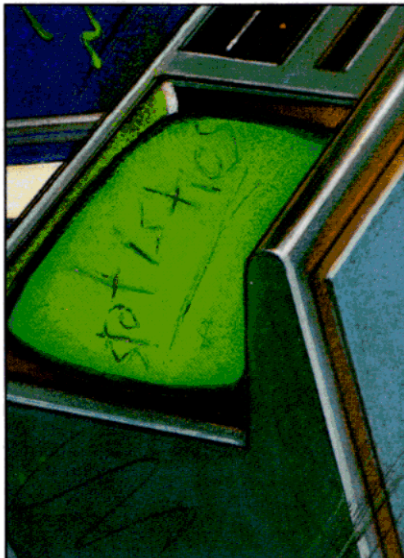
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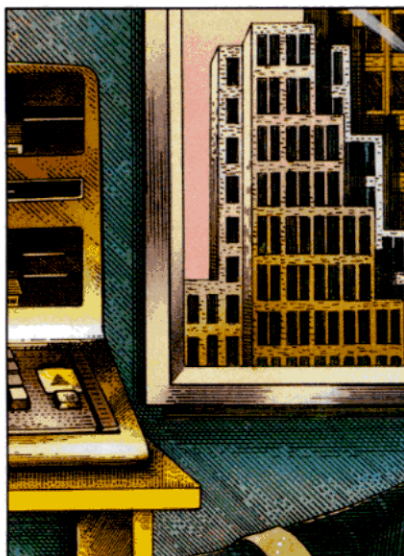
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An introduction to C, the language that goes everywhere.
- 41. **Write Away** by Daniel Zenzel Jr.  
All you need to run your own simple C programs. (Model 4; Load 80; Model 1000)
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structions provided. 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.

## Directory

### C Trainer

Article: Write Away (p. 41).  
System: Model 4, 64K RAM.  
Basic C interpreter.  
Language: Basic.  
Cassette filespec: B.  
Disk filespec: CTRAINER/BAS.

### Hoops

Article: Net Results (p. 52).  
System: Model III (Models I and 4 with changes), 32K RAM.  
Basketball statistics program.  
Language: Disk Basic.  
Cassette filespec: C.  
Disk filespec: HOOP/BAS.

### Break In

Article: Interrupt Anytime (p. 66).  
System: Model III, 48K RAM; Series 1 or Apparat editor/assembler.  
Interrupts for TRSDOS 1.3.  
Language: Assembly.  
Cassette filespecs: BREAK (src), BREAKI (cmd), DEMO (cmd), SCROLL (src), SCROLL (cmd).  
Disk filespecs: BREAKIN/SRC, BREAKIN/CMD, DEMO/CMD, SCROLL/SRC, SCROLL/CMD.

### Locator

Article: The Right Address (p. 74).  
System: Model 4/4P, 32K RAM.  
Locate TRSDOS 6.X.X system addresses.  
Language: Basic.  
Cassette filespec: D.  
Disk filespec: LOCATOR/BAS.

### Windows

Article: Window Screens (p. 58).  
System: Models III and 4, 48K RAM, high-resolution board.  
Graphics and a pie chart application.  
Language: BasicG.  
Cassette filespecs: E, F, G, H.

Disk filespecs: SINEWAVE/BAS, PRISMING/BAS, VIEWPORT/BAS, WINDOWS/BAS.

### Rembrandt

Article: Rembrandt Redux (p. 76).  
System: Model III, 48K RAM; Series 1 or Apparat editor/assembler.  
Screen dumps for graphics program.  
Language: Assembly.  
Cassette filespecs: LIST1 (src), LIST2 (src).  
Disk filespecs: LIST1/SRC, LIST2/SRC.

### Page

Article: Tidbit #30 (p. 83).  
System: Model 4, 64K RAM.  
List files by line or screenful.  
Language: Basic.  
Cassette filespecs: I, PAGE (cmd).  
Disk filespecs: PAGE/BAS, PAGE/CMD.

### Convert

Article: Project 80 (p. 84).  
System: Model 4 (Models I and III with changes), 32K RAM.  
Converts object files to hex/ASCII.  
Language: Basic.  
Cassette filespec: J.  
Disk filespec: CONVERT/BAS.

### Squeeze

Article: The Next Step (p. 108).  
System: Model 4, 64K RAM.  
Filter to condense debugged programs.  
Cassette filespec: SQUEEZ (cmd).  
Disk filespecs: SQUEEZE/SRC, SQUEEZE/FLT.

### Delete

System: Models I and III, LDOS 5.1.  
A multiple file kill command for LDOS 5.1.  
Cassette filespec: DEL (cmd).  
Disk filespec: DEL/CMD.

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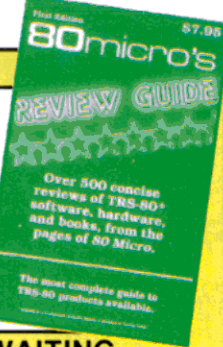
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# Radio Shack: Smurfin' USA

I'm spoiled. I'm so used to having dozens of computers at my disposal that I sometimes forget just how expensive they are. That's why I like to look through the Radio Shack sale fliers that occasionally come my way. They give me a new perspective on just how much a dollar really is these days.

Most recently, the Fall Sale flier landed on my desk, and it's loaded with bargains. My favorite section is the where-is-as-is sale. This is two pages stuffed full of discontinued gizmos and gadgets that Radio Shack is trying to unload—portable radios, telephones, walkie-talkies, and other electronic detritus.

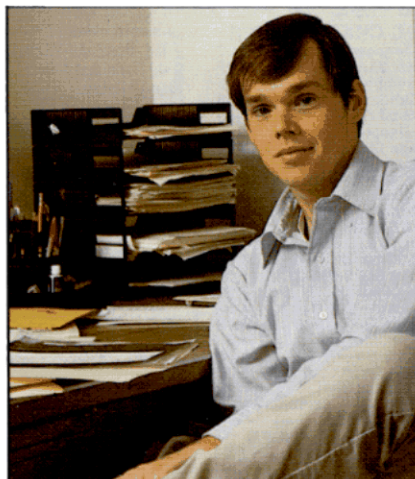
The stars of this particular spread are the Model 100 and Model 4. The Model 100, placed at the top of the first left-hand page, is the main attraction—\$299 for the 8K model. "Buy now for Christmas Giving!" exhorts the copy. The Model 4 is right below, at \$299 for the 16K cassette version and \$799 for 64K and two drives.

Now, \$799 is a pretty good price for a full-blown computer. But as part of the where-is-as-is sale, the Model 4 begins to look pricey. For the cost of a 64K system, I could buy 40 Trim-Fones (\$19.95 each), 114 cordless alarm clocks (\$9.95 each), or 161 Smurf radios (\$4.94 each). One hundred and sixty-one Smurf radios—now, there's something to think about. Having a computer in your home will scarcely get you a nod these days, but 161 blue Smurfs in your living room will make you the talk of the neighborhood.

The Model 4 and Model 100 aren't the only computer systems advertised in the flier. On the next-to-last page is the Tandy 1000 Personal Word Processing System—a Model 1000 with monitor, DMP-130 printer, DeskMate; and Homeword word processor for \$1,299. Overall, a pretty attractive deal.

But wait. This is even more expensive than the Model 4. For the extra \$500, I could buy 101 more Smurf radios, enough to fill the kitchen, the bathroom, and part of my study.

OK, I don't really need 262 Smurf radios. But the where-is-as-is pages are gorged with other goodies. In fact, \$1,299 will buy one of almost every item there. The list is practically endless:



Duofone talking home monitor	89.95
ET-280 pulse phone	24.95
ET-280 touch-tone phone	29.95
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TRC-84 CB walkie-talkie	14.95
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PC-2 printer/cassette interface	49.95
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PC-1 printer/cassette interface	29.95
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16K Color Computer II	99.95
MC-10 16K RAM module	9.95
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PocketVision LCD pocket TV	99.95
Realistic STA-204 receiver	129.95
Burger King radio	6.47
Smurf radio	4.94
Chronomatic clock radio	32.95
SCR-15 cassette recorder	79.95
Personal AM/FM stereo	21.95
Slim-Line pocket radio	6.95
CTR-51 desktop recorder	39.95
SCP-14 stereo cassette portable	34.95
Semiautomatic car antenna	22.95
Door-mount car speakers	19.95
Science-Fair digital computer kit	9.95
Science-Fair AM/FM radio kit	8.95
Video enhancer/stabilizer	59.95
AM/FM stereo portable radio	37.95
Super-Copter toy	12.95
3-D Sky Duel game	9.95
Total	1,288.15

True, I don't need three phones, three cassette recorders, or eight radios. I'd be hard put to find much use for the MC-10

RAM module or Pocket Computer interfaces. But, what the heck, Christmas is coming up. Now's the time to give my mother that semiautomatic car antenna she's always wanted.

What the Radio Shack fliers ultimately prove is that we Americans can be perfectly happy with the simple pleasures of life, whether they be a \$12.95 pair of fold-up headphones or a \$6.88 Solar Energy Project Set that's a "great gift for kids 8 to 88." We owe a debt to Tandy for offering us such simple, low-cost alternatives to megabuck computing.

## Trivia Time

One of CompuServe's TRS-80 special-interest groups recently produced an impressive thread devoted entirely to technical trivia of the TRS-80's early days. Here's a sampling: You'll find the answers on p. 82. If you get more than half, you can consider yourself a genuine old-timer.

1. Which system had only three error messages, and what were they?
2. You typed in SYSTEM and then followed the \*? command with /12345 to do what?
3. What was the real update password on the TRSDOS 2.1 SYS files?
4. Finish this sentence: "Joe, you r-----!" (Hint: this sentence was found in unlikely places on the first release of TRSDOS 1.3 disks.)
5. TRSDOS 2.2 and 2.3 included two programs called TEST1/CMD and TEST2/BAS. TEST1/CMD was a memory test program. TEST2/BAS was supposedly a "disk stress test program." In reality, TEST2/BAS was what Radio Shack program doctored up to look like it was actually doing something?
6. What did the initials of IJG, now-defunct publisher of the "...Other Mysteries" books, stand for?
7. Which DOS would not allow a Basic program to access a random file with a different LRL than that used to create the file?
8. Vern Hester wrote a DOS for the Model 1 that never became popular. What was it?
9. Level I Basic had only two string variables. They were fixed length. What were they and how many characters could they hold?
10. What was Level III Basic? ■

★ ★ ★ ★ ★  
**80 MICRO**  
**JUNE, 1985**  
 Bug free: ★ ★ ★ ★ ★  
 Does the job: ★ ★ ★ ★ ★  
 Easy to use: ★ ★ ★ ★ ★  
 Good docs: ★ ★ ★ ★ ★

**CAMEO**

ROMAN

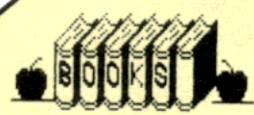
Nostalgia

LOMBARDIAN

Pump

celtic

Playbill



OUTLINE

Elegant

Pretorian

CHAINED

SHADOW

Chancery Medium

POKER

HANUKAH

BACKLITE  
BUCKLE

Rotunda

REV BAN

Calligraphy

Old English

INCISED TRAJAN

BELLS

CITY

Mini Cubes

Small Boldface

XMAS

USA

CLIMBING

Small Bold Italics

MOON LITE

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To use DOTWRITER, just write your text with any popular TRS-80 Word Processor (such as ALLWRITE or

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36 more letter-set disks are available separately. Each has 3-12 complete typefaces. The disks costs less than \$25 each and you may purchase them at any time.



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**I**f your VisiCalc spreadsheets are too wide for your printer, our "LONGVIEW" option may be just what you need. It is an add-on that turns spreadsheets sideways so that DOTWRITER can print them down the page instead of across. LONGVIEW comes with three additional fonts.

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DOTWRITER needs a TRS-80 I, III, 4 or 4P with 2 disk drives and 48K of memory. Separate versions of DOTWRITER support EPSON MX-80 with Graf-trax, MX-100 with Graftrax-Plus, and FX, IX, RX; C.I.TOH 8510/1550; MICROLINE 84-2/92/93; RADIO SHACK DMP 110-2100/CGP-220; GEMINI 10X/15X and other STAR printers.

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**A**LLWRITE will save you time and let you produce the highest-quality, most professional-looking letters, term papers, and reports available on a micro-computer.

### Allwrite Can Save You Time!

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

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

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

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

ALLWRITE shows you where you forgot to turn off underlining, boldface, italics, or double-width. Special on-screen Preview feature shows page breaks and page layouts... including underlining and boldface. In "Summary" mode, ALLWRITE quickly flags formatting errors

without wasting time printing all the text. These standard features make document preparation faster and easier than ever!

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

**A**LLWRITE salvages text from bad disks! If a sector goes bad, you won't lose the entire file, because it

### TAKES FULL ADVANTAGE OF YOUR MODEL 4.

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

will skip bad sectors, read the rest of the file, and then show you where the lost text belongs. This advanced error recovery turns a disaster into a feeling of profound relief.

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

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### ALLWRITE Is Easy To Learn

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

ALLWRITE's superb documentation will get you started quickly. Portions of it are designed for beginners, with every feature clearly explained in step-by-step tutorial style. Since you won't always be a beginner, other parts of the book offer advanced topics. There is a cross-reference summary chapter, a 14-page comprehensive index, and a detailed Table of Contents. We've been developing computer programs and manuals for over 23 years, and understand the importance of good documentation.

**A**LLWRITE works with all major DOS's on Models 1, 3, and 4/4P.

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Perhaps the best reason of all for having ALLWRITE is the continuing support we offer you: friendly, expert, direct support that is unsurpassed in the micro-computer industry.

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**"ALLWRITE is a professional system that sets a new standard in word processing. It's powerful and easy to learn and use."**

**80 MICRO, Nov., 1984**

### Customer Comments

*"This is the best software package I have ever received . . . superb, easy to use, fast, and has more features than the business word-processor at the office."*

(E.R.L.)

*"Your company and products have to be one of the strongest factors I can think of for keeping me with the TRS-80!"*

(J.R.H.)

*"NEWSSCRIPT is the Cadillac of word processors. ALLWRITE is the Mercedes Benz!"*

(B.E.)

*"... a very readable manual."*

(D.S.)

### BENEFITS OF OWNING

★ ★ ALLWRITE ★ ★

If Word Processing is important to you, PROSOFT's ALLWRITE is the best choice you can make. The clean, professional appearance it adds to your letters and reports will make an excellent impression on people. We will be happy to send you free print samples so that you can see for yourself how good ALLWRITE will make you look.

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## Writer's Block Letters

I agree with Eric Maloney (Side Tracks, August 1985, p. 8): Word processors do not improve writing. I always used to write quickly and easily with a pen or typewriter, but Scriptit brought about writer's block. All those editing commands intimidated me while I was writing a first draft; I spent too much time tinkering and too little time writing.

Now I use Delmer D. Hinrichs' Basic Word Processor ("The Return of Hinrichs' Word Processor," March 1984, p. 100) almost exclusively. It has many editing commands, but they're off in the edit mode, where they should be. While I'm writing, I have one editing command at my disposal—the backspace. And that, too, is how it should be.

80 Micro has published several different versions of Hinrichs' program. The one I use appeared in the January 1983 issue (p. 200). If you use it in conjunction with Mark Goodwin's type-ahead utility ("Getting Ahead," July 1985, p. 65), you'll find keyboard response excellent. And since Hinrichs wrote his program in Basic, you can easily modify it to suit your needs.

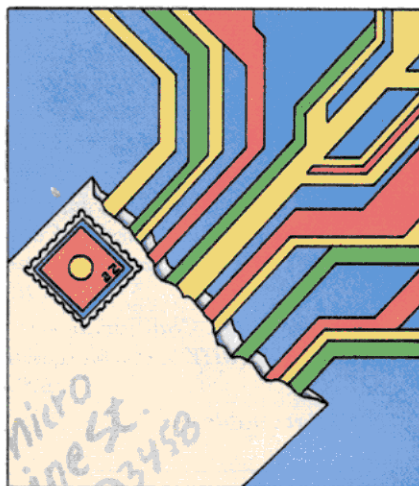
Mark Allen Reed  
West Lebanon, NH

I'm delighted that Eric Maloney plans to return to his manual typewriter since he seems to have a need to indulge himself in some kind of language orgy. Also, since he says he has to struggle to express himself with a word processor, he should stop using one. However, what he believes is true for him clearly is not true for most of the rest of us. That word processors don't improve writing for most people is absurd.

The notion that word processors can liberate creative writing by removing most of the restrictions imposed by the pencil or typewriter is completely accurate in the view of many people who are much more productive after using a word processor.

Anyone experienced with word processors knows that they do not supply creativity to writers who have none, but they do make writing creatively much easier and more efficient than any other method known.

Murlon H. Dye  
Commerce, TX



Eric Maloney's observation about word processors is quite accurate. One should also note that a word processor will not directly improve a writer's style if he lacks it. Word processors do make rewriting and editing a breeze, especially with large amounts of copy, but they're no substitute for a command of the language, punctuation, ability, and innovation.

I disagree, however, that they can injure writing skills. The person pushing the pencil or tapping the keys will determine the worth of the creation. If Maloney finds he's more creative with an ordinary typewriter than with a word processor, perhaps he's suffering from a case of cursor-blinks-anxiety, a recently discovered emotional disorder brought about by the eternal, unrelenting blink of screen cursor that reaches into a person's subconscious with the hidden message, "Come on! Come on! What's the next word! sentence! paragraph!"

Jim Merlino  
Montgomery, AL

My cursor likes to hum old Smokey Robinson tunes.

—E.M.

80 Micro's BBS is open 24 hours a day. It offers programs you can up- and download, special-interest groups, and a classified section. You can reach the board at 603-924-6985; UART settings are 300/1200 baud, 8-bit words, 1 stop bit, no parity.

## Basic Solution

In your August 1985 issue you ran articles on Model 4 Basic (p. 38) and GW-Basic (p. 46). Both articles touted the use of the Common and Chain statements to link Basic programs. In practice, I've found both statements useless. The problem is that you have to save the programs you want to chain in ASCII format. If a program is so long that you have to separate it into smaller programs, the individual modules take so long to load as to be impractical.

I think it's faster to save the programs in compressed form and save to a disk file the variables you want to pass. Then the succeeding program, linked to the first one by a Run statement, can reload the variables.

For even greater speed, you can save the variables to a RAM disk. The variable-passing routines found in Lewis Rosenfelder's *Basic Faster and Better* work well in Model III mode on a Model 4, but they won't work with Model 4 Basic or GW-Basic.

William D. Tabor Jr.  
Thibodaux, LA

## Window-Comments

Thank you for the favorable review of our product, Window-Comm (November 1985, p. 31). One thing the review didn't mention was that Pacific Software Consultants offers a \$10 rebate to each customer who persuades a friend to buy the product (limit one per purchased copy), making Window-Comm an exceptional value at \$8.95 after the rebate. A friend sold on it need only include the software license number of the original purchaser along with his order and we'll send the latter a \$10 rebate check.

The other thing you should know is that, while Window-Comm had been running on the Model III, we released a Model 4 version in October 1985. It offers several enhancements. All Model 4 owners who bought the Model III version will receive the Model 4 version free of charge.

Stephen W. Apple  
Pacific Software Consultants  
San Luis Rey, CA

Send your correspondence to Input, 80 Micro, 80 Pine St., Peterborough, NH 03458.

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80 Micro review 12/84  
Easy to use? ★★★★★  
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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.



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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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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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.

**Q:** Thank you for including the kind remarks concerning TBase, my subroutines for recording data on cassette-based TRS-80 computers (July 1985, p. 17). Unfortunately, I have received a letter from Bruce O'Connor, a lawyer in Seattle, WA, who complains that my program name is too similar to a trademark of his client's, Traveling Software Inc. I have thus renamed my product Tapestry, and am including a copy of O'Connor's letter in the manual distributed with each copy of my work. (David B. Dillon, Derwood, MD)

**A:** For those who missed Dillon's letter in the July 1985 Feedback Loop, he has developed a set of 19 Assembly-language routines that let Model III Basic maintain a cassette-based data file much the same way that Disk Basic maintains a random-access ASCII file. For more information, contact Dillon at 16533 Baderwood Lane, Derwood, MD 20855.

**Q:** In the July 1985 Feedback Loop (p. 16), Ralph Turner asked for help in using cassette Scripsit 3.1 with his DMP-200 printer. I think I have a patch he could use. It isn't particularly elegant, but it gets the job done with a minimum of trouble.

My patch occupies Scripsit's title area, so that it steals no memory from your text. I used a method suggested by Arne Rohde's VCMOD utility (April 1983, p. 210). It lets you send control codes to your printer by intercepting every less-than sign it encounters and Anding the ASCII value of the following character with 31. (In other words, the program keeps subtracting 32 from the ASCII value until the result is itself below 32.) Using this method, you can send the escape character (CHR\$(27)) to the printer by embedding <; or <( into the text; the BEL character (CHR\$(7)) by embedding <', <G, or <q; and so on.

In addition, if you want to print characters with ASCII values above 127, simply embed a greater-than sign in the text, followed by the character with an ASCII value of 128 less than that of the



character you want to print. To print CHR\$(240), embed >'; to print CHR\$(191), embed >; and so on.

Keep in mind that the less-than and greater-than signs foul up Scripsit's justification routines. I'd suggest setting J=N at the beginning of your document. And don't be frightened by the mention of Anding ASCII values—with your printer's ASCII code charts nearby, and a half-hour or so of practice, you'll soon get the hang of it.

Use a high-memory monitor (or

EDTASM) to enter this program into memory after you load Scripsit, then transfer control to Scripsit's entry address, 4303 hexadecimal (hex). In addition, change memory locations EE7 hex and 4EF7 hex from CD 3B 00 to CD BD 48. Be sure to change these addresses before transferring control to Scripsit. This final alteration installs the patch. (Mark Reed, West Lebanon, NH)

**A:** Thank you for sending in your Scripsit patch (see the Program Listing).

**Q:** I have a Level II 16K Model I, and I have just upgraded to a Model 4P. I want to transfer all my old programs to my new computer. Here in Chile some special chips (Signetics 2681) are not available and it is not easy to build an RS-232 interface for my Model I. I found Bob Hart's article "Bare Bones Communicator" in the June/July 1982 issue of 80 Micro (p. 128). I built the circuit and it worked... in one way. I can transfer Basic programs from the Model I to Model 4P but the Model I doesn't acknowledge Model 4P signals. I suspect the XRX modification in my old machine is the problem. I have read about that mod, but I don't know what

## Program Listing. A Scripsit patch program.

```
; Hand Assembly of "Patch"
;   written by Mark Allen Reed for Model III cassette
;   Scripsit, version 3.1
;   assembled to begin at location 48BDH, Scripsit's
;   title area
;
PATCH  PUSH    AF                F5
        LD      A, (FLAG)        3A E7 48
        OR      A                B7
        JR      NZ, NEWPRT       20 11
        POP     AF               F1
        CP      '<'              FE 3C
        JR      Z, SAVFLG        28 08
        CP      '>'              FE 3E
        JR      Z, SAVFLG        28 04
LOOP    CALL    003BH            CD 3B 00
        XOR     A                AF
SAVFLG  LD      (FLAG), A        32 E7 48
        RET
NEWPRT  CP      '<'              FE 3C
        JR      NZ, GRAPHC       20 05
        POP     AF               F1
        AND     1FH              E6 1F
        JR      LOOP             18 EF
GRAPHC  CP      '>'              FE 3E
        JR      NZ, LOOP         20 EB
        POP     AF               F1
        OR      80H              F6 80
        JR      LOOP            16 E6
FLAG    DEFB     0              00
```

End

# The Amazing A-BUS

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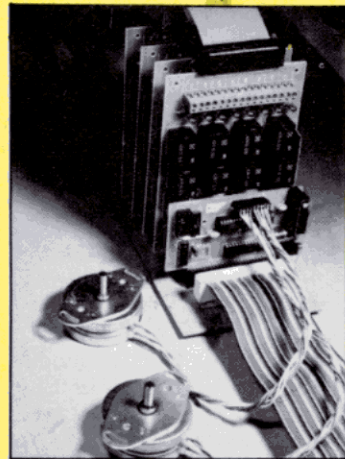
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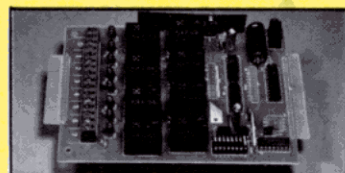
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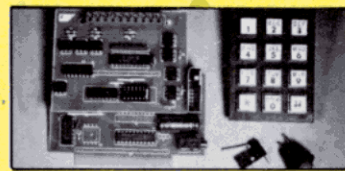
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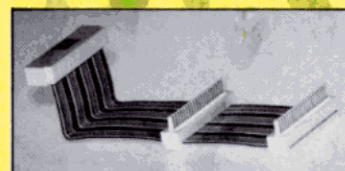
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it is. My model I has the serial number 058836 and two NEC ROM chips (8043364 and 8043732); the initial prompt is "Memory size?" Can it have the XRX modification? If it has, how can I disable it momentarily? (Jorge Herrera Endesa, Los Angeles, Chile)

**A:** Before you start looking at the XRX modification, alter the DB-25 connector you're using by tying lines 6, 8, and 20 together. The problem may be that the Model 4P is waiting for your Model I to transmit a Clear-to-send or Data Terminal Ready signal. Because the bare-bones communicator doesn't have those lines attached to anything, the Model 4P thinks the Model I isn't ready to receive, so it sends nothing.

Next, the XRX-III modification improves the reliability of the cassette file-loading procedure by making allowances for the low-quality cassette units and tapes on the market. It does, however, mean you can't use the cassette port at speeds other than 500 baud. If you have the XRX modification installed, and tying lines 6, 8, and 20 together doesn't help your RS-232 communications, then you must disable the XRX-III modification.

Information about the XRX-III modification and the standard TRS-80 cassette circuitry is available in Dennis Kitz's book *The Custom TRS-80 & Other Mysteries*. This book is currently available from Montezuma Micro, an 80 Micro advertiser.

**Q:** I bought a Model 4P and haven't been able to find programs for it in 80 Micro. Can you explain why? (Kenneth Fonseca, Los Angeles, CA)

**A:** One thing to keep in mind about the Model 4P is that all Model III and many Model I programs will run on it. While the program listings might not explicitly say 4P, most will work fine. Also, a great many of the more powerful programs for the Model 4 series are written in machine-language, such as Hardin Brothers' windowing program for the Model 4 (June, July, and August 1985, p. 102, 100, and 98, respectively).

**Q:** The letter from Jon C. Schultz in your August column (p. 16) concerned a Radio Shack disk drive he bought in Japan that he can't get repaired. Your answer was to write to Tandy's Japanese division and ask for a service manual. I believe I can help him. I don't have the service manual for the specific drive he has but I'm quite sure that I can repair it for \$50 or less if he will send it to me at my floppy disk drive repair service.

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alignment of any single-sided 35-, 40-, or 80-track drive. Double-sided drives cost \$5 more. If something has to be fixed to achieve proper alignment, we charge \$25 extra for troubleshooting and repair. That includes all parts except for heads, motors, and special LSI chips (found in units like Atari drives, for example). And if you need one of those noncovered parts, we'll give you the option of taking the unit back at no charge.

We service only 5¼-inch floppy drives but handle all brands, models, and configurations. We have a simple Atari 400 to test Atari-compatible drives, an Apple II+ to test Apple-compatible drives, and a VIC-20 to test Commodore drives. But you might be interested to know we use a pair of TRS-80 Model I computers with Percom Doublers to test all other drives, such as IBM, Texas Instruments, Osborne, Compaq, and Sanyo, after they come off the bench. (Les Logan, Logan-Bower Mini-Floppy Center Inc., Norfolk, VA 23513)

**A:** Thanks for your help.

**Q:** I have written several programs that require the deletion of records from direct-access files. I can put deleted records at the end of the file with keys such as ZZZZZ or something similar, but I would like to have the option to shorten the file length by changing the directory entry. Is there a patch or a POKE that changes the length characteristic in the directory of a TRSDOS 1.3 system so that I can shorten files? (Richard Earp, Pensacola, FL)

**A:** I know what you mean about wanting to delete such records, but fooling directly with the disk directory is not something you should do lightly. The DOS does more than just count the number of records in a file, it maintains a granule allocation table (GAT) that specifies which sections of the disk are free and which are occupied, a list of the tracks and sectors occupied on the disk by each file (in that file's directory entry), and the exact byte in the last sector immediately following the last byte of your file.

Changing the file length without changing the associated information in the GAT and directory entry is begging for a disaster. A time-consuming but simple way to delete such files is to write a Basic program that just copies the data to a new file that is the proper length, then deletes the old file and renames the new one with the old one's name. While this is slower, it has the advantage of letting the DOS do all the file location work, and doing it properly.

For more information about the design of the directory track, get Harv Penning-

ton's book *TRS-80 Disk & Other Mysteries* from Montezuma Micro. The book was written for the Model I, but the directory track design is the same for the III.

**Q:** When I use a Model 4, an Epson FX-80 printer set for a 2K buffer, and Model 4 Basic, and I type in the command OUT 248,15, I may or may not get the desired compressed print. When it works correctly, exiting Basic leaves the printer in the compressed-print mode. What do I need to do to assure that the response will be compressed print? (I presume that what precedes that command is the key, and have tried preceding OUT 248, 15 with the command OUT 236, INP(252) OR 16.)

Also, how do you define drive 1 as logical drive 5? (R.M. Doerr, Rolla, MO)

**A:** What you are doing is sending the code 15 to your Epson printer. Another way to do the same thing is to type LPRINT CHR\$(15) from Basic. I'm not sure why the Out command doesn't always work.

Setting drive 1 to drive 5 is simple. At the TRSDOS prompt type: SYSTEM (DRIVE = 5, DRIVER = "FLOPPY/DCT") and press enter. The floppy driver program will prompt you for the physical location of the drive you want read-dressed. In this case type in "2" and press the enter key. And that's it. If you now type "DIR :5", the drive light on drive 1 will come on and the disk in it will have its directory scanned and displayed. Don't use this technique to make drive zero another logical drive. While you can do so, you might have difficulty trying to boot up your computer with the modified system.

Once you're satisfied with drive arrangement, use the SYSGEN command to save the new configuration to your disk. The next time you turn on the power, drive 1 will act as drive 5.

**Q:** In the August 1985 issue (p. 16), Carl Sturmer wrote about a problem that he was having with SuperScripts and the alignment for the special characters. Your suggestion to try different increments until he discovered the magic number was close to target.

I had the same problem and wrote to Tandy. They informed me that the spacing values listed in the Daisy Wheel Printer 410 manual were incorrect. If you print in elite or pica pitch, the width values are always 10 or 12 respectively. If you are printing in proportional spacing, the table values given in the printer manual on page 28 need to be multiplied by 2. After I followed these adjustments, my output lined up correctly. I didn't find anything wrong with SuperScripts. (David J. Kelton, Richmond, VA)

**A:** Thank you for informing us of the exact nature of the problem. And it's nice to know that the problem isn't SuperScripts as we thought.

**Q:** In response to Craig L. Cole's question in the February 1985 issue (p. 18), I have noticed one other upgrade for the Model I that seems promising. In the September 1984 issue (p. 182), Micro-Labs Inc. advertises 80-GRAFIX, a plug-in, clip-on board upgrade for any Model III/I to provide 128 user-definable characters. It comes with over 20 programs and costs \$99.95. It's very brief and not well explained, but I would interpret the "user-definable characters" to be characters that use the "graphics" built in to the Model I: the 384 by 192 (I believe) pixels from which the computer creates the characters.

Is this board still made? If so, can you clarify what the board does and tell me how I can get it? (Greg Bryant, Raleigh, NC)

**A:** Yes, it is still manufactured. You can order it from Micro-Labs Inc., 902 Pinecrest, Richardson, TX, 75080 (214-235-0915). Unfortunately, I don't have any more information than what was in that advertisement. If anyone out there has bought and used this device, would you like to tell us about it and give your opinions?

**Q:** I have a Model I Level II computer. I bought the parts from Radio Shack and installed a lowercase kit without realizing that I need a driver program. Then Radio Shack told me that they could not furnish the driver! Can you or one of your readers help me on this one? (Edward R. King, Bloomington, IL)

**A:** Dennis Kitz's book, *The Custom TRS-80 & Other Mysteries*, has a short machine-language driver you can use either in DOS or Level II Basic, as well as a key repeat/debounce routine. This book is currently available from Montezuma Micro. If you don't already have it, you'll find it an excellent investment for your Model I. In addition, when you upgrade to DOS, you'll find that most DOSes automatically include an upper-/lowercase driver as part of the system.

**Q:** I am acquiring a Model 4 and an MS-DOS machine. I'd like to keep my Model I on-line for communications, but it takes up a lot of space. The solution would be to hide the expansion interface and the central processing unit under my desk, extend the monitor cable, and then buy an external keyboard with a long cable. How could I patch the new keyboard into the system or where can I find information on same? (Joel M. Reed, New York, NY)

**A:** Dennis Kitz's book, *The Custom TRS-80 & Other Mysteries*, has just the solution you want. Kitz designed a remote keyboard and video setup to let him put his Model I in one room while working in another (this was so he could sit beside his warm wood stove without worrying about the smoke or dust contaminating the computer or its drives). It isn't difficult; it just requires a little soldering work.

**Q:** I am writing in response to Charles H. Samuel's question regarding the sort from the Tandy newsletter (June 1985, p. 17). The code in question is a call to the CINT function in ROM, CD 0A7F. This code is in the same address in both Models I and III and converts the number the USR statement passes to an integer in the HL register pair. Many machine-language programs use this call to properly load HL with the passed parameter.

The easiest way to implement these subroutines on the Model 4 is to replace CD 7F 0A with zeros (NOP instructions), then define a variable, such as Sort, as the starting address. If the integer variable N contains the number of elements, you can invoke the subroutine by the statement CALL SORT (N).

Model 4 Basic appears identical to MBasic in CP/M. The pointer to the variable in parentheses automatically loads into the HL pair. This is described in the TRSDOS 6 manual in Part II under the Call statement.

People accustomed to loading an integer array with multiple parameters can use this same method. Delete the CD 0A7F statements in the routines, define a variable to point at the entry point, and execute the calls by the Basic statement Call routine (P%(0)).

Not only does this work, but following the purpose of machine-language subroutine calls becomes easier, since you can make a variable name more descriptive than a USR statement. (Larry E. Fosdick, Athens, GA)

**A:** Thanks for troubleshooting the sort routine. You can now use it on all the low-number series Tandy computers, Models I to 4.

**Q:** I am writing about a letter from a reader in Germany (January 1984, p. 28) that described the problems he had with his computer when he tried to connect it to the 220-volt, 50-hertz power line. We have this kind of power line in Argentina and I recently had a similar problem with the drive motor self-starting.

After a long session with an oscilloscope checking the various test points in the computer, I found a problem in the

power transformer, which has a primary winding designed for 110 V and 60 Hz. Apparently the transformer was designed with little margin for overload. When you connect it to a 50 Hz line, it overloads due to the overmagnetization, and the output results in a distorted sine wave with plenty of harmonics.

The drive, a Tandon TM-100 sold by Radio Shack as an external unit for the Model III, has two power supplies: a +5 V and a +12 V. The +5 V is built around a three-terminal regulator, which is a high gain device and subject to auto oscillations. Because the power supplies put out a distorted waveform, the harmonics reach sine wave proportions and the regulator would oscillate at regular intervals.

The control lines of the drive are active low (low voltage indicates a logical zero), so the Motor On line (among others) is pulled up to a logical 1 (+5 V) to signify an off state. Because the logical 1 depends on the +5 V line, when the regulator oscillates this power line drops to zero. The servo motor, which works from the +12 V line, is fooled into thinking a true Motor On signal has been received and turns on the drive motor.

The solution is to replace the current 110 V power supply with one using a 220 V 50 Hz primary winding. (Javier Henderson, Buenos Aires, Argentina)

**A:** Thank you for a clear description of the mysterious overseas self-starting drive problem. If your overseas system suffers from this complaint, just replace the current drive power supply with a new one designed for the 220 V power grids frequently used worldwide.

**Q:** This is a response to William Kirksey's question about how to transfer Radio Shack's MicroChess from tape to disk (August 1984, p. 14). I have a dual drive 48K Model III running TRSDOS 1.3. By using the Tape command I could transfer my version of MicroChess from tape to disk. Since you have a Model III, try using TRSDOS 1.3 to make the transfer. (S.R. Perry, Hayward, CA)

**A:** So it is possible to move the game to disk. I was afraid that there might have been some noncontiguous code in it that precluded the transfer. Thanks. ■

You can reach Radio Shack's National Parts Division at 900 E. Northside Drive, Fort Worth, TX 76102, 817-870-5662. M/C and Visa accepted; each order has \$1.50 handling charge.

Terry Kepner is a freelance writer and programmer, and an associate editor of 80 Micro. He's been writing about microcomputers since 1979.

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4-STAR Review - July 1985 issue

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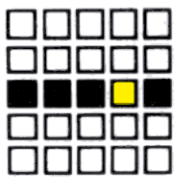
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# Tandy's 1985 Seesaw: Revenues Up, Profits Down

## Tandyland

**Financially speaking, last year was pretty tough for Tandy.** Although the company took in 2 percent more money in fiscal 1985 (which ended June 30) than in 1984, its net profit dropped almost 33 percent, the first such drop since 1978 (see the Figure).

In raw figures, Tandy reported a \$189.1 million profit on sales of \$2.84 billion for fiscal 1985. That compares with a \$281.9 million profit on \$2.78 billion in sales the previous year.

In comments published in the *Fort Worth Star-Telegram*, Garland Asher, Tandy director of financial planning, blamed Tandy's bad year on the slumping business computer market. Asher cited as evidence disappointing sales of the Model 2000, on which Tandy took an \$18 million write-off last April (see *Pulse Train*, August 1985, p. 21). The success of the Tandy 1000 and strong sales of the 1200 HD further weakened the 2000's sales position, according to Asher, and Tandy accordingly cut the 2000's price to \$1,599 in July.

Despite last year's financial setbacks, both Tandy officials and industry analysts remain upbeat about the company's future. Don F. Sinsabaugh of Swergold Chefitz, a New York investment banking firm, sees some exciting new products on the horizon for Tandy. However, none of them is in the microcomputer market. "The videocassette recorder market will continue to grow. In audio, compact discs are strong, and cellular communications will have strong growth in the next couple of years as prices come down. Tandy will get its fair share of that." Meanwhile, Tandy's Asher says, "This is going to be a big year for new products, both in the computer area and [for] other merchandise."

So far, the optimism seems justified. July 1985 sales indicate a rebound from Tandy's dismal fiscal 1985 numbers: Worldwide sales were up 12 percent over

July of last year, and U.S. sales were up 19 percent.

**With January approaching, we'll soon see if the rumors of a new Tandy Color Computer are on target.** Speculation about a new breed of Color Computer has gone on for two years now, but recently the rumors have been full of explicit details.

Word is that the machine will run under Microware's OS-9 operating system with a 640- by 400-pixel screen, up to 512K of RAM, and one double-sided 3½-inch disk drive. The scuttlebutt on CompuServe puts the computer's price at \$499.

For old CoCo users, the good news is that Tandy will still sell the CoCo II, but at the reduced price of \$99 and only in a 64K configuration. Tandy might bundle DeskMate with the new computer, as they're doing with the Model 4D and the Tandy 1000. The CoCo DeskMate costs \$99.95 and has two more functions than the 1000 and 4D versions: a simple paint module and a general-ledger module.

As usual, Tandy won't confirm or deny reports of a more powerful CoCo in the offing.

**Meanwhile, speculation about a new Tandy laptop can, for the moment, be put to rest.** The anticipated Tandy 600, which, according to rumor, would take

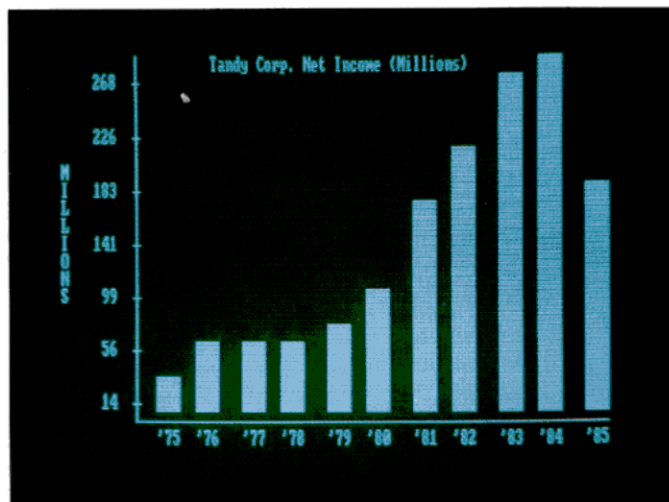


Figure. Tandy's annual net profits for 1975-1985.

on Data General's DG-1 MS-DOS portable, is vaporware.

According to my sources, Tandy did develop a new laptop, though it wasn't MS-DOS-based. But the feeling in the Tandy Towers was that the machine was a kludge and would never make it to market.

On the other portable hand, a new version of the Model 100 might show up soon. Tandy reportedly had a new thin-line 100 in the works as of early September, readying it for an October introduction. The revamped machine will have a minimum configuration of

24K RAM and should cost \$299.

My source tells me that Tandy won't adapt the Model 200 to the new, thin design. While that might sound like a non-story, the reason behind the decision should spark some interest.

Apparently, Tandy's agreement with Kyocera Ltd. of Japan, makers of the 200, was for a limited order of 85,000 units. The stipulation was that if the machine didn't sell as well as expected, Kyocera would produce no more machines, and Tandy would simply sell off its stock until it was gone. At this point, Tandy's still working off the original lot of 85,000 computers, and has no plans to order any more.

**I often report how Tandy computers do against their competitors, but it's worth mentioning that Tandy also sells a significant number of printers, monitors, disk drives, and modems.** In its July 22, 1985, issue, *Computer + Software News* published June sales figures for computers and peripherals, and Tandy ranked no lower than second in any category (see Table 1).

Of the best-selling personal computer brands, Tandy/Radio Shack placed second with 20 percent of the retail market. They were second in the printer category with 18 percent of the market, and first in sales of monitors and disk drives, with shares of 18 and 21 percent, respec-

	Brand	% retail sales
Computers	IBM	30
	Radio Shack	20
	Apple	19
Printers	Epson	18
	Tandy	18
	Apple	15
Monitors	Tandy	18
	Apple	14
	IBM	14
Disk Drives	Tandy	21
	Apple	19
	IBM	7
Modems	Hayes	43
	Tandy	20
	Apple	13

Table 1. Best-selling brands of personal computers and peripherals during June 1985.

tively. Tandy's share of the modem market was 20 percent, good enough for a second-place finish.

## MicroTrends

Some microcomputer companies aren't happy about a recent deal between IBM and the Mexican government, whereby IBM will own and operate a microcomputer manufacturing plant in Mexico. That's a significant departure from Mexico's national trade law requiring that computer plants have Mexican majority ownership.

Earlier this year, Mexico let Tandy start manufacturing Model 1000 computers in a Mexico City plant, but limited Tandy's ownership stake to 49 percent. Similarly, Apple has a minority share in an operation that produces Apple IIs in Mexico.

Tandy's reaction to the exception was subdued; they were generally pleased to be able to produce their top seller in Mexico and open up a Latin American distribution network for the 1000. But Richard Hojel, chairman of Apple de Mexico, didn't like it a bit. "What we're seeing here is a tremendous amount of arm-twisting by a very powerful company," said Hojel. "In principle I'm in complete agreement with IBM's presence, because I believe the best defense of private enterprise is competition. But let's all play by the same rules."

In August, Microsoft and IBM penned a joint software development agreement that virtually guarantees Microsoft's position as developer of future IBM PC operating systems. The move quashed rumors that IBM was preparing to introduce a proprietary operating sys-

Device	% sold 1983	% sold 1989 (est.)
Digitizer	33.2	18.6
Data tablet	11.9	36.4
Light pen	9.0	4.4
Touch screen	6.4	12.2
Joystick	17.5	5.1
Trackball	6.8	3.3
Mouse	9.4	13.2
Speech	5.8	6.8
Total Sales	\$131 million	\$962 million (est.)

Table 2. The U.S. workstation interface device market.

tem for its PC line. In an interview with CW Newsnet, IBM analyst Michele Preston of L.F. Rothschild, Unterberg, and Towbin said, "The agreement puts to rest whatever questions remained about IBM moving away from DOS. It's very positive for the industry." Microsoft is apparently free to license jointly developed products to other manufacturers, good news for Tandy and other makers of IBM compatibles.

Market researchers at International Data Corp. see a bright future for companies manufacturing data entry devices such as data tablets, light pens, and touch screens. IDC expects sales of these units, collectively called workstation interface devices (WIDs), to increase sevenfold through 1989 (see Table 2).

In 1983, manufacturers shipped 1.6 million WIDs. IDC estimates shipments of almost 12 million units by 1989. In terms of revenue, IDC expects the WID market to grow from \$131 million in 1983 to \$1 billion in 1989.

## Hot Items

**GTE's putting their Telenet network** in the hands of the everyday telecommuter with a service called PC Pursuit.

Subscribers can call all BBSes and on-line data bases within GTE's 12-city network for \$25 a month, regardless of the amount of time spent on-line.

The catch is that you must also place your call from an area code covered by the network, which links Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, San Francisco, and Washington. According to Telenet president David Hann, GTE chose those cities for start-up because their local calling areas contain about 23 percent of the U.S. population.

PC Pursuit supports 300-, 1,200-, and 2,400-baud operation; you can get more information about the system by calling 800-835-3001.

**What would J. Edgar Hoover think?** Microcomputer users who subscribe to CompuServe can now help track down fugitives on the FBI's 10 Most Wanted list.

CompuServe members can access a file provided by the FBI of biographical information on the reprobates. If you have the proper hardware and CompuServe's Professional Connection or Vidtex software, you can even get a high-resolution picture of the varmint.

To access the 10 Most Wanted list, type in GO FBI at CompuServe's 1 prompt. You then choose a vagabond's name from a list displayed on the screen.

The reason for this service? According to CompuServe's Richard A. Baker, "Many of our subscribers are professionals such as doctors, lawyers, and dentists. Like everyone else, fugitives require the use of [professional] services. In addition, many of these fugitives have distinct scars, tattoos, and limbs so alert subscribers may spot one of them."

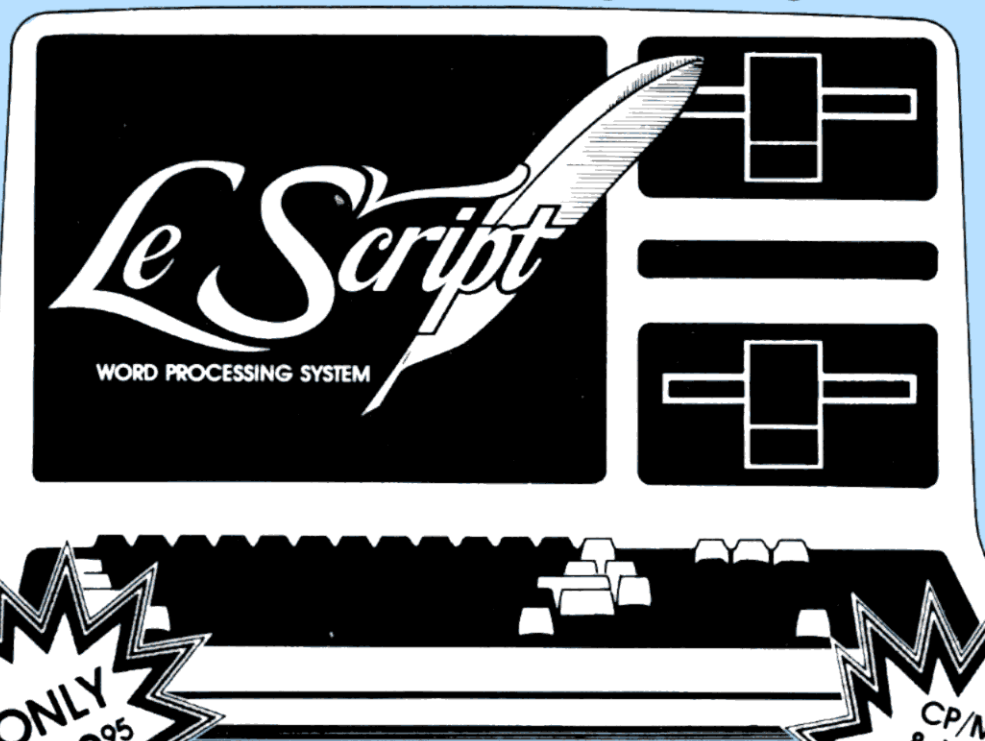
Appealing to the public seems to pay off for the FBI. Since 1950, when the 10 Most Wanted program began displaying photos in post offices, citizen cooperation has resulted in the capture of 109 of the 366 fugitives on the list.

## Update

**Portable computers' popularity** problems aren't confined to the U.S., according to Systems Concepts Ltd., a London-based research firm. In a study of the European portable market, they found that only 85,000 units sold on the continent last year, even though 12 million Europeans travel on the job.

Systems Concepts believes the market isn't understood yet. Instead of focusing merely on portables' size, they say, sellers should bill their products as "personal support systems." The report notes that buyers want more than a machine that fills out forms; they want a system that will improve the way they work. Specialized software for portables is another need, according to the study. ■

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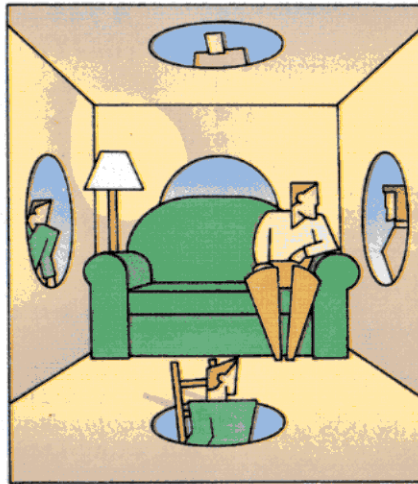
If you're using Arnold van Beverhoudt's **Graph Master program** (February 1985, p. 68) with a **DMP-120**, here's a tip from Alfred Kohlberg Jr. of New Carrollton, MD. Set DIP switch 1 to on and rewrite line 3038 to read `LPRINT CHR$(10)::LPRINT CHR$(13)::Y=Y+1:IF Y=48 GOTO 3046`.

Ray Pelzer tells us that his **Cross-check program** (September 1985, p. 66) **won't recognize the period as a variable character** in a Basic program. Clifford I. Knight cites the period as an undocumented but valid character in his article "Summer Romance: Learning to Love Model 4 Basic" (August 1985, p. 38).

Speaking of Cliff Knight, his **Scrip-Aid modification** to Scripsit (January 1985, p. 60) apparently **isn't compatible with Scripsit 01.00.01**. Don Coffin of Los Alamos, NM, found this out when he tried to use ScripAid with a version of Scripsit he had upgraded; the print functions didn't work. If you've had the same problem, try using Scripsit 01.00.00.

We're still getting **Model 4 scroll-protect routines** in response to our article "Stationary Department" (May 1985, p. 74). The latest is from Andy Levinson: 10 `NN%=0:N%(0)=78:N%(1)=1798:N%(2)=3902:N%(3)=13841:NN%=VARPTR(N%(0)):CALL NN%(NL%):RETURN`. Simply set `NL%` for the number of lines you want to protect. Program Listing 1 shows the source code.

Gilbert A. Emmert of Madison, WI, submits a **modification to our Fast-Bas Basic compiler** (January 1985, p. 42) that lets you specify an upper limit on the section of RAM FastBas uses and changes the reserved memory size from within the compiler. It also lets you determine the amount of variable space to set aside. You can now use compiled programs with other high-memory programs and compile machine-language subroutines more readily. Program Listing 2 lists the lines you should change. Also, delete line 1010. Finally, line 7275 determines `HIGH$` in LDOS; other DOSes might require different addresses. If your DOS has no equivalent to `HIGH$`, delete line 7275.



## Hints and Tips

Two readers have written in with ways to **activate the Model 4P's RAM test**. Bernard P. Tiltges of Lexington Park, MD, found that you can press the hyphen, left arrow, and right arrow keys simultaneously, while J.A. Kempen of Coevorden, Netherlands, discovered the 6-8-0 combination.

Michael Friedland of San Bernardino, CA, has a simple JCL file (Fig. 1) that lets you **send printer control characters to an Epson** from DOS, Basic, and some programs. You use the `@` key followed by a letter. The `@` key translates into an escape code. Thus, the printer reads `@E` as "escape-E."

Program Listing 1. Source code for scroll protect routine.

```
LD      C,(HL)      ;Get low byte integer argument from Basic
LD      B,7         ;Condition code for scroll protection
LD      A,15        ;VDC TL SVC code
RST     28H         ;Do the SVC
RET     ;Return to Basic
```

Program Listing 2. FastBas modification.

```
512 POKEM,P:PRINTP:M=M+1:IFM<-12+TP THEN RETURN ELSE
CLS:PRINT:PRINT "Program has exceeded protected memory size"
1001 GOTO 7200
1005 Q=PEEK(16548)+256*PEEK(16549):L=1:K=0:FP=0:CF=0:MC=PEEK(16561)
+PEEK(16562)*256+3-65536:M=MC
1013 Q=Q1
1015
VT=-2*26+TP:VF=-4*26*(1+IS)+VT:VA=-4*NO*DO+VF:VD=-4*NT*DT*DT-2*
NT*DT+VA:VS=-NS*(SL+1)+VD:VN=-(SL+1)+VS:PRINT:PRINT "Zero
variables":GOSUB 7136 'CLEAR
7136 CL=VN:GOSUB 814:P=175:GOSUB 512:GOSUB 902:P=119:GOSUB
512:CL=VN+1:GOSUB 814:GOSUB 900:CL=TP-VN-1:GOSUB 814:P=1:GOSUB
512:P=EL:GOSUB 512:P=D1:GOSUB 512:P=237:GOSUB 512:P=176:GOSUB
512:RETURN 'CLEAR
7200 IS=10:DO=20:DT=20:SL=40:NO=26:NT=2:NS=26
7210 PRINT "Number of additional S.P. variables per letter=";
IS::INPUT New=";IS
7220 PRINT"Dimension of 1-D arrays=";DO::INPUT New=";DO
7230 PRINT"Dimension of 2-D arrays=";DT::INPUT New=";DT
7240 PRINT"Length of strings=";SL::INPUT New=";SL
7250 PRINT"Number of 1-D arrays allowed=";NO::INPUT New=";NO
7260 PRINT"Number of 2-D arrays allowed=";NT::INPUT New=";NT
7270 PRINT"Number of strings allowed=";NS::INPUT New=";NS
7271 PRINT:PRINT
7275 HP1=PEEK(&H4411)+256*PEEK(&H4412):PRINT"HIGH$=";HP1;
7277 BP1=PEEK(16561)+256*PEEK(16562)+1:PRINT "Start of reserved
memory";BP1
7278 INPUT"New start of reserved memory=";BP1:BP1=BP1-1
7279 D1=INT(BP1/256):EL=BP1-256*D1:POKE 16562,D1:POKE 16561,EL
7280 INPUT"Top of usable memory";TP1:IF TP1>HP1 THEN 7280
7284 IF TP1<BP1 THEN 7278
7290 IF TP1>32767 THEN TP1=TP1-65536
7300 TP=INT(TP1):PRINT:GOTO 1005
7400 ' ***** END OF THE COMPILER *****
```

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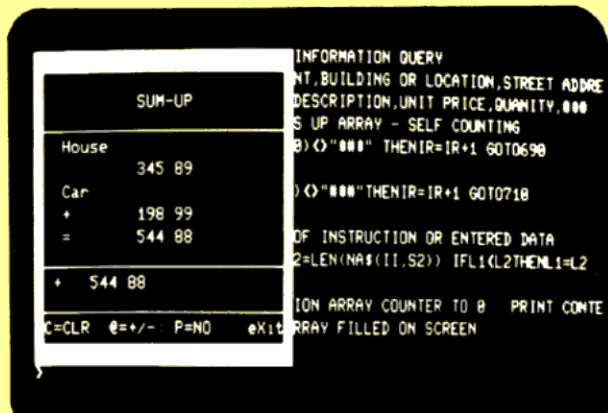
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Leigh L. Klotz of McComb, MS, reports that TRSDOS 6.2 lets you use **periods instead of slashes as separators** when entering the date on boot-up, and notes, "This makes filling in the date from the numeric keypad a snap."

Model 2000 owners: Alice Davis of Columbiaville, MI, sent the short **Basic screen print routine** in Program Listing 3. Line 15 includes the number of lines to print, while line 20 represents the width. You can print portions of the

*Program Listing 3. Model 2000 screen print routine.*

```
15 FOR A=1 TO 24
20 FOR B=1 TO 80
30 C=SCREEN(A,B)
40 LPRINT CHR$(C);
50 NEXT B
60 NEXT A
```

```
SET *FF TO FORMS/FLT
FILTER *PR TO *FF
FORMS (XLATE=X'401B)
```

*Figure 1. JCL file for sending Epson printer codes.*

screen by changing the values; for example, to print the lower right quarter, change line 15 to FOR A = 13 TO 24 and line 20 to FOR B = 41 TO 80.

Figure 2 lists **several patches** we've received recently. The first, from Kenneth Stahl of Manassas, VA, prevents Model 4 ALEDIT's J command from erasing the first column of the response. The second two, also from Stahl, let you permanently enable **external drives 2** and 3, respectively, under TRSDOS 6.2. The next four, 4-7, are from James R.

Reed of Dallas, TX. The first eliminates delta symbols used to indicate two spaces in **SuperScriptit**. The next adds the library command **Kill**, which functions as Remove does. The third disables **password checking**. Finally, the fourth prevents the screen from clearing after a pause when reading long directories.

Patches 8 and 9, from Adam Rubin of Wappingers Falls, NY, disable the carrier detect check so Models III and 4 **Videotex Plus**, respectively, will run with modems other than the Radio Shack Modem II. ■

1. PATCH ALEDIT/CMD (D05,46=C3 E1 3E:F05,46=C5 D5 E5)
2. PATCH BOOT/SYS.LSIDOS (D02,84=C3:F02,84=C9)
3. PATCH BOOT/SYS.LSIDOS (D02,8E=C3:F02,8E=C9)
4. PATCH SCRIPSIT/CTL (D14,28=18:F14,28=20)  
PATCH SCR35/CTL (D01,30=18:F01,30=20)
5. PATCH SYS1/SYS.LSIDOS (D02,81=4B:F02,81=00)
6. PATCH SYS2/SYS.LSIDOS (D02,33=18:F02,33=28)
7. PATCH SYS6/SYS.LSIDOS (D0A,5F=00 00 00:F0A,5F=3E 69 EF)
8. PATCH VIDTEX/CMD (ADD=73BE,FIND=C8,CHG=C9)
9. PATCH VIDTEX/CMD (X'489A'=0 0 0)

*Figure 2. Patches.*

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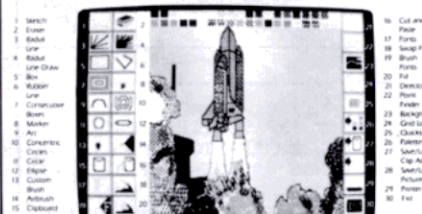
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# Top Draw: Micro-Labs' High-Resolution Graphics Tools

by David Engelhardt

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**Draw** runs on the Models III and 4/4P and requires Micro-Labs' Grafyx Solution or a Radio Shack high-resolution board and GBasic 3.0. Micro-Labs Inc. (see address above). \$39.95.

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Good docs: ★★★★★  
Bug free: ★★★★★  
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Commercial software for the Models III and 4/4P high-resolution (hi-res) boards has been slow in coming, but off-the-shelf products are finally making their way into computer stores. Micro-Labs offers several packages for its hi-res board, including GBasic, Draw, and the Joy-Mouse Interface. The software works on Micro-Lab's Grafyx Solution hi-res board, which is highly compatible with Radio Shack's board.

Overall, I was impressed with Micro-Labs' three products. They represent some of the best graphics products I've



seen for the TRS-80-compatible high-resolution boards. While GBasic isn't fully compatible with Radio Shack's BasicG, it has more functions and features. And Radio Shack doesn't have an equivalent to the Draw program or the Joy-Mouse Interface.

## GBasic 3.0

GBasic offers more features and versatility than Radio Shack's BasicG, even though it's smaller by about 500 bytes. It also provides wider printer support, including that for Radio Shack, Okidata, Epson, Anadex, Centronics, C. Itoh, and NEC printers.

The GBasic disk contains 40 programs and files of practical applications, demos, examples, and utilities. It requires TRSDOS 6.1.X on the Model 4/4P, with Basic 1.1.0 (other versions of Basic won't work). GBasic will also merge with standard Basic under TRSDOS 1.3, LDOS, DOSPLUS 3.5 and IV (and its extended Basic), and NEWDOS/80. Check with Micro-Labs for the correct version of Basic for proper operation.

GBasic offers some features BasicG doesn't. You can save or load high-resolution screens created with Micro-Labs' Draw program in standard picture file format from within GBasic. You can put an entire screen in reverse video format

with a single command. You can even load a version of GBasic into high memory, and call Assembly-language subroutines to perform hi-res functions.

Micro-Labs designed GBasic 3.0 to fully support its hi-res board, but it doesn't completely support Tandy's board. The differences lie mainly in the commands that control screen resolution. Also, Radio Shack's board doesn't allow text overlay of graphics, while Micro-Labs' board does.

## GBasic Commands

GBasic links itself to standard Basic; you invoke its functions by preceding

commands with the @ symbol. Some of the commands match those of Radio Shack's BasicG, while others differ in both name and operation.

GBasic offers two commands to put you in hi-res mode, one for the Micro-Labs board, the other for the Radio Shack board. Micro-Labs recommends using @ON1 to enable graphics on the Radio Shack board, since it doesn't show hash lines when writing to the display. I found the Micro-Labs board's @ON command much faster in manipulating the display. The @OFF command turns off the hi-res screen and returns you to the normal text screen.

The Micro-Labs hi-res board gives you a choice of display density, which you specify with GBasic's Mode command. In addition to the standard 640- by 240-pixel resolution, you can select resolutions of 512 by 192 pixels and 320 by 240 pixels.

GBasic gives you myriad commands for drawing geometric figures. You set individual points by specifying X,Y screen coordinates and a color parameter that dictates different video densities. Available color values range from zero to 255, which produce "colors" from blanks to solids.

You can test these points to determine their status with the Point command

and a pair of coordinates. The command returns a value of 1 when the point is set, zero if clear, and 2 if it is out of the 640-by-240-pixel graphics boundary.

You draw lines by specifying X,Y coordinates and a color value. Once you draw one line, you can continue to draw others by specifying only endpoints (X2,Y2 coordinates). Each time GBasic draws a line, the previous stop point (X2,Y2) becomes the implied X1,Y1 value for the next line; you just keep supplying X2,Y2 coordinates.

You can also make boxes and circles. The Circle commands not only let you draw circles, they produce ellipses with different aspect ratios, sections of ellipses, and arcs as well.

You can fill in any of GBasic's shapes with the Fill command. You must make sure you enclose the fill area by solid lines or the fill will bleed outside the shape. A Fill parameter lets you stipulate the density of the fill.

You can change every point on the graphics screen to its reverse-video complement with a single command, and you can print text on-screen, specifying where it's to go with X,Y coordinates. You can print text from left to right, sideways from top to bottom, upside down from right to left, and sideways from bottom to top.

GBasic even lets you simulate animation with Get and Put commands. You can put small sections of a display into an array and retrieve it back to the screen in reverse video. You can also And, Or, or XOR the contents of the array to the screen.

You define sections of the screen to be used as plotting areas or windows with GBasic's Using command. You can use the optional Frame parameter to frame the viewing area, fill it in with various patterns, or erase its contents.

A Print command prints your graphics display. An available Printer parameter lets you specify what kind of printer you're using based on a predefined set of printer codes.

Once you finish designing a screen, you can save it to or retrieve it from disk. Since GBasic saves displays in a disk file, you must use standard Basic commands to open and close them. For example, to load in a display file you type in OPEN "R",1,"FILE NAME/XXX":@LOAD:CLOSE.

## Utilities

GBasic comes with several utilities. GTest is a small demonstration routine that runs through a series of graphics displays to verify GBasic's operation. While GTest isn't as long or extensive as Radio Shack's BasicG test, it seems to be effective. It also demonstrates some of GBasic's high-resolution displays.

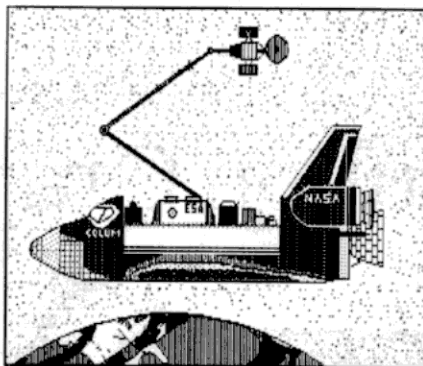


Figure. Printout of a high-resolution design created with Draw.

GBasic/LOD is the Assembly-language program that invokes GBasic's graphics commands. It loads itself into high memory to accommodate machine-language calls to the graphics routines.

SAVLOAD/CMD and SAVLOAD/BAS save and load high-resolution pictures to disk.

Mode V performs the same functions as GBasic's @ON, @ON1, and @OFF commands, and lets you control the hires display from TRSDOS: Setting V equal to zero disables graphics display, to 1 enables the 512 by 192 mode (640 by 240 on the Model 4 board), and to 3 enables 640-by-240-pixel resolution.

The VECTORS/ASM and POINT/ASM source code files contain Assembly-language programs that demonstrate line-

drawing, screen-clearing, and point-plotting routines. You'll need an editor/assembler to access them.

## GBasic's Docs

The GBasic manual is short, but makes up for its brevity with sample demonstration programs written in both Basic and Assembly language. It also provides the high-resolution entry points in upper memory so you can do your own Assembly-language calls to the graphics routines.

## Draw

Draw is a 10K Assembly-language program that lets you create and edit sophisticated high-resolution graphics. You use the arrow keys along with Draw's simple commands to create boxes, circles, set or reset points, and so on. You can also shift a screen in any direction, and save any portion of it to disk. In addition, Draw works with Micro-Labs' Joy-Mouse Interface to facilitate drawing.

Draw comes on a TRSDOS 1.3 disk with a few sample high-resolution programs; you have to convert it to use it with TRSDOS 6.X systems. The disk includes a couple of design templates, two "TRON" movie pictures, a dragon, and a picture of the space shuttle.

## Draw Commands

Loading Draw and pressing the enter key puts you in Draw's Edit mode. You use the commands displayed on-screen to draw pictures and manipulate the display (Table 1 summarizes Draw's commands).

You draw in one of five modes. The first four, numbered zero to 3, appear on the command list. Mode zero clears every set point the cursor hits. Mode 1 sets every point the cursor hits and mode 2 puts each point in reverse video. Mode 3 lets you skip around the display without affecting the picture and mode 4 lets you enter text on-screen.

Once you position Draw's cursor, pressing the spacebar changes the point under the cursor to reverse video. This lets you do detail work without changing modes. You can clear the display with the clear key, and the break key exits Draw.

Drawing lines and boxes is as simple as positioning the cursor over one point, anchoring it with the E or B key, moving the cursor to the end point (corner point if a box), and pressing the appropriate key again. You draw circles in the same way, except that you have to supply certain parameters to draw ellipses and arcs.

You fill in an area on the display with the F command. It accepts values from zero to 255 so you can stipulate the desired shading or binary bit pattern. Here

## The Star Ratings

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

In most cases, the overall rating is an average of the ratings in each of the four specific categories. However, some overall ratings may be higher or lower than this average, depending on the reviewer's subjective opinion.

The stars mean:

- ★★★★★ Superior;
- ★★★★ Excellent;
- ★★★ Good;
- ★★ Fair;
- ★ Poor.

The ratings terms translate as follows:

**Easy to use:** How easy is it for the new user to use the hardware/software/book?

**Good docs:** Is the documentation clear and helpful in explaining the product's use and anticipating user problems?

**Bug free:** Did the reviewer encounter any bugs while using the product?

**Does the job:** How well does the product do what it was designed for?

again, you have to enclose the area you want to fill to prevent spillover.

You enter text on the screen with the T command, with characters comprising an 8- by 10-dot matrix. It supports upper/lowercase characters beginning at the current cursor position.

Draw includes two interesting capabilities for screen manipulation. The Negate Screen command puts every point on the screen in reverse video, creating some intriguing results. The Reverse Image command produces a mirror image

emulates resolutions of 640 by 240 pixels, 320 by 240, 160 by 240, and 160 by 120. You can also create dotted lines when you move the cursor in mode 2 at a "brush" setting of 3 or 4.

The Get and Put commands send and retrieve drawings to and from Draw's 22K memory buffer. You define the portion of the screen you want to save by specifying two opposite diagonal corners of a rectangular area. Then Draw prompts you to name the area with one or two characters. You can save as many

port on the Models III and 4/4P, lets you connect Radio Shack's Color Mouse, Koala Touch Pad, Electronic Book, joystick, or any other Color Computer joystick to your computer. The Interface also provides an on-board expansion connector in case you're using the one on your computer.

The Joy-Mouse Interface works with GBasic, Draw, and Micro-Labs' graphics board, providing direct and quick cursor positioning and drawing. Resolution values of both X and Y coordinates range from zero to 255. The hardware supports both GBasic and Assembly-language programs.

Micro-Labs based the Interface on the ADC0809 8-bit/eight-channel analog-to-digital chip and uses only four of the available eight channels. It offers two joystick modes: proportional and eight-position. The proportional mode, for a Color Computer joystick, varies an analog signal. The eight-position mode works with Atari or Alpha-type joysticks that return a value corresponding to one of eight positions. You need different software for each of the modes.

When using the Joy-Mouse Interface with Draw, you choose from two mouse modes. The first plots a screen resolution of 256 by 240 pixels. The second mode offers full 640- by 240-pixel resolution but divides the screen into three sections with overlaps. (Since the interface can return only X,Y coordinates within the zero to 255 range [due to the 8-bit analog-to-digital converter], it splits the 640 by 240 screen.)

The ? command puts you in the full-screen mode (256 by 240 pixels) and you can set two horizontal dots at a time. The / command puts you in the 640- by 240-pixel mode. Since this resolution splits the screen, the comma key shifts you to the right screen and the period key to the left.

I used the Koala Touch Pad with Draw and found it easy to create drawings. You need to apply constant pressure on the pad while drawing or you'll start splattering dots. While in Draw's Skip mode (mode 3), you draw when you press and hold the left Koala button. For intricate pictures, I recommend using the arrow keys.

## Conclusion

If you're interested in high-resolution applications, I think Micro-Labs' software and hardware products offer anything you could want.

I do have one complaint about the manuals' numbering: Micro-Labs skipped some of the numbers and duplicated others. This is a minor point, but Micro-Labs should rectify the problem so that the quality of the manuals matches that of the software and hardware. ■

<ARROW KEYS>—Move cursor	<SPACE>—Complement point
<SHIFT> + <ARROW>—Move screen	<CLEAR>—New picture
<BREAK>—Exit program	<ENTER>—Exit subcommand
0—Clear point mode	1—Set point mode
2—Complement point mode	3—Skip mode
B—Draw a box	C—Draw a circle
D—Dump screen to printer	E—Set line endpoint
F—Fill in shape	G—Get block from screen
J—Jump to position	L—Load hi-res screen
M—Display menu	N—Negate screen
P—Put block onto screen	R—Reverse image L/R
S—Save hi-res screen	T—Text entry mode
V—Velocity of cursor	W—Paint brush width
X—Random X coordinate	Y—Random Y coordinate

Table. Draw commands.

of the original display. It even displays text in reverse.

You can dump the display to a printer by pressing the D key. The Figure shows a high-resolution space shuttle dumped to my Okidata 92 printer.

Press the S key to save your display to disk in standard SAVLOAD format, which you can load from GBasic or TRSDOS. You can scan any directory by pressing the appropriate drive number key (zero to 3), then decide on which drive to save the display file.

## Other Features

You can reposition Draw's entire screen in any direction by pressing the shift and arrow keys. The display moves one dot at a time in the up/down direction and two dots in the left/right direction. Dots that shift off the screen wrap around to the opposite side.

The J command lets you move the cursor directly to a position you specify with X,Y coordinates. Entering X,Y values of zero positions the cursor to the screen's top left-hand corner.

The V command changes the cursor's speed. You can vary the speed in 10 increments, with zero being the fastest. The slowest speed moves the cursor across the screen one dot at a time.

You can change the width of the cursor paint brush by specifying values of from 1-4. This changes the pixel size, which

blocks as disk space allows or until you fill the 22K buffer.

The Put command redraws a previously saved block anywhere on the screen. You position the cursor where you want the upper left corner of the block to begin. When you invoke Put, Draw displays a list of all your saved blocks. You then specify how you want the block put back on-screen; you can copy the block to the screen and overlay the screen's contents, change each point to reverse video, or use the commands And, Or, and XOR to manipulate the screen and block contents.

After putting blocks into Draw's buffer, you can save them to disk for later use. Press the break key, copy down the number that represents the end of the buffer, and exit Draw.

Once in TRSDOS, save your modules to disk with TRSDOS's Dump command: Type in DUMP FILE NAME/CMD (START = X'B9A8', END = X'nnnn').

After saving the modules, type in DO DRAW and answer the prompt to load in LXDraw, which then loads the block module into memory and executes Draw. You can then look at the module names and write them to the screen with the Put command.

## Joy-Mouse Interface

The Joy-Mouse Interface, a hardware add-on for the input/output expansion

# NEW SORTING UTILITIES FOR TRS-80 MODELS 1 & 3

## BSORT51

### - Multi-dimension BASIC array sort

**BSORT51** is a replacement for the CMD"O" sort of the standard BASIC. Rather than being limited to single dimension string arrays, **BSORT51** can sort one or two dimension arrays of any type - integer, single or double precision, or string. Multiple key arrays may be specified, and the sorting on each key can be done in either ascending or descending order.

Tag arrays (those that do not affect the sort, but merely follow along) may also be specified. **BSORT51** can also create an integer index array without affecting the actual order of the elements in the "sorted" array. For string arrays, "midstring" parameters allow sorting based on a portion or "midstring" of the key array elements.

**BSORT51** is entirely machine language, so it is fast. It is invoked off of disk during program execution and will continue with the next statement in the program after execution. This means that NO extra memory is needed to use **BSORT51**.

Order L-32-200 at \$39 plus S&H.

## DSM51

### - Disk virtual sorting utility

**DSM51** is THE versatile Disk Sort utility for Model 1 or 3 owners using LDOS 5.1. It is a high speed, disk virtual sorting utility that eliminates the burden of sorting from your applications development project. **DSM51** will create and maintain index files for you. Since the sort is disk virtual, your only limitation is the amount of available disk space, not available memory!

**DSM51** can sort random type files consisting of integer, single and double precision, or ASCII data fields. The file can be up to 65535 records long, with an LRL between 1 and 1024 bytes. Sort fields can be up to 253 characters long. Up to 12 fields can be used as select criteria or sort keys. Any type of relation (e.g. 'equal to', 'less than or equal to', etc.) may be applied to your selection criteria. In addition, logical operators (AND/OR) may be used. For instance: "sort by zip all people with a last name of either Smith or Jones". Any of the 12 specified select fields may also participate in the sort. For example: "sort in zip order and alphabetically by last name within the same zip".

**DSM51** can save a template of the sort/select specifications to a disk file, and may also be run from JCL. This allows even the non-sophisticated user to create index files with a single command.

**DSM51** is 100% machine language, so it is FAST! Compare these sort times to the method you are currently using: Select, Sort, and create an index of 1000 records on two 10 byte ASCII fields, a double precision number, a single precision number, and an integer (34 characters total). With **DSM51**, the select and sort is done in under 20 seconds from hard disk, and under 40 seconds from floppy.

**DSM51** requires the LDOS 5.1 operating system, and is intended for use with user developed applications or programs that currently use index pointer files. Please note that **DSM51** creates an index file as opposed to actually re-ordering the data file.

Order L-35-204 at \$79 plus S&H

Domestic orders add \$1 shipping per product plus \$5 handling for any order not pre-paid by check or money order.

## NEW HARD DISK BACKUP UTILITY FOR TRS-80 MODELS 1, 3 & 4

### Replace Tandy's slow file backup program!

## FASTBACK

Hard disk owners - tired of waiting forever while the HARDCOPY/BAS (Model 1/3) or HDCOPY4/BAS (Model 4) program slowly copies your hard disk file to floppy sector by sector? Do you want to automate your backup procedure and greatly increase its speed at the same time? If so, the **FASTBACK** utility package is for you!

**FASTBACK** is a 100% machine language program designed to quickly backup a file from hard disk to floppy. It automatically recognizes all floppy formats - single or double sided, 40 or 80 tracks, etc. Built in error checking prevents stopping in the middle of a backup - simply put in a new disk and the process will continue. FASTREAD allows you to restore the file from floppy back to the hard disk should the need occur.

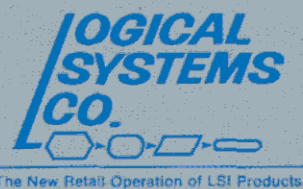
All prompts needed to start these utilities can be answered with a JCL file, allowing you to totally automate the startup. Once started, the programs will prompt for a new disk when needed, and show the next disk number to insert. This makes it possible for an ordinary user to perform perfect backups time after time without fear of mistake.

#### Typical timings for FASTBACK:

Model 3	Model 4
Single sided, 40 track	Double sided, 40 track
50 seconds, full verify	95 seconds, full verify

The **FASTBACK** package requires LDOS 5.1 for the Model 1 or 3, and TRSDOS 6.2 for the Model 4/4P.

Order L-30-055 (Model 1/3) or L- 30-056 (Model 4), each priced at \$49 plus S&H.



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## Money Decisions: Bang for the Buck

by Wynne Kelfer

★★★★★

**The Money Decision Series** runs on the Model 4/4P (64K) and requires one disk drive. Tandy/Radio Shack, One Tandy Center, Fort Worth, TX 76102. \$49.95 per module.

Easy to use: ★★★★★

Good docs: ★★★★★

Bug free: ★★★★★

Does the job: ★★★★★

**T**he Money Decisions Series is a group of five Model 4 programs that can help you make financial decisions on anything from simple-interest loans to complex real estate investments.

### The Programs

Most of us know how to calculate interest earned, but things get more complicated with additions to the initial investment and/or daily compounding. If you throw in tax percentage calculations, you might get lost. That's where the Money Decision Series comes in: It offers virtually any kind of financial analysis you'd want to make. You enter the appropriate data at the prompts, and the program does the hard work.

Tandy sells the series in five independent volumes: Basic Investment Analysis (Money Decisions I), Real Estate and Loans Analysis (II), Business Statistics and Forecasting (III), Business Management (IV), and Advanced Investment Analysis (V). You buy only those programs of interest, and each works similarly; once you use one, you know how to use them all.

Each module displays its available functions on a main menu. After you choose an option, you enter the appropriate variables.

At times, the variables' on-screen descriptions don't clearly indicate what input the program expects—you have to consult the manual. But you can make corrections after you input data, and you can calculate a data value on the fly using the add, subtract, multiply, or divide symbol.

You can display or print out the results of calculations. The on-screen results scroll by, but you stop them by pushing any key. If you print out the results, you can change or reenter the data values to repeat the same equation at the end of the printout.

The Money Decisions modules include on-screen tutorials that describe overall functions and specific sections from within the program. The tutorial moves

slowly, which is fine the first time you use it, but it's tiresome if you need information near the end.

You may be able to get along without the manual by using the tutorial if you understand financial concepts. But, if any of them are new, you'll need the manual's detailed explanations.

Strangely enough, you can't save your data to disk, and you lose everything in moving from one module to another.

I did find mention in the Special Options section in Money Decisions IV that you can save your input values and results to a file, but the command doesn't work. And the Special Options table doesn't display this command. It may be that Radio Shack at one time was going to have a Save Files option, but later canceled it and didn't catch this reference.

### Simple Investments

The beginning investor or homeowner would probably find greatest utility in the first two modules in the series, Basic Investment Analysis and Real Estate and Loans Analysis. Some of the calculations are quite elementary, so they give the lowest dollar value of the five programs.

Basic Investments helps you calculate personal investment values: how much you must invest periodically to reach a specific goal; how much you can withdraw in equal amounts over a given time span; the interest rate you need to meet a specific goal; the rate of return on investments with differing cash flows; the effects of continuous compounding; the current value of stocks and bonds; and present and future values of annuities. An accompanying chart shows earned interest over a period of time before and after taxes.

The second module, Real Estate and Loans Analysis, lets you figure loan costs from every angle. You can calculate a loan amount from interest, time, and payment amounts; payment amount from time, interest, and principal values; your final payment if you pay off a loan at any point in the payment schedule; time needed to pay a loan at certain interest and payment rates; and interest rates when you have time, payments, and principal data.

You can develop amortization tables for a regular mortgage, as well as calculate adjustable-rate mortgage balloon payments. People planning a mortgage will like the comparison table, which lets you change the loan parameters and see how that affects the terms of the loan. For example, how much more interest will you pay as your mortgage goes from 20 to 25 to 30 years? You can also figure the actual cost of any property, both monthly and total, including the taxes, insurance and utilities.

***The second module lets you figure the cost of property, both monthly and total, including taxes, insurance, and utilities.***

In typical loans, much of the early payments goes to interest, not principal. This, of course, affects your tax return. Real Estate and Loans Analysis can calculate how much of your payments go to interest, using the Rule of 78s that banks use. It displays the interest for the month, accumulated interest, and interest still owed.

Finally, you can do some rudimentary forecasting, based on past data and smoothed according to your specifications. You can also print out bar graphs of your forecasts, with or without the smoothing constant.

As in all the Money Decisions programs, you can internally pass the results of one computation to another section of the program. I used the program to figure the payment amount for a mortgage, then passed that result to another section to display amortization tables.

### Not for the Novice

Money Decisions III and IV, Business Statistics and Forecasting and Business Management, are business financial programs. The first of these is almost entirely devoted to statistical forecasting. You can determine risk-adjusted net present value, expected value of a future event, and average growth rate. You can calculate payoff matrix analyses, Bayesian decision analyses, regression analyses, moving average forecasts, exponential smoothing forecasts, and apportionment by ratios.

A regression analysis, for example, forecasts a future item, such as sales, based on a past correlation between sales and advertising. You may choose linear, geometric, or exponential correlation, but you can't enter more than 24 pairs of values. For each year, you would enter a Y value for sales and an X value for advertising. Unfortunately, you can't label variables in this or any other function. You input and output data in terms of X and Y, and you must remember which is which. At the end, you may enter interpolated X values and see the forecast in Y sales.

The Business Management module includes the following business management functions: lease/purchase analyses; depreciation switches (from accelerated to straight line), rates, and amounts; salvage values; tax depreciation schedules; equipment cost analyses; break-even analyses; linear cost/revenue schedules; fixed and variable production costs; production cost schedules; production alternative cost comparisons and profit/loss; job cost bidding analyses; optimal order and production quantities; inventory reorder and turnover ratios; profit sharing; bonus effects on taxes; and forecasting bar graphs. This program, unlike the others, comes on two disks.

The last program in the series, Advanced Investment Analysis, is strictly for advanced investors. It includes calculations for items like future value (when payments and withdrawals vary), present value of a tax deduction (the deduction being the interest on a loan), current value of a treasury bill (known face value, issue and maturity dates), accrued interest on bonds, and net present value (variable cash flows and periods).

One notable function, called Financial Management Rate of Return, differs from standard internal rate of return calculations by taking into account the cost of financing.

I think Advanced Investment would be highly useful for sophisticated investors. Its functions allow syndicated investment analysis, ratio analysis (of business financial situations), merger evaluation, leverage and earnings per share, and more.

## Documentation

Each Money Decisions manual has the same layout. For each function, it explains the calculation, prints the formula, and gives an example. I found the descriptions of the various financial concepts impressive: I understood and used previously unfamiliar ideas.

The docs include a glossary, which defines all the terms, and a special section elaborating on concepts such as compounding, forecasting, and discounted cash flow.

## Conclusion

The Money Decisions Series certainly covers the field in terms of financial computations.

However, I was disappointed to find that all the modules cost \$49.95. I have no argument with this price for the advanced programs, but this seems steep for the Basic Investment and the Loans and Real Estate packages, which give you fewer useful functions for the money. ■

# A Disk Zapper With a Difference

by Mark Goodwin

★ ★ ★

**Hyperzap** runs on the Models I and III (48K) and requires one disk drive. Hypersoft, P.O. Box 51155, Raleigh, NC 27609. \$49.95

Easy to use: ★ ★ ★ ★ ★

Good docs: ★ ★ ★ ★ ★

Bug free: ★ ★ ★ ★ ★

Does the job: ★ ★ ★ ★ ★

**H**yperzap is nothing new as a class of software—it's a Model I/III/4 disk zapper—but it does offer some features unique to a utility of this type, including extended directory listings and a memory modification capability. Unfortunately, Hyperzap's inadequate documentation and confusing data entry requirements tarnish its glow.

Hyperzap is versatile; it reads single-, double-, and mixed-density disks. In addition, it automatically detects what brand of double-density board you have

and adjusts the disk driver's operation accordingly (since I tested Hyperzap on a Model 4, I was unable to verify this feature).

## Features

Hyperzap's main menu presents you with 18 command options (see Fig. 1), many of them standard for a disk zapper: read and write disk sectors, read and format disk tracks, read address marks, position the head to selected tracks, and copy disks.

Hyperzap does offer a unique directory mode, however (see Fig. 2). It displays sequential sector numbers, logical track numbers, spare bytes contained in the address marks, logical sector numbers, sector length codes, data address marks, the memory address for the sectors' data, angular positions, type codes, sector densities, and good or bad CRC values.

While in the directory mode, you can append sector entries; copy the current track entries to the next track; delete, insert, and edit sector entries; generate a standard track; edit sector data; read sectors into memory; change the track bytes; and write sector data to a disk.

*Continued on p. 124*

Screen 1: *** Command Options ***				Parameter	Src	Destn
A Read addr mrks	XC Disk Copy	.	Drive Number	:00	:01	
C clr Track Table	B AutoBoot Disk	.	No. of tracks	:40	:40	
D display Table	Z Autopilot	.	Steps/Track	:01	:01	
I inspect memory	P Change Params	.	Head at track	:00	:00	
J ## jump @ ##	+ Step & repeat	.	Side	:00	:00	
S Read sectors	T # seek track	.	Size 5/8 inch	:05	:05	
Q Write sectors	E comb. A,S,D	.	Stepping rate	:01	:01	
R S/D read track	H(elpful) facts	.	Track offset	:00	:00	
W Format Track	YX Quit & reboot	.	Sector skew	:02	:02	
Hyperzap uses	4300-8161	Track/sector table	9000-90A3			
Sector data	9C00-9C00	Track buffer	E700-FFFF			
Autopilot	9800-9800	P Screen Print	Clear -->			

Figure 1. Hyperzap's main menu.

Screen 2:												
Physical	> 01	00	00	00	01	Y	FB	9C00	0673	IBM	Y	S
track 00	02	00	00	01	01	Y	FB	9D00	4446	IBM	Y	D
Sector Table												
Total 02 sectors												
Drive 00												
05 inch.												
Hyperzap uses	4300-8161	Track/sector table	9000-90B9									
Sector data	9C00-9E00	Track buffer	E700-FFFF									
Autopilot	9800-9800	P Screen Print	Clear -->									

Figure 2. Hyperzap's directory mode.

## TRS-80™ MODEL 1, 3, AND 4 SOFTWARE

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### TYPITALL Word Processor \$129.95 TYPITALL with Spelling Checker \$179.95

Word Processor upwardly compatible with SCRIPSIT — it reads your old SCRIPSIT files and uses the formatting and cursor movement commands you are already familiar with. But it is a completely new word processor with so many advanced features that we can't even mention all of them here.

Send **any** control or graphic/special character to the printer. Control/graphic characters included **in the text** so that you have complete control of all features of your printer. Print the formatted text **on the screen** before going to the printer. Send formatted text to a **disk file** for later printing. **Merge** data from a file during printing. Names, addresses, and other text can be inserted during printing. No need for a separate program for "mail merge" capabilities. Print while editing (spooling). Assign **any sequence of keystrokes** to a **single** control key. Call up to 16 **help screens** at any time. **Move cursor** forwards or backwards by character, word, line, or page. **Reenter** the program with **all text intact** if you accidentally exit without saving the text. Optional spelling checker comes with 29,500 word dictionary. Verify a 3,500 word document in **less than two minutes**. True Model 4 (80 x 24 display, TRSDOS 6) and Model I/III versions.

### SYSTEM DIAGNOSTIC \$99.95

Is your computer working correctly? **Are you sure?** System Diagnostic has complete tests for every component of your TRS-80 Model 1, 3, or 4 (separate versions necessary for each model).

**ROM:** checksum test. **RAM:** three tests including every location and data value. **Video display:** character generator, video RAM, video signal. **Keyboard:** every key contact tested. **Line printer:** character tests with adjustable platen length. **Cassette recorder:** read, write, verify data. **Disk drives:** disk controller, drive select, track seek, read sectors, formatting, read/write/verify data with or without erasing, disk drive timer, disk head cleaner. Single or double density, 1-399 tracks. **RS-232-C interface:** connector fault, data transmission, framing, data loop, baud rate generator.

### SMART TERMINAL \$74.95

The **Intelligent** telecommunications program for your TRS-80 Model 1, 3, or 4, or Model 2 CP/M. **Memory buffer** for sending and receiving files. **Automatic transmission** of outgoing data. **Automatic storage** of incoming data. **Character translations.** True BREAK key. Help screens, line feed filters, echo and line printer toggle switches, and more.

### TRS-80™ MODEL III ASSEMBLY LANGUAGE \$16.95

A complete course in assembly language, written for the **beginner**. Contents include: The Z-80 instruction set; TRS-80™ Model III ROM and RAM; using the Editor/Assembler; reading, printing, and moving data; arithmetic operations with integers; floating-point and BCD numbers; logical and bit operations; cassette input and output; USR subroutines in BASIC; RS-232-C data communications; disk input and output; the TRSDOS 1.3 disk operating system.

### MONITOR #5 \$22.95 Book and MONITOR #5 \$29.95

A comprehensive machine language monitor and debugging program. **Display** memory in ASCII or hexadecimal format. **Disassemble** memory to show machine language commands. **Move and compare** blocks. **Search and modify** memory. **Relocate** machine language programs. Read and write **cassette tapes**. **Unload** programs in low RAM on disk. **Print** optionally on video display or line printer. **Save and load** disk files. **Input and output of disk sectors**, bypassing disk operating system. **Complete debugging package**, including setting and displaying registers, single stepping through machine instructions, setting breakpoints, and executing machine language operations.

## TRS-80™ – TANDY – MS-DOS IBM – CP/M SOFTWARE

### SMALL BUSINESS ACCOUNTING \$99.95

Newly revised, this program is based on the **Dome Bookkeeping Record #612**, and handles **general ledger** and **payroll** for a small business. Category breakdowns are provided for both income and expenses. Monthly, through last month, and year-to-date summaries computed. Start the fiscal year with any month.

Payroll section handles up to 99 employees. Automatic computations for F.I.C.A., federal and state income tax. Three optional deductions also included. Print both payroll and expense checks using same forms. Reports include monthly, quarterly, and year-to-date summaries, 941 and W-2 forms. Simple and easy to learn — ideal for first-time computer users.

### HOME BUDGET and CHECKBOOK ANALYST \$59.95

A complete checkbook program together with budgeting, income and expense analysis, comparisons, and projections. Enter and print checks, enter deposits, and compute your current checking balance. Program also handles non-check expenses, bank debits, and income. Monthly and year-to-date summaries and yearly projections based on data through a known month. Monthly expenses compared to a pre-established budget.

### MAILING LIST \$69.95

Build and maintain mailing lists of up to as many names as you can fit on standard diskettes (1,250 for TRSDOS and CP/M, 2,500 for MS-DOS). Four-line labels with optional line that can be used either for unprinted data or as part of the label. Add, change, delete, or find names. Sort according to data in **any** field. Print labels in 1, 2, 3, or 4 adjustable columns.

### SMALL BUSINESS MANAGEMENT SYSTEM \$299.95

A complete **point-of-sale** program for a small business. Handles **order entry, invoicing, inventory, and bookkeeping**, including general ledger, accounts receivable, and accounts payable. Includes up to 999 8-character part numbers. Items deducted from inventory when orders entered. Handles both customer accounts and single orders. Invoices printed on forms or plain paper and include discounts, sales taxes, and shipping and handling charges. General ledger produces monthly and year-to-date totals. Receivables tracked to invoices, automatically updated as income entered. Inventory reports track sales by part numbers.

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# MONTENZUMA MICRO

PRESENTS

WOW!  
ANOTHER  
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## MONTE'S TOOLKIT

# \$49

REQUIRES: Montezuma Micro CP/M® 2.2 version 2.21+

Monte's Toolkit is a collection of utilities that will prove useful to every owner of Montezuma Micro CP/M (you all are owners, aren't you?). It's a disk full of programs that perform functions that are difficult, cumbersome or expensive to do any other way. Monte has tried, in his own way, to briefly explain each function for you below. Read on and be saved.

**DOUBLECROSS**® allows unlimited file transfers between CP/M®, IBM-DOS and Model 3/4 LDOS®/TRSDOS® with unsurpassed ease and speed. In fact, you can move just about anything from any disk to any other disk but you might have to make changes for program operation. Lotus 123® just flat won't run on your Model 3 and I doubt that you could ever modify Scripsit® enough to run on the IBM. Simple menus guide you through the operation with minimal keystrokes. Just tag the files you want in the directory display and go. You won't get doublecrossed with **DBLCROSS**.

**FREEFORM**® formats and backs up Model 3/4 LDOS/TRSDOS and IBM MS & PC-DOS (versions 1.x, 2.x and 3.x), both single side and double side plus there is a special "clone" copy when you just don't know or care what you have. Just insert a disk and copy away. All you have to know about the disk is how to get it into the drive. The Analysis feature lets you look at and print the actual structure of a disk - even the ones with "funny" formats.

**WSPR** lets you print to almost any printer using almost any control code. It's nearly magic and does a whole lot more than I can talk about here including letting you print *anything* your printer can print.

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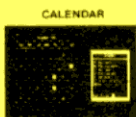
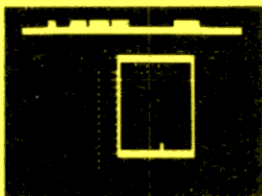
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# MONTENZUMA MICRO

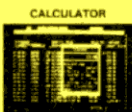
PRESENTS

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PRESENTS

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CP/M formats	YES	NO
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# Born to Run

From its inception, C was developed as an unfettered and transportable language; one C program works unaltered on a number of computer systems. JOHN B. HARRELL III gives you the lowdown and describes its structure and commands.

**T**he babble of languages available for microcomputers makes it hard for a programmer to decide on something new. If you're not satisfied with Basic, Assembly, or Pascal, or if you're curious about other languages, I encourage you to explore C.

I'm not an expert in C, but I've reviewed three exceptional compilers and have gained a real fondness for the language. In this article, I'll introduce some of the concepts that led me to accept C so readily.

## A History Lesson

C was developed as a system programming language for the Unix operating system on a PDP-11 minicomputer. The objective was to give the programmer power comparable to Assembly language's without Assembly's tediousness. C was also designed to be portable among a variety of computer systems. The most outstanding example of its power and versatility is Unix itself: Some 90 percent of it is written in C. Unix would not be implemented on so many computers had it been written in another language.

You can best classify C as a medium-level language. Its sophisticated control structures and neat, compact notation are similar to those of PL-1, Pascal, and Algol. However, it lacks many of those languages' features, such as string and data storage manipulation, and advanced input and output facilities.

This weakness is also C's greatest strength. It is relatively uncluttered yet has what you need to manipulate data, much as an assembler does. Thanks to C's minimal structure, a compiler can generate highly efficient code. In fact, compilers

on the market today produce better code than most programmers are capable of.

## First Words

C is a language of symbols. On first sight, a complex program is enough to make you swear you'll never C. Programs comprise functions, each of which performs a unique task. Each program must have a main function, which is the first part of the code that executes. The standard first example of a C program displays the phrase "hello, world":

```
main( )
{
    printf("hello, world\n");
}
```

The MAIN( ) statement denotes the function the operating system will initialize. The function body starts with a left brace and ends with a right brace. C uses shorthand notation; what could be easier than typing in { and } instead of Begin and End, as you do in Pascal or Algol?

The PRINTF statement is a library function that instructs the computer to display the string on the standard output device. The \n character is C notation for an end-of-line character (other common characters also have special C notations).

Before I move on to a more difficult example, look at Figs. 1-3. Figure 1 lists C's reserved words. Figure 2 lists some common functions a C compiler includes in its standard library. These generally accepted Unix equivalents add all the required functions to the language. Figure 3 describes C's operators—the real power of the language. Using them, you can perform a complex operation in a single statement.

In C, identifiers are composed of letters

and numbers. You must make an identifier's first character a letter, however.

C is case-sensitive. For example, identifier "abc" differs from "ABC." You must put all reserved words in lowercase. It's convenient to type in all identifiers and reserved words in lowercase, reserving uppercase for symbolic constants in macros (I'll discuss this later).

## Learning to Type

C supports several data types, which generally conform to the basic units of computer physical structure such as bytes, words, or double-words.

The smallest unit of storage is "char," typically a byte long. It can hold one character, and will hold all members of the computer's character set. Characters cannot have a negative value.

The next unit of storage is an "int," or integer value. On a typical microcomputer, this value is a 16-bit word. You can modify an int with "short" or "long" to denote decreased or increased precision (and storage allocation).

You can also designate an integer value as unsigned, which makes the compiler treat the number without regard to sign. For example, a normal integer value on the IBM PC will typically represent values from -32,768 to 32,767. An unsigned integer can assume values of zero to 65,535.

C also supports operations on floating-point numbers such as  $6.023 \times 10^{23}$ . Single-precision numbers are called "float" and double-precision values are called "double." For many microcomputers, float values will have six to seven digits of precision and double values will have about 15 digits of precision.

## The ABCs of Storage

The default storage class is "automatic"; that is, a program automatically allocates variables whenever it executes a function and removes them when the

function ends. Automatic variables don't retain their values from one execution of the function to the next.

You can also classify automatic variables as "register" variables, with some restrictions. This tells the compiler to gen-

erate code that maintains these values in the computer's registers as long as possible. The program therefore executes faster by using the registers more efficiently.

Sometimes you want variables to retain their last values from one function execution until the next. You do this by declaring the variables as "static"—the compiler will reserve permanent space for them. This might speed up a program by reducing the overhead it takes to allocate and deallocate variables automatically. However, static variables can prevent the code from being reentrant and recursive. You need reentrant code if your program is to be "burned" into a read-only memory (ROM).

Variables can also be "extern," or external, to the function declaring them; the current function block uses them but you define them in some other module. The extern attribute reserves no space in the module where you declare the variable as external.

auto	entry	short
break	extern	sizeof
case	float	static
char	for	struct
continue	goto	switch
default	if	typedef
do	int	union
double	long	unsigned
else	register	while
	return	

Figure 1. C's reserved words.

Name	Description
double atof(cp)	String to double, integer, or long integer conversion.
int atoi(cp)	
long atol(cp)	
ftoa(val,buf,prec,type)	Converts from double-precision number to char in a specified format type and precision.
Close(fd)	Close the file or device pointed to.
fclose(stream)	
open(fd)	Opens the file or device for input and/or output.
fopen(stream)	
read(fd,buf,bufsize)	Unbuffered input and output functions.
write(fd,buf,bufsize)	
fread(buf,size,cnt,str)	Buffered binary file input/output.
fwrite(buf,size,cnt,str)	
fseek(str,offset,origin)	Reposition a stream or file.
lseek(fd,offset,origin)	
getc(stream)	Get next character from an input stream or stdin.
getchar( )	
gets(s)	Get a string terminated by a new line character from stdin or specified stream.
fgets(s,stream)	
ioctl(fd,cmd,atty)	Set or determine the mode of the console.
char *malloc(size)	Dynamic memory allocation functions.
char *calloc(nelem,size)	
printf(fmt,[arg]. . .)	Format print output to stdout or the specified stream.
fprintf(str,fmt,[arg]. . .)	
sprintf(buf,fmt,[arg]. . .)	Format print output to the specified buffer.
putc(c,stream)	Put a character to the specified stream or stdout.
putchar( )	
puts(str)	Put a character string to stdout or the specified stream.
fputs(str,stream)	
scanf(fmt,[ptr]. . .)	Scan stdin input or the specified stream and convert text under format control.
fscanf(str,fmt,[ptr]. . .)	
sscanf(buf,fmt,[ptr]. . .)	Scan buffer; convert text under format control.
char *strcat(s1,s2)	Concatenate two strings.
strcmp(s1,s2)	Compare two strings and return result.
char *strcpy(s1,s2)	Copy string s2 to s1.
strlen(s)	Return string length.
char *index(s,c)	Find first occurrence of character in string.
toupper(c)	Converts character c to the designated case.
tolower(c)	

Figure 2. Partial list of C standard library functions.

## Control Structures

The most important control feature in C is the block, a group of statements enclosed in braces { }. These statements (and declarations, too) become one logical statement. I'll use "statement" to mean a single statement or block.

Probably the most common decision statement is If. . .Else, which has the syntax

```
if (expression)
    true-statement;
else
    false-statement;
```

where "else" is optional. If the result of the expression is true (or nonzero), the program executes "true-statement"; otherwise, it executes "false-statement."

Like Pascal, C executes a set of statements until a condition is met in two ways: While and Do. . .while. The difference is that a While statement tests the expression before executing. Do. . .while always executes the statement at least once. Their syntaxes are:

```
while (expression)
    statement;
```

and:

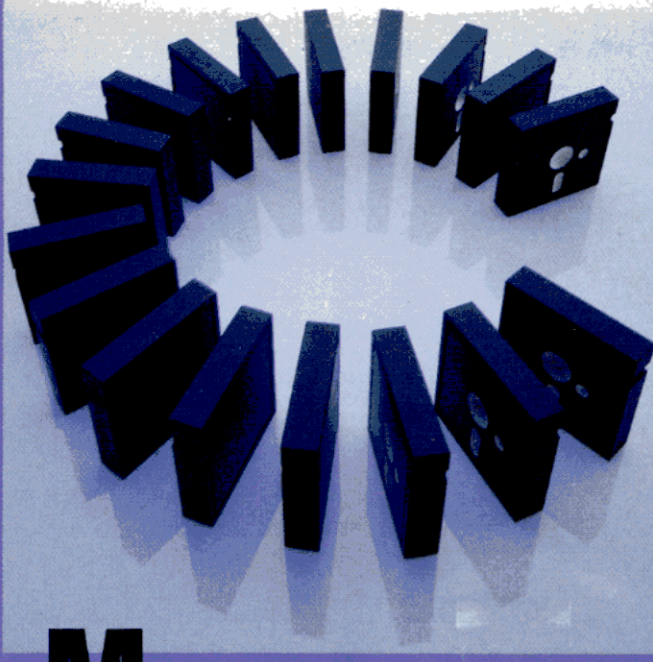
```
do
    statement;
while (expression);
```

A closely related control statement is For, which has the syntax:

```
for (expr1; expr2; expr3)
    statement;
```

The For statement evaluates expr1 as an initializing expression for the loop. Then it evaluates expr2 and tests it. If that value is true, the program executes the statement. It next evaluates expr3 (normally the incremental value for the loop) and repeats the cycle.

C also provides a multipath decision statement, similar to Pascal's Case statement, called Switch, that evaluates an expression and tries to match it to one of



by Daniel Zenzel Jr.

A C interpreter—  
and seven simple programming  
examples—get you started with C.

# Write Away

**M**y Basic interpreter, C Trainer (see Program Listing 1), will give you an idea of what C is all about without having to buy a C compiler. It's not very powerful, but it will run the C routines I provide. You can also write your own little C programs with it.

You create your C source program in Basic or with a word processor, saving the program in ASCII format. In Basic, you produce left and right braces, respectively, with the clear/shift/< and clear/shift/> keys, and the backslash with the clear/slash combination.

You can include program comments, but be aware that they will strain the capabilities of C Trainer and increase the amount of garbage collection. I find that programs without comments run 20 to 30 percent faster than those with.

Once you save your C program, run C Trainer and enter the name of your source file. After C Trainer loads the program, it automatically forces string garbage collection. If you don't want this, delete line 2480. You'll avoid a delay, but for some programs you'll just postpone it until some time during execution.

Be patient when C Trainer executes a program. The interpreter, since it is in Basic, works slowly. It might even appear at times to hang up. Just give it a little extra time before hitting the break key.

C Trainer only supports the integer type, and not pointers, arrays, or user functions. It can only interpret a MAIN() procedure. I did, however, implement the standard library functions PRINTF, PUTCHAR, and GETCHAR, so that you can have limited input and output from the C program. PRINTF allows the %d options to print integers, and PUTCHAR requires an integer argument. (For PUTCHAR, the argument is the number whose CHR\$( ) you want to print.)

The Figure summarizes the C constructs that C Trainer supports, with their required formats and restrictions. The sample programs in Program Listings 2-8 give examples of the PRINTF and PUTCHAR/GETCHAR functions.

As for arithmetic, I implemented simple expressions only. This means that only simple assignment and addition, subtraction, multiplication, division, incrementation (i + +), and decrementation (i - -) will work. This should be enough to at least get an idea of how C works.

If C Trainer encounters any syntax errors,

the interpreter will usually display an error message and stop. This means that all errors in a C program are fatal. At this point you should load your C program back into Basic and correct the error. Some of the error messages aren't the best, but you can easily modify the code to display what you want.

A little tip: When an error stops the interpreter, the variable FPOS contains the relative byte in the source program that was executing when the error occurred. Also, the string array CPROG\$( ) contains the entire C program. You can easily in-

## **For loops: for (var1 = var2; var1 <= var3; var1 + +)**

The comparison must be < =

The initializer must be =

The increment must be + +

Nesting of For loops is not allowed

You can have a While nested in

A single statement or block is OK

## **While loops: while (var OP var2)**

Comparisons OK are <, >, =, !=

Var must be variable name

Var2 can be either number or variable

Single statements or blocks are OK

While loops cannot be nested

You can nest a For into a While

## **If...Else: if (var1 OP var2)**

Comparisons OK are <, >, =, !=

Var1 must be variable name

Var2 can be either number or variable

Single statements or blocks are OK

If statements cannot be nested

You can use For or While in the If

## **Arithmetic: var = var1 OP var2; var3 + +, var3 - -**

OP is +, -, /, \*

var1, var2 can be variable or numbers

var, var3 must be variable name

*Figure. Supported C constructs.*

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dex into this array to display the section you had a problem with by using direct Basic commands.

Finally, I've documented the source code, so you can modify it to support different features. ■

You can write to Daniel Zenzel Jr. at  
P.O. Box 936, Berwick, PA 18603.



## System Requirements

Models 4 and 1000  
64 K RAM  
Basic

### Program Listing 1. C Trainer Interpreter.

```

100 | -----
110 | CTrainer                                Daniel Zenzel, Jr.                August, 1985
120 |
130 |
140 | This program will interpret a very small subset of the C Language. The
150 | input for this program is a C program, created using the standard BASIC
160 | editor, that was saved with the ASCII option (save "fname",a). This
170 | interpreter is by no means complete, or for that matter, it does not
180 | follow the K and R standardization of C.
190 |
200 | Its purpose is to merely demonstrate the use of the C language as an
210 | alternative to BASIC, and give one a chance to 'play' with C, in its
220 | simplest form.
230 | -----
240 | DIM CPROG$(1500),FUNCTION.NAME$(5),FUNCTION.LOC$(5),VAR.NAME$(20),
    | VAR.INT$(20)
250 | CLS:PRINT:PRINT"CTrainer - A 'C'- Language Interpreter By Daniel Zenzel, Jr
    | ":PRINT
260 | INPUT "Enter Source File Name >>";CFNAME$
270 | GOSUB 2310
280 | PRINT "Interpreting Program...."
290 | -----
300 | This code processes global declarations and function declarations
310 | -----
320 | TOKEN.VAL$="":GOSUB 1820
330 | WHILE TOKEN.VAL$<>"MAIN"
340 | IF TOKEN.VAL$<>"INT" THEN 420
350 | WHILE TOKEN.VAL$<>"":
360 | GOSUB 1820: GLOBAL.COUNT = GLOBAL.COUNT + 1
370 | VAR.NAME$(GLOBAL.COUNT)=TOKEN.VAL$
380 | VAR.INT$(GLOBAL.COUNT) = 0
390 | GOSUB 1820
400 | WEND
410 | GOTO 520
420 | IF DELIM$ <> "(" THEN PRINT"Function Declaration Expected":STOP
430 | FUNCTION.COUNT = FUNCTION.COUNT + 1
440 | FUNCTION.NAME$(FUNCTION.COUNT) = TOKEN.VAL$
450 | FUNCTION.LOC$(FUNCTION.COUNT) = FPOS-LEN(TOKEN.VAL$)
460 | WHILE TOKEN.VAL$ <> "{": GOSUB 1820: WEND
470 | BC%=1
480 | WHILE (BC%<>0)
490 | GOSUB 1820
500 | IF TOKEN.VAL$="{ " THEN BC%=BC%+1 ELSE IF TOKEN.VAL$="}" THEN BC%=BC%-1
510 | WEND
520 | GOSUB 1820
530 | WEND
540 | -----
550 | At this point, we should be at the symbol MAIN(), to start the program
560 | -----
570 | GOSUB 1820:GOSUB 1820:GOSUB 1820: ' get to the first statement
580 | WHILE (TOKEN.VAL$<>"")
590 | GOSUB 1820: ' Get statement token
600 | IF TOKEN.VAL$="WHILE" THEN GOSUB 3570: GOTO 620
610 | IF TOKEN.VAL$="PRINTF" THEN GOSUB 650 ELSE IF TOKEN.VAL$="PUTCHAR" THEN GO
620 | SUB 900 ELSE IF TOKEN.VAL$="FOR" THEN GOSUB 2500 ELSE IF TOKEN.VAL$="IF" THEN GO
630 | SUB 3140 ELSE IF TOKEN.VAL$="INT" THEN GOSUB 1210 ELSE IF TOKEN.TYP=1 THEN GOSUB
640 | 1440
650 | WEND
660 | PRINT:PRINT:PRINT "CTrainer - Done"
670 | END
680 | -----
690 | Routine to handle the printf statement. On entry, fpos will point to
700 | the left paren of the function call.
710 | -----
720 | WHILE CPROG$(FPOS)<>CHR$(34): FPOS = FPOS + 1:WEND
730 | BS="" : WHILE (CPROG$(FPOS)<>CHR$(34)) : IF CPROG$(FPOS) <> "\" THEN BS = BS
740 | + CPROG$(FPOS):FPOS = FPOS + 1: GOTO 740
750 | FPOS = FPOS + 1: IF CPROG$(FPOS) = "n" THEN BS = BS+CHR$(13): FPOS = FPOS +
760 | 1 : GOTO 740 ELSE IF CPROG$(FPOS) = "t" THEN BS=BS+CHR$(9): FPOS = FPOS + 1 : GO
770 | TO 740
780 | IF CPROG$(FPOS) = "x" THEN FPOS = FPOS + 3
790 | WEND
800 | IF CPROG$(FPOS)= CHR$(34) THEN FPOS = FPOS + 1
810 | CD%=INSTR(BS,"%d")
820 | WHILE CD%>0 : GOSUB 1820: GOSUB 1820 : ' get comma and identifier
830 | IF TOKEN.TYP <>1 THEN PRINT "Printf Syntax Error":STOP
840 | CL%=TEMPVAR.COUNT+GLOBAL.COUNT:WHILE VAR.NAME$(CL%)<>TOKEN.VAL$: CL%=CL%-1
    | : WEND
850 | BS = LEFT$(BS,CD%-1)+STR$(VAR.INT$(CL%))+RIGHT$(BS,LEN(BS)-CD%-1)
860 | CD%=INSTR(BS,"%d")
870 | WEND
880 | GOSUB 1820: ' consume the closing paren
890 | PRINT BS;

```

Listing 1 continued on p. 130

the following constant values. If it finds a match, the program executes the statement associated with this constant. The following example demonstrates the Switch statement:

```
switch (input_ch) {
    case 'A': statement-1;
               break;
    case 'B': statement-2;
               break;
    default: statement-3;
}
```

Switch evaluates the integer expression in parentheses and tries to match it to one of the values indicated in the case labels. If it finds a match, the program continues with the statement associated with that case label. If it doesn't find a match, the statement associated with the default label executes.

The Break statement shunts program execution to the end of the block. Unlike other similar implementations, the switch program flow begins executing on the first match and the program will continue unimpeded to the end of the block. You use the Break statement to force execution of only those statements associated with the selected case label.

While Break forces the program immediately to exit the program control block containing it, this might not be what you want. To skip the remaining statements in the block but continue with the loop until the conditions for termination are satisfied, use the Continue statement.

Since C is a structured language, you can write most programs without GOTO statements, but C's GOTO label statement is there when you need it.

## C in Action

Now for some simple programs. My first example uses a standard library function to copy all data from the keyboard to the screen:

```
main( )
{
    int c;
    while ( (c = getchar()) != -1 )
        putchar(c);
}
```

Note the expression in the While statement. The program gets a character, assigns it to the variable c, and tests the result to see if the program detected an end-of-file (-1) indicator. If not, the program sends the character to the standard output device using the PUTCHAR function.

This is an example of the shorthand notation C allows. Why would this program be useful? MS-DOS supports command-line redirection of console input and output from and to other devices or files. If your DOS doesn't support this feature, most run-time packages supplied with commercial C compilers do support it. You could use this simple routine, for example, to copy a file to the video or printer.

Now look at the more complex example in Program Listing 1, Count. This brief

## Operator Description

[ ]	Array subscripting.
—>	Reference to a structure element using a pointer.
.	Reference to a structure element by structure name.
( )	Function calls.
*	Unary * used as a pointer reference.
&	Unary & used as an address reference.
-	Unary negation (two's complement).
!	Unary logical negation (! expr yields 1 if expr is false and 0 if true).
~	Unary ~ yields a one's complement of its operand.
++	Increment operator. If used before the operand, it is incremented before use; if used after it, it is incremented after use.
--	Decrement operator. If used before the operand, it is decremented before use; if used after it, it is decremented after use.
(type)	Cast operator. Used to force the conversion of its operand to the specified data type.
sizeof	Returns the size of the operand in bytes.
*	Multiplication: a * b.
/	Division: a / b.
%	Modulus: a % b yields the remainder of dividing b into a.
+	Addition: a + b.
-	Subtraction: a - b.
<<	Left shift: a << b shifts a left by b bits.
>>	Right shift: a >> b shifts a right by b bits.
<	Tests for a < b and returns truth value.
>	Tests for a > b and returns truth value.
<=	Tests for a <= b and returns truth value.
>=	Tests for a >= b and returns truth value.
=	Tests for a = b and returns truth value.
!=	Tests for a <> b and returns truth value.
&	Bitwise And operator: a & b.
^	Bitwise Exclusive Or operator: a ^ b.
	Bitwise Inclusive Or operator: a   b.
&&	Logical And operator: a && b. Left-to-right evaluation is guaranteed and the second operand is not evaluated if the first operand is false.
	Logical Or operator: a    b. Left-to-right evaluation is guaranteed and the second operand is not evaluated if the first operand is true.
e1?e2:e3	Conditional operator: if expression e1 is true then the result is expression e2 else the result is expression e3.
=	Expression assignment operator: a = b.
+=	This and the following operators perform assignment of the expression following them to the left-hand value after performing the operation designated. For example: a op = b is equivalent to writing the expression as a = a op b.
-=	
*=	
/=	
%=	
<<=	
>>=	
&=	
^=	
=	
,	Two or more expressions separated by the comma are evaluated left-to-right and the result of the overall expression is the evaluation of the right-most subexpression.

Note: The operators are grouped in descending order of precedence. Operators have equal precedence within their group.

Figure 3. C's operators.

program will read from the standard input until it detects an end-of-file marker (EOF). As it reads, it counts characters, words, and lines in the text. When it finds the EOF, it displays these totals.

The statements beginning with the # character are called preprocessor statements and direct the compiler to perform specific actions.

The #define statement defines a macro for the compiler that you can use later by referring to that name; in this case, EOF means -1 in the program. These macros can be powerful and can include parameters for substitution into the definition.

The following example of a macro definition produces a function that yields the maximum value of two numbers:

```
#define MAX(A,B) ((A) > (B) ? (A) : (B))
```

This expression uses what's called a ternary or conditional operator (expr1 ? expr2 : expr3). It first evaluates expr1; if this expression is true, the result is expr2; otherwise, the result is expr3. I'll return to this later.

Next in Listing 1 comes the header main() identifying this as the main program, then declaration of variables. The counters of characters, words, and lines are integers; if you run this on an exceptionally large file (greater than 32K), you should declare them as long integer variables.

The While loop contains the heart of the program. The expression c = getchar() reads the next character from the standard input and assigns its value to the variable c. Then, the program checks the character for an EOF. If it finds one, GETCHAR returns a value of -1; otherwise GETCHAR returns the character value. This is the reason for declaring c as an integer value—a char variable is 8 bits and can hold only 256

values, providing no way to distinguish EOF from one of the characters.

When the program reads a character, it increments the character counter [+ + nc]. When it finds an EOF character, it increments the number of lines [+ + nl].

Next, the program checks the character for "white space" characters; that is, blanks, tabs, and end-of-line characters (EOLs). The logical operator || (logical or) connects logical tests.

C evaluates expressions containing || from left to right and ends the evaluation when an expression is true. Similarly, the logical operator && (logical and) proceeds from left to right and ends when it evaluates a false expression. This differs from languages such as Pascal or Fortran, which evaluate the entire expression each time it executes before determining its truth value. For example, the Pascal statement:

```
IF X <> 0 AND (1/X) > 3 THEN statement;
```

will always abort on a divide-by-zero error if X is zero. A similar statement using the C operators will not abort.

If the program finds a white space character, it sets the flag variable "inword" to false, indicating that the program is currently not in a word. If it finds another character and inword is false, then the program sets inword true to reflect the start of a word and increments the number of words [+ + nw].

The last part of the program uses the library routine PRINTF to display its summary. This information outputs to the file "stdout," for which the default device is the system console or video display.

## Functioning

The examples I've given so far don't tax the power of C. Now I'll introduce some

more advanced features, starting with functions.

In most other languages, functions are separate entities of code that perform some calculations and return a single value. In C, functions describe logical blocks of code that perform a related task. Functions may or may not return a value; they combine the capabilities of Pascal's functions and procedures.

Unlike Pascal, C lets you declare functions in any order within a program module. What's more, you can write and compile functions separately. C encourages you to subdivide your code into logical blocks and to build on these blocks.

Previously, I defined a macro to return the maximum of two numbers (look back at it for a moment). One side-effect of using macros is that the expressions are reevaluated for each repetition of the parameter in the substitution string. In the example above, the compiler evaluates twice the expression you substituted for A and B.

If you need a maximum value function extensively, defining MAX as follows might be much more efficient:

```
int max(a,b)
int a,b;
{
    return ((a>b) ? a : b);
}
```

This function evaluates only integer parameters, while the macro evaluates a maximum value for any type of data you supply as parameters. You gain efficiency because the compiler generates code to evaluate all parameters prior to calling the function—the function has to work with only a single numerical value for each parameter.

Another benefit of C is its excellent handling of pointers, variables that contain the address of another variable, thereby pointing to the variable. You can use the unary operator \* to denote the next operand as the address of a specific type of data item you want to manipulate. The unary operator & instructs the compiler to use the operand's address instead of its value. For example, you could declare ptr as a pointer to a float (float \*ptr) and pi as a real variable (float pi), then write:

```
ptr = &pi;
*ptr = 3.14159;
```

The first statement assigns the variable pi's address to the pointer variable, so the second statement is the same as writing pi = 3.14159. If you're confused, my next example should help clarify things.

Arrays are closely related to pointers. In fact, in most cases you can use them interchangeably. Any array operation you can do with subscripting can also be done with pointers.

You define arrays as in most other languages. The statement int numbers[100] defines an array of 100 consecutive integer values that you access via subscript values from zero through 99. Note that the index value begins at zero so the highest

Program Listing 1. Count (from The C Programming Language).

```
/*
   This example program is taken from The C Programming Language by
   Brian W. Kernighan and Dennis M. Ritchie, page 18
*/

#define YES      1
#define NO       0
#define EOF     -1

main()           /* count lines, words, and chars in the input */
{
    int c, nl, nw, nc, inword;

    inword = NO;
    nl = nw = nc = 0;
    while ( (c = getchar()) != EOF) {
        ++nc;
        if (c == '\n')
            ++nl;
        if ( (c == ' ') || (c == '\n') || (c == '\t') )
            inword = NO;
        else
            if (inword == NO) {
                inword = YES;
                ++nw;
            }
    }
    printf("%d %d %d\n", nl, nw, nc);
}
```

End

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Device Independent Graphics (same CMDs all graphic modes and computers)	*	N/A	N/A	N/A	N/A
SAME File commands all computers?	*	N/A	N/A	N/A	N/A
STRUCTURED: Labels, Functions, LONG IF etc.	*	*	N/A	*	N/A
Same editor commands all versions/computers	*	*	N/A	N/A	N/A
Sieve benchmark (Byte January 1983, 10 iter's)	13.7 sec.	14.1 sec.	14.9 sec.	261 sec.	2190 sec.
Shell-Metzner SORT (Sybes-BASIC for Scientist's and Eng. 2,000 5 char. strings)	19 sec.	28 sec.	71 sec.	194 sec.	2700 sec.
Executable Machine Lang. & approx. File size	12k	12k	32k	N/A	N/A
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value is one less than the maximum dimension value. C also supports multidimensional arrays, but you soon learn that you can better write these expressions as arrays of pointers.

I don't want to spend too much time on pointers and arrays, but I'll demonstrate some of their power in a more detailed example (sorry, this one doesn't work with the C interpreter accompanying this article (see p. 41)).

### Searching Questions

Program Listing 2, Find, finds a specified string in a text file. It interrogates the command line for parameters and a string to search for. Then it scans input read from the standard input file (stdin), searching for the text string. The optional parameters can specify whether the program displays lines containing the string and whether it displays corresponding line numbers along with the text. The command syntax is FIND [-x] [-n] string, where the x and n parameters are optional and "string" represents any string not containing blanks or other delimiters.

The first statement defines the maximum number of characters you can put on any one line. It uses the preprocessor control statement #define to establish the symbolic name MAXLINE with the proper buffer size.

The main program declaration—main (argc,argv)—tells the compiler that you want to interrogate the command line parameters. The variable argc provides a count of parameters on the command line, including the command name. The variable argv is an array of pointers, each corresponding to the starting character of each command string. Note that you must declare these two variables just after the main program header.

The next statement declares the line buffer and a pointer to a character. The program also declares variables for the line counter and for flags to determine whether to display lines containing the string and their line numbers.

The first While loop scans the command line arguments for the x and n parameters. The first part, --argc > 0, tells the While loop to look at parameters while the parameter count is greater than zero. The -- operator decrements the counter before testing it.

The second part of the While clause tests the first character of the parameter for a leading minus sign, which is required to identify the parameters. The expression (\*++argv)[0] == '-' requires detailed explanation. Argv is an array of pointers to character strings. The first pointer is for the command name in some systems. The \*++argv says to increment to the next pointer and then use that value. You need parentheses around this expression because of the evaluation priority of the operators \* and ++. The [0] looks at the parameter's first character.

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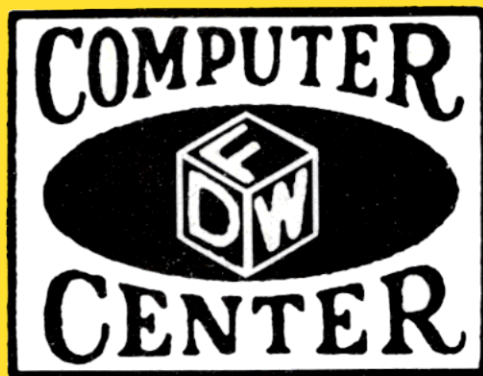
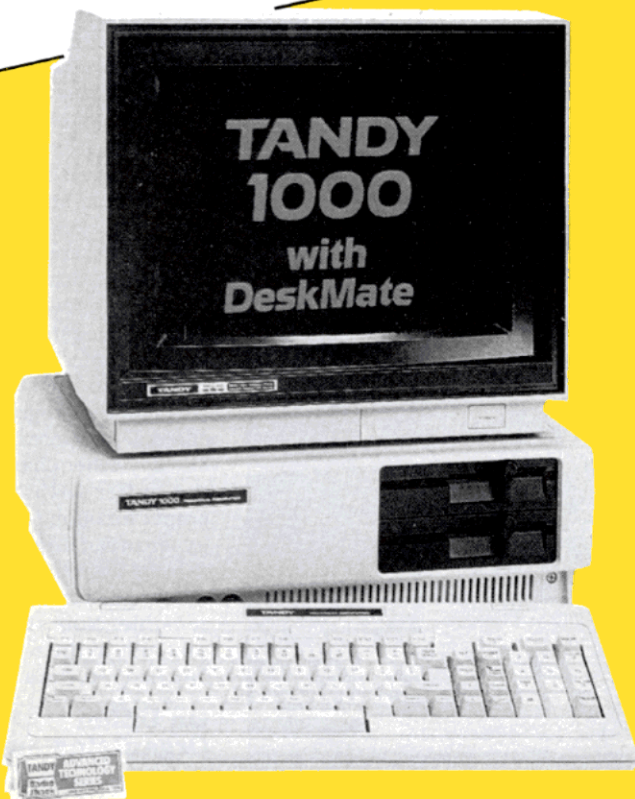
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and the remaining part of the test compares this parameter to a minus sign.

The program lets you specify the two parameters separately or in one command switch (e.g., -nx). The For statement scans the remaining characters on the selected parameter for valid switch options. The Switch statement checks the options and sets the appropriate flags or displays an error message if the option is invalid.

When the While loop is completed, argc should equal 1, signifying that only the String parameter remains. The If statement checks for a string present and prints an error message and exits if it is not.

The Else clause for this If statement is the heart of the program. It gets a line, checks for the string, performs the designated functions, and continues until there are no more lines in the input stream.

Two functions, Index and GETLINE, do these tasks. The Index function searches the line buffer for the string. If the string is found, Index returns an integer representing the starting position in the buffer. If the string isn't found, Index returns a -1 (this is a normal C function exit showing that the desired function was not done).

GETLINE reads characters from the input file and examines them for an end-of-line character. If it doesn't find an EOL, the program inserts the character into the buffer up to the limit specified. If it finds an EOL, it terminates the buffer as a normal C string (with a zero byte '\0') and returns with the actual length of the line. If no line is available, GETLINE returns a zero value.

Index handles the string and line buffers as character arrays. Note that the function declaration of the two arrays doesn't have to specify the size of the array; it merely tells the compiler that the two variables represent character arrays.

The first For loop initializes the line buffer index "i" and tests the character element s[i] for nonzero. This means the program hasn't reached the end of the buffer. The statement part of this For loop is a block consisting of another For statement and a completion test.

This For loop contains an expression with the comma operator as the initializing expression [j = 1, k = 0], which executes once. The loop test consists of two parts: a test to see if t[k] is zero (end of search string) followed by a comparison of the buffer to the string [s[j] = t[k]].

The last part of the statement consists of two expressions separated by another comma forming the increments for the array indexes. Since the For statement expressions do all the work, no further action is required and the semicolon signifies a null statement.

When the program exits from the For statement, one or both conditions are true: The search string has been exhausted or the string does not match. The If statement tests for a string match and returns an appropriate result.

That's how you do it with arrays. Now

Unions can exist within structures and structures may be in unions. You reference unions using the same operators as for structures.

## How Fast Is C?

I included one last programming example as a test of C's performance. Program Listing 3, Sieve, contains source listings in Basic, Pascal, and C for the Sieve of Eratosthenes prime number generator, which has become the *de rigueur* benchmark test. I ran these tests with compilers for Basic, Pascal, and C on a Model 4P and a Tandy 2000. Figure 4 shows the results.

## Choosing a Compiler

The compiler is the most important part of any C language software package. Compilers usually generate Assembly-language output that you must assemble. You should get one that generates native Assembly language using standard mnemonics if you want to modify your Assembly code.

For example, Aztec's package generates code in standard assembler format; you can't use it with Microsoft's assembler but Manx's assembler really is better anyway. Your compiler must be able to handle the language as defined in *The C Programming Language* by Brian W. Kernighan and Dennis M. Ritchie (Prentice-Hall, \$19.95). If you're interested in C, you must have a copy of this book.

Your compiler also must support full preprocessor macro definitions and conditional compilation controls if you're going to easily port your software from one computer to another.

Aztec C prides itself on just this type of support. I have moved programs written for the Model 4 to the Tandy 2000 and IBM PC with relative ease.

Other support software is vital also. This includes the library support. A full Unix-like library is essential. Of the compilers I have seen, Aztec is best in this area. Unix-style utilities are also necessary. Make is a utility that updates complex modular programs by recognizing modules that need recompiling, compiling them, and linking them together. A source level debugging tool helps find those kinky problems that occur from time to time. Another needed tool is a library manager so you can make your own libraries of compiled functions or update existing ones.

On the IBM PC and other 16-bit computers, the compiler should be able to handle all combinations of memory models. This means that you should be able to select code space less than or greater than 64K. Similarly, you should be able to use more than 64K of data space or limit yourself to the smaller configuration. Not all 16-bit compilers support this.

## And Finally

C isn't for everyone. It is not a panacea

for programming problems. You can do most simple programming tasks in Basic, and C is more difficult to use than many languages. As Fig. 4 shows, compile times

are relatively long and can significantly slow program development.

Why, then, is C so popular? It is outstanding for software development. The

Listing 3 continued

```
90 FOR J = 0 TO 8190
100 IF NOT FLAGS(J) THEN GOTO 170
110 PRIME = J + J + 3
120 ' PRINT PRIME,
130 FOR K = J+PRIME TO 8190 STEP PRIME
140 FLAGS(K) = 0
150 NEXT
160 COUNT = COUNT + 1
170 NEXT
180 NEXT
190 PRINT COUNT;" primes."
```

(b) program sieve(output);

```
const
    size = 8190;
    size1 = 8191;

var
    i, prime, k, count, iter : integer;
    flags : array[0..size1] of boolean;

begin
    write('10 iterations: ');
    for iter := 1 to 10 do
        begin
            count := 0;
            for i := 0 to size do
                flags[i] := true;
            for i := 0 to size do
                if flags[i] then
                    begin
                        prime := i + i + 3;
                        write(prime:8);
                        k := i + prime;
                        while (k <= size) do
                            begin
                                flags[k] := false;
                                k := k + prime;
                            end;
                        count := count + 1;
                    end;
            end;
            writeln(count, ' primes.');
```

```
(c) /* Benchmark */
#include <stdio.h>
#define SIZE 8190 /* size of the number array */
#define SIZE1 8191 /* SIZE + 1 */
#define NTIMES 10 /* number of times to execute loop */
#define TRUE 1
#define FALSE 0

char flag[SIZE1];

main() /* compute primes using the Sieve of Eratosthenes */
{
    register int i, j, k, count, prime;
    printf("%d iterations: ", NTIMES);
    for (i = 1; i <= NTIMES; i++)
    {
        count = 0;
        for (j = 0; j <= SIZE; j++)
            flag[j] = TRUE;
        for (j = 0; j <= SIZE; j++)
        {
            if (flag[j])
            {
                prime = j + j + 3;
                /* printf(" %d ", prime); */
                for (k = j+prime; k <= SIZE; k += prime)
                    flag[k] = FALSE; /* discard multiples */
                count++;
            }
        }
    }
    printf("%d primes.\n", count);
    exit(0);
}
```

End

Unions can exist within structures and structures may be in unions. You reference unions using the same operators as for structures.

## How Fast Is C?

I included one last programming example as a test of C's performance. Program Listing 3, Sieve, contains source listings in Basic, Pascal, and C for the Sieve of Eratosthenes prime number generator, which has become the *de rigueur* benchmark test. I ran these tests with compilers for Basic, Pascal, and C on a Model 4P and a Tandy 2000. Figure 4 shows the results.

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The compiler is the most important part of any C language software package. Compilers usually generate Assembly-language output that you must assemble. You should get one that generates native Assembly language using standard mnemonics if you want to modify your Assembly code.

For example, Aztec's package generates code in standard assembler format; you can't use it with Microsoft's assembler but Manx's assembler really is better anyway. Your compiler must be able to handle the language as defined in *The C Programming Language* by Brian W. Kernighan and Dennis M. Ritchie (Prentice-Hall, \$19.95). If you're interested in C, you must have a copy of this book.

Your compiler also must support full preprocessor macro definitions and conditional compilation controls if you're going to easily port your software from one computer to another.

Aztec C prides itself on just this type of support. I have moved programs written for the Model 4 to the Tandy 2000 and IBM PC with relative ease.

Other support software is vital also. This includes the library support. A full Unix-like library is essential. Of the compilers I have seen, Aztec is best in this area. Unix-style utilities are also necessary. Make is a utility that updates complex modular programs by recognizing modules that need recompiling, compiling them, and linking them together. A source level debugging tool helps find those kinky problems that occur from time to time. Another needed tool is a library manager so you can make your own libraries of compiled functions or update existing ones.

On the IBM PC and other 16-bit computers, the compiler should be able to handle all combinations of memory models. This means that you should be able to select code space less than or greater than 64K. Similarly, you should be able to use more than 64K of data space or limit yourself to the smaller configuration. Not all 16-bit compilers support this.

## And Finally

C isn't for everyone. It is not a panacea

for programming problems. You can do most simple programming tasks in Basic, and C is more difficult to use than many languages. As Fig. 4 shows, compile times

are relatively long and can significantly slow program development.

Why, then, is C so popular? It is outstanding for software development. The

Listing 3 continued

```

90 FOR J = 0 TO 8190
100 IF NOT FLAGS(J) THEN GOTO 170
110 PRIME = J + J + 3
120 ' PRINT PRIME,
130 FOR K = J+PRIME TO 8190 STEP PRIME
140 FLAGS(K) = 0
150 NEXT
160 COUNT = COUNT + 1
170 NEXT
180 NEXT
190 PRINT COUNT;" primes."

```

(b) program sieve(output);

```

const
    size = 8190;
    size1 = 8191;

var
    i, prime, k, count, iter : integer;
    flags : array[0..size1] of boolean;

begin
    write('10 iterations: ');
    for iter := 1 to 10 do
        begin
            count := 0;
            for i := 0 to size do
                flags[i] := true;
            for i := 0 to size do
                if flags[i] then
                    begin
                        prime := i + i + 3;
                        write(prime:8);
                        k := i + prime;
                        while (k <= size) do
                            begin
                                flags[k] := false;
                                k := k + prime;
                            end;
                        count := count + 1;
                    end;
            end;
            writeln(count,' primes.');
```

```

(c) /* Benchmark */
#include <stdio.h>
#define SIZE 8190 /* size of the number array */
#define SIZE1 8191 /* SIZE + 1 */
#define NTIMES 10 /* number of times to execute loop */
#define TRUE 1
#define FALSE 0

char flag[SIZE1];

main() /* compute primes using the Sieve of Eratosthenes */
{
    register int i, j, k, count, prime;
    printf("%d iterations: ", NTIMES);
    for (i = 1; i <= NTIMES; i++)
    {
        count = 0;
        for (j = 0; j <= SIZE; j++)
            flag[j] = TRUE;
        for (j = 0; j <= SIZE; j++)
        {
            if (flag[j])
            {
                prime = j + j + 3;
                /* printf(" %d ", prime); */
                for (k = j+prime; k <= SIZE; k += prime)
                    flag[k] = FALSE; /* discard multiples */
                count++;
            }
        }
    }
    printf("%d primes.\n", count);
    exit(0);
}

```

End

	C	Pascal	Basic Interpreter	Basic Compiler
<b>Model 4/4P</b>				
Source file size	836	811	344	344
Execution file size	8,785	19,076	21,927	33,092
Source time (sec)	123	62	N/A	179
Execution time (sec)	27.1	175	945	20.3
<b>Tandy 2000</b>				
Source file size	896	896	384	384
Execution file size	3,942	27,148	52,672	23,248
Source time (sec)	62	84	N/A	67
Execution time (sec)	3.3	4.2	569	6.0

The code size listed for the Basic Interpreter includes the size of the interpreter itself. The compilation times listed include the time required to assemble, link, and/or convert the source code into a stand-alone program.

Model 4/4P: TRSDOS 06.02.00 Disk Operating System  
Microsoft BASIC Interpreter 01.01.00  
Microsoft BASCOM Compiler version 5.35  
Manx Aztec-C80 Version 1.06B  
TRS-80 (Alcor) Pascal 02.00.00.

Tandy 2000: MS-DOS Disk Operating System Version 02.11.02  
Microsoft BASIC Interpreter 01.03.00  
Microsoft BASCOM Compiler Version 5.50  
Manx Aztec-C86c Version 3.20C  
Microsoft PASCAL Version 3.13.

Figure 4. Sieve of Eratosthenes comparison.

biggest cost factor in developing software is the time required to design, write, and debug the code. If you can reduce any of these factors, your profit will increase. C does this in a major way, since it makes coding routines in Assembly language (a lengthy process) virtually unnecessary.

Other important factors in software design are overall size and speed. As you can see from the simple example in Fig. 4, the code a good C compiler produces is far smaller than that of other compilers for microcomputers. Also, C's compiled code executes as fast as, and often faster than, that of other compilers.

If you're interested in programming applications software and want to exploit your computer fully, you must have a compiler. C lets you run your software on the widest possible variety of systems, and I highly recommend that you investigate it. ■

John B. Harrell III writes about programming and edits Spreadsheet Beat. You can contact him c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.



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Execution speed on the Model 3 for 10 iterations of the prime number program published in Byte, Jan 83, page 284.

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# NET RESULTS

by David H. Pleacher

**Hoops covers the court in recording and reporting basketball statistics by team or player.**

**R**eading through a sheet of basketball statistics may not substitute for the give and take of live play but, as any high school coach can tell you, the numbers give you the lowdown on team performance. My Model I/III/4 basketball statistics program, Hoops, keeps track of a team's record, an individual's record, and overall game statistics (see the Program Listing and Fig. 1).

Hoops lets you print out five different reports: the team record (see Fig. 2), team totals by game (see Fig. 3), cumulative totals for each of the team members (see Fig. 4), an individual player's statistics, and the printout for a particular game.

## Getting Organized

The key to Hoops' statistical manipulation lies in its file handling (see the Table for Hoops' line descriptions). The program uses both random-access and sequential files; it opens random-access files using Basic's buffer 1 and sequential files with buffer 3.

Hoops records up to 20 players' statistics in random-access files called `PLAYER1/TXT`, `PLAYER2/TXT`, and so on. Each of these files contains records; record 1 holds the statistics for game 1, record 2 for game 2, and so on. Hoops stores the team totals for each game in the random-access file called `PLAYER21/TXT`, and the opponents' totals for each game in `PLAYER22/TXT`.

Hoops also uses five sequential files. `TEAMINFO/TXT` contains the school's (or team's) name, the coach's name, the year, the number of wins and losses, and the number of players on the team. `GAMES/TXT` contains the name of the opponent, the date, whether it's a home or away game, and the score for each game.

`PLAYERS/TXT` contains the names and jersey numbers of all the players. Hoops keeps the cumulative totals for a team in `TOTALS/TXT`. It initially fills this file with zeros. Hoops uses one other file, `TEMPFILE/TXT`, when you make corrections; the program opens it through buffer 2.

## File-Handling Routines

To see how Hoops' file-handling routines work, follow the routine for adding a player to the team (lines 4470-4570). When you select the option to add a player from the main menu, Hoops first opens the sequential file `TEAMINFO/TXT` for input and reads the data from it. Then it opens the sequential file `PLAYERS/TXT` for input and reads the data from that file. Finally, it opens the sequential file `TOTALS/TXT` and reads the totals for each player from that file.

After you enter the additional players and their corresponding jersey numbers, Hoops opens the sequential files `PLAYERS/TXT` and `TOTALS/TXT` for output, and writes the updated data to them. For example, if you just added the 16th player to a team, the routine opens the random-access file `PLAYER16/TXT` and fields it. This file contains player 16's statistics for each game. If you already played four games when you add player 16 to the team, Hoops fills the first four records with zeros using the `RSET` (lines 790-860) and `Put` (line 880) statements.

Often, Hoops accesses several files to make one printout. For example, to print the statistics for the third game, you need the sequential files `TEAMINFO/TXT`, `GAMES/TXT`, and `PLAYERS/TXT`; and record 3 of each of the random-access files `PLAYER1/TXT`, `PLAYER2/TXT`, ..., `PLAYER22/TXT`.

## Using Hoops

Use the template in Fig. 5 to record game statistics during play. You can later add this data to the program's statistical files.

To use Hoops, enter Basic with three variable files and run the program. (Hoops has a fun but time-consuming opening display. Delete lines 80 and 5150-5350 to eliminate it.)

To enter data for a new team, select option A from the main menu. Hoops prompts you for the school (or team) name, the coach's name, and the players' names and jersey numbers. If you make

an error, Hoops lets you correct it at the end of each record input.

Once you enter this information, you can choose any of Hoops' other options: add a player, type in statistics for a game, make corrections to previously entered data, or print out reports. If, by mistake, you select the option to update statistics or the option to add a player, you are given a chance to exit from that module immediately.

Hoops lets you enter a zero for a particular category by pressing the enter key. This is useful when a team member plays only two minutes in a game and most of that player's statistics are zeros.

To print out the statistics, you need a printer with a 110-column capability. You must use 11-by-14-inch paper if your printer prints 132 columns, condensed printing if you have an 80-column dot-matrix printer, or elite printing for a daisy-wheel printer. Feeding single sheets of 8½-by-11-inch paper sideways makes excellent printouts on a daisy-wheel printer.

## Hoops' Limitations

You can enter only the 13 statistics the program uses. Although these are probably the most basic basketball statistics, some coaches might keep additional statistics, like minutes played.

You need to keep players' names to 20 characters, and opponents' names to 14. I did this to keep the printouts to 110 columns. ■

Write to David H. Pleacher at 5047 Caroline Ave., Stephens City, VA 22655.



## System Requirements

**Models I and 4 with changes**

**Model III**

**32K RAM**

**Disk Basic**

**Printer (110-column)**



**Model 1 change:**

Remove POKEs.

**Model 4 changes:**

Correct PRINT @ locations.

Change 960 to 1200 in lines 160 and 200.

Remove POKEs.

Delete opening display: lines 80 and 5150-5350.

Change % to \ (clear key with ? key).

Figure 1. Program changes for the Models 1 and 4.

John Handley High School Basketball Statistics  
1984 - 85

Coach: Bill Isherwood Won: 9 Lost: 1

Game	Date	Opponent	Score	
			Us	Opponent
1	12/11/84	Clarke County	69	63
2	12/14/84	Warren County	64	57
3	12/18/84	Parkview	61	51
4	12/20/84	Martinsburg	68	62
5	12/27/84	Harrisonburg	53	59
6	12/28/84	James Wood	82	48
7	01/04/85	Broad Run	68	60
8	01/11/85	Loudoun County	67	56
9	01/12/85	Loudoun Valley	63	62
10	01/19/85	Osbourn	84	68

Figure 2. The team record.

John Handley High School Basketball Statistics  
1984 - 85

Coach: Bill Isherwood Won: 9 Lost: 1

G#	Date	Opponent	H/A	PGM	FGA	FG %	FTM	FTA	FT %	Pts.	Sco. Avg.	Off. Reb.	Def. Reb.	Tot. Reb.	Reb. Ovr.	Ten.	A	Drw Fou	Blk Stl	F	
1	12/11/84	Clarke County	Away	32	70	45.7	5	16	31.2	69	69.0	23	22	45	45.0	18	16	1	9	6	18
2	12/14/84	Warren County	Home	26	65	40.0	12	29	41.3	64	64.0	19	20	39	39.0	17	15	0	20	7	18
3	12/18/84	Parkview	Away	25	50	50.0	11	16	68.8	61	61.0	11	19	30	30.0	9	19	1	7	4	13
4	12/20/84	Martinsburg	Home	25	50	50.0	18	28	64.3	68	68.0	12	15	27	27.0	17	13	1	10	4	16
5	12/27/84	Harrisonburg	Home	23	63	36.5	7	12	58.3	53	53.0	17	16	33	33.0	14	14	0	13	6	17
6	12/28/84	James Wood	Home	33	65	50.8	16	21	76.2	82	82.0	16	17	33	33.0	17	14	0	21	6	15
7	01/04/85	Broad Run	Away	25	49	51.0	18	25	72.0	68	68.0	7	15	22	22.0	19	15	1	17	2	15
8	01/11/85	Loudoun County	Home	28	57	49.1	11	18	61.1	67	67.0	17	17	34	34.0	21	17	0	14	4	17
9	01/12/85	Loudoun Valley	Away	24	59	40.7	15	23	65.2	63	63.0	17	16	33	33.0	11	15	0	10	2	20
10	01/19/85	Osbourn	Home	31	58	53.4	22	29	75.9	84	84.0	7	16	23	23.0	12	18	1	16	2	15
Totals				272	586	46.7	135	217	61.4	679	67.9	146	173	319	31.9	155	156	5	137	43	164

Figure 3. The team totals by game.

John Handley High School Basketball Statistics  
1984 - 85

Coach: Bill Isherwood Won: 9 Lost: 1

## 10 Game Totals

#	Player	G	Qtr	FGM	FGA	PG %	FTM	FTA	FT %	Pts.	Sco. Avg.	Off Reb	Def Reb	Tot Reb	Reb. Avg.	Trn Ovr	A	Drw Fou	Stl	Blk Sht	F
10	Dwayne Richardson	10	21	1	9	11.1	2	7	28.6	4	0.4	1	2	3	0.3	8	0	0	7	0	6
12	Evan Humbert	10	37	19	45	42.2	25	34	73.5	63	6.3	7	23	30	3.0	25	65	2	20	1	25
13	Harold Brown	3	4	2	9	22.2	0	1	0.0	4	1.3	0	1	1	0.3	0	0	0	0	0	0
14	Jason Morgan	10	38	73	140	52.1	25	43	58.1	171	17.1	27	16	43	4.3	31	30	1	40	3	31
20	Joe Wilson	9	34	24	50	48.0	14	23	60.9	62	6.9	21	19	40	4.4	17	12	2	28	5	27
32	John Morgan	10	38	78	160	48.8	42	63	66.7	198	19.8	39	43	82	8.2	27	10	0	15	24	23
54	Mike Hardware	10	36	36	75	48.0	5	12	41.7	77	7.7	29	37	66	6.6	18	6	0	10	8	22
44	Mario Pritchett	10	33	16	41	39.0	12	17	70.6	44	4.4	5	11	16	1.6	12	14	0	10	0	9
40	Richard Pell	10	30	12	34	35.3	6	8	75.0	30	3.0	8	12	20	2.0	10	1	0	2	1	14
34	Mike Look	8	18	4	12	33.3	4	7	57.1	12	1.5	1	4	5	0.6	3	8	0	3	0	2
21	Jeff Veal	3	4	3	5	60.0	0	1	0.0	6	2.0	3	3	6	2.0	3	1	0	0	0	1
22	Daniel Robinson	4	5	2	3	66.7	0	0	0.0	4	1.0	2	0	2	0.5	1	1	0	1	0	2
30	Jude Sparrow	6	8	2	3	66.7	0	1	0.0	4	0.7	3	2	5	0.8	0	0	0	1	1	2
-	Team Totals	10	40	272	586	46.4	135	217	62.2	679	67.9	146	173	319	31.9	155	156	5	137	43	164
-	Team - per game	1	4	27	59	46.4	14	22	62.2	68	67.9	15	17	32	31.9	16	16	1	14	4	16
-	Opponents	10	40	240	535	44.9	106	162	65.4	586	58.6	153	167	320	32.0	0	0	0	0	0	155
-	Opp. - per game	1	4	24	54	44.9	11	16	65.4	59	58.6	15	17	32	32.0	0	0	0	0	0	16

Figure 4. The cumulative totals for team members.

# John Handley High School Basketball Statistics 1984-85

Game #6 Opponent: James Wood Home

#	Player	Qtr	FGM	FGA	FG%	FTM	FTA	FT%	PTS	SC	Off	Def	Tot	Reb	Trn	A	Drw	SH	Blk	F
10	Dwayne Richardson	3	0	2	0.0	2	2	100.0	2	2.0	0	1	1	1.0	4	1	0	3	0	2
12	Evan Humbert	3	2	3	66.7	8	9	88.9	12	12.0	1	0	1	1.0	1	3	0	2	0	3
13	Harold Brown	2	2	7	28.6	0	0	0.0	4	4.0	0	1	1	1.0	0	0	0	0	0	0
14	Jason Morgan	3	7	11	63.6	3	3	100.0	17	17.0	2	2	4	4.0	1	4	0	2	0	2
20	Joe Wilson	1	2	6	33.3	0	0	0.0	4	4.0	3	1	4	4.0	0	3	0	6	1	1
32	Joh																	3	7	

Figure 5. Template for recording game statistics.

## Legend

Qtr	Quarter	FTM	Free throws made	Def	Defensive rebounds	Drw	Draw offensive fouls
FGM	Field goals made	FTA	Free throws attempted	Tot	Total rebounds	Stl	Steals
FGA	Field goals attempted	FT%	Free throws percentage	Reb	Rebounds	Blk	Blocked shots
FG%	Field goals percentage	Off	Offensive rebounds	Trn	Turnovers	Sht	Shots
		Reb	Rebounds	Ovr	Assists	F	Fouls

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Lines	Description
70-130	Main program.
150-340	Most-often-used subroutines.
350-1770	Frequently used subroutines.
1780-1970	Main menu.
1980-2490	Statistics update module.
2500-2580	"Team record" module.
2590-2710	"Team totals by game" module.
2720-2890	"Cumulative totals for team members" module.
2900-3100	"Statistics for individual player" module.
3110-3370	"Statistics for a particular game" module.
3380-4460	Change statistics—make corrections.
4470-4570	"Add team members" module.
4580-4800	Initialization routine.
4810-5110	Program instructions.
5120-5140	Housekeeping.
5150-5350	Opening display.
5360-5400	Error-handling routines.

Table. Program outline of Hoops.

### Program Listing. Hoops.

```

10 REM ** Basketball Statistics **
20 REM ** David Pleacher **
30 REM ** John Handley High School **
40 REM ** P.O. Box 910, Winchester, VA 22601 **
50 REM
60 REM ** Main Program **
70 CLEAR 500:ON ERROR GOTO 5370
80 GOSUB 5160 ' Opening Display
90 GOSUB 5130 ' Housekeeping
100 GOSUB 4820 ' Instructions
110 GOSUB 1790 ' Menu
120 GOSUB 1590 ' End of Program
130 END
140 :
150 REM ** Subroutine to press <ENTER> to continue **
160 PRINT#960, "Press <ENTER> to continue."
170 IF INKEY$ <> CHR$(13) THEN 170
180 CLS : RETURN
190 REM ** Subroutine for YES/NO answer **
200 PRINT#960, "Is this information correct (Y/N) ?";
210 POKE 16409,1:TS=INKEY$
220 IF TS <> "Y" AND TS <> "N" THEN 210
230 POKE 16409,0 : RETURN
240 REM ** Print to TEAMINFO/TEXT file **
250 OPEN "O",3,"TEAMINFO/TEXT":PRINT#3,S$,"";CS$,"";YS$,"";G;W;L;P:CLOSE:RETURN
260 REM ** Input from TEAMINFO/TEXT file **
270 OPEN "I",3,"TEAMINFO/TEXT":INPUT#3,S$,CS$,YS$,G,W,L,P:CLOSE:RETURN
280 REM ** Zero values of T(x,y) **
290 FOR X=1 TO 22:FOR Y=1 TO 20:T(X,Y)=0:NEXT Y:NEXT X:RETURN
300 REM ** Print to TOTALS/TEXT file **
310 OPEN "O",3,"TOTALS/TEXT"
320 FOR X=1 TO P:GOSUB 340 :NEXT X:FOR X=21 TO 22:GOSUB 340 :NEXT X
330 CLOSE:RETURN
340 FOR Y=1 TO 20:PRINT#3,T(X,Y):NEXT Y:RETURN
350 REM ** Input from TOTALS/TEXT file **
360 OPEN "I",3,"TOTALS/TEXT"
370 FOR X=1 TO P:GOSUB 390 :NEXT X:FOR X=21 TO 22:GOSUB 390 :NEXT X
380 CLOSE:RETURN
390 FOR Y=1 TO 20:INPUT#3,T(X,Y):NEXT Y:RETURN
400 REM ** Print to PLAYERS/TEXT file **
410 OPEN "O",3,"PLAYERS/TEXT"
420 FOR X=1 TO P:PRINT#3, P$(X),";",N$(X):NEXT X:CLOSE:RETURN
430 REM ** Input from PLAYERS/TEXT file **
440 OPEN "I",3,"PLAYERS/TEXT"
450 FOR X=1 TO P:INPUT#3,P$(X),N$(X):NEXT X:CLOSE
460 P$(21)="Team Totals": N$(21)="-":P$(22)="Opponents": N$(22)="-"
470 RETURN
480 REM ** Zero values of S(x) **
490 FOR X=1 TO 20:S(X)=0:NEXT X:RETURN
500 REM ** Zero values of A(x) **
510 FOR X=1 TO 20:A(X)=0:NEXT X:RETURN
520 REM ** Update 12 Statistics for players and opponents **
530 PRINT#449,"Field Goals Made"; : INPUT A(3)
540 PRINT#481,"Field Goals Attempted"; : INPUT A(4)
550 PRINT#513,"Free Throws Made"; : INPUT A(6)
560 PRINT#545,"Free Throws Attempted"; : INPUT A(7)
570 PRINT#577,"Offensive Rebounds"; : INPUT A(11)
580 PRINT#609,"Defensive Rebounds"; : INPUT A(12)
590 PRINT#641,"Turnovers"; : INPUT A(15)
600 PRINT#673,"Assists"; : INPUT A(16)
610 PRINT#705,"Draw Offensive Fouls"; : INPUT A(17)
620 PRINT#737,"Steals"; : INPUT A(18)

```

Listing continued

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Listing continued

```

630 PRINT#769,"Blocked Shots"; : INPUT A(19)
640 PRINT#801,"Fouls"; : INPUT A(20): RETURN
650 REM ** Sum statistics for each individual player **
660 FOR Y=2 TO 20:T(X,Y)=T(X,Y)+A(Y):S(Y)=S(Y)+A(Y):NEXT Y
670 IF T(X,4)=0 THEN T(X,5)=0 ELSE T(X,5)=T(X,3)/T(X,4)*100
680 IF T(X,7)=0 THEN T(X,8)=0 ELSE T(X,8)=T(X,6)/T(X,7)*100
690 T(X,9)=T(X,3)*2+T(X,6):T(X,13)=T(X,11)+T(X,12)
700 IF T(X,1)>0 THEN T(X,10)=T(X,9)/T(X,1):T(X,14)=T(X,13)/T(X,1)
710 IF A(4)>0 THEN A(5)=A(3)/A(4)*100
720 IF A(7)>0 THEN A(8)=A(6)/A(7)*100
730 A(9)=2*A(3)+A(6):A(10)=A(9):A(13)=A(11)+A(12):A(14)=A(13):RETURN
740 REM ** Forms player file name from player number **
750 TS=STR$(X):TS=RIGHT$(TS,LEN(TS)-1):PS="PLAYER"+TS+ "/" :TEXT":RETURN
760 REM ** Open Random - Access file **
770 OPEN "R",1,PS,42
780 FIELD 1,2 AS QB$,2 AS FM$,2 AS FS$,4 AS FT$,2 AS F2$,4 AS F3$,2 AS P$
,2 AS SA$,2 AS OS$,2 AS DR$,2 AS TR$,2 AS RA$,2 AS TN$,2 AS AA$,2 AS DP$,2 AS ST$,
2 AS BS$,2 AS PS$:RETURN
790 REM ** reset statistics in the buffer **
800 RSET QB$=MKI$(A(2)):RSET FM$=MKI$(A(3)):RSET FS$=MKI$(A(4))
810 RSET FP$=MKI$(A(5)):RSET FT$=MKI$(A(6)):RSET F2$=MKI$(A(7))
820 RSET F3$=MKI$(A(8)):RSET PS$=MKI$(A(9)):RSET SA$=MKI$(A(10))
830 RSET OS$=MKI$(A(11)):RSET DR$=MKI$(A(12)):RSET TR$=MKI$(A(13))
840 RSET RA$=MKI$(A(14)):RSET TN$=MKI$(A(15)):RSET AA$=MKI$(A(16))
850 RSET DP$=MKI$(A(17)):RSET ST$=MKI$(A(18)):RSET BS$=MKI$(A(19))
860 RSET PS$=MKI$(A(20)):RETURN
870 REM ** PUT INFO INTO R-A FILE **
880 PUT 1,G:CLOSE:RETURN
890 REM ** Sum team totals **
900 S(1)=1:S(2)=4
910 IF S(4)>0 THEN S(5)=S(3)/S(4)*100
920 IF S(7)>0 THEN S(8)=S(6)/S(7)*100
930 S(9)=S(3)*2+S(6):S(10)=S(9):S(13)=S(11)+S(12):S(14)=S(13)
940 FOR Y=1 TO 20:T(21,Y)=T(21,Y)+S(Y):NEXT Y
950 IF T(21,4)>0 THEN T(21,5)=T(21,3)/T(21,4)*100
960 IF T(21,7)>0 THEN T(21,8)=T(21,6)/T(21,7)*100
970 IF G>0 THEN T(21,10)=T(21,9)/T(21,1):T(21,14)=T(21,13)/T(21,1)
980 SU=S(9):RETURN
990 REM ** Change S( ) to A( ) **
1000 FOR Y=1 TO 20:A(Y)=S(Y):NEXT Y:RETURN
1010 REM ** PRINT TO GAMES/TEXT FILE **
1020 IF G=1 THEN OPEN "O",3,"GAMES/TEXT" ELSE OPEN "E",3,"GAMES/TEXT"
1030 PRINT#3, OS$," ",D$," ",H$," ",SU,ST:CLOSE:RETURN
1040 REM ** Lprint Heading for printouts - first 4 lines **
1050 LPRINT "TS=SS+ Basketball Statistics":GOSUB 1110
1060 LPRINT TAB(T) TS:LPRINT TAB(50) Y$:LPRINT "":RETURN
1070 REM ** Lprint lines 5 and 6 of most printouts **
1080 TS="Coach: "+CS+" Won: "+STR$(W)+" Lost: "+STR$(L):GOSUB 1110
1090 LPRINT TAB(T) TS:LPRINT "":RETURN
1100 REM ** Center Titles **
1110 T=LEN(TS):T=INT((109-T)/2):RETURN
1120 REM ** Assign temporary variables to be printed **
1130 TS="Sco. Off Def Tot Reb. Trn Drw Blk"
1140 LPRINT TAB(61) " ":TS:RETURN
1150 TS=" Player":RETURN
1160 TS="G Qtr FGM FGA FG % PTM PTA FT % Pts. Avg. Reb Reb Avg. Ovr A Fou
Stl Sht F":RETURN
1170 TS="-- "+STR$(21,"-"):RETURN
1180 TS="-----":RETURN
1190 TS="*":RETURN
1200 TS=" %":RETURN
1210 TS="*":RETURN
1220 TS="***":RETURN
1230 TS="***.":RETURN
1240 TS="*":RETURN
1250 TS=" %":RETURN
1260 TS="*":RETURN
1270 TS="G# Date Opponent H/A ":RETURN
1280 GOSUB 1180:TS="-- "+STR$(14,"-")+ "---- "+RIGHT$(TS,80):RETURN
1290 TS="*":RETURN
1300 TS="* Opponent: % % %":RETURN
1310 REM ***** Insert Paper message *****
1320 CLS:PRINT"Do you have an Epson Printer?":GOSUB 210 :IF TS="N" THEN 1350
1330 PRINT"Do you want compressed printing?":GOSUB 210
1340 IF TS="Y" THEN LPRINT CHR$(15):F2=1
1350 PRINT:PRINT"Please insert paper in your printer.":PRINT
1360 PRINT"Now Press <ENTER> when you are ready to print.":GOSUB 170
1370 PRINT:PRINT"Statistics are now being printed."
1380 PRINT:PRINT"Please do NOT remove paper until the menu reappears on the" :
PRINT"screen.":RETURN
1390 REM ***** Change it? *****
1400 PRINT:PRINT"Do you wish to change it (Y/N)?":GOSUB 210 :RETURN
1410 REM ***** Print Individual's statistics on Screen *****
1420 PRINT#64,"Player: ";PS(PN);
1430 PRINT#193,"Quarters: ";A(2);
1440 PRINT#257,CHR$(31),"Field Goals Made: ";A(3);
1450 PRINT#289,"Field Goals Attempted: ";A(4);
1460 PRINT#321,"Free Throws Made: ";A(6);
1470 PRINT#353,"Free Throws Attempted: ";A(7);
1480 PRINT#385,"Offensive Rebounds: ";A(11);
1490 PRINT#417,"Defensive Rebounds: ";A(12);
1500 PRINT#449,"Turnovers: ";A(15);
1510 PRINT#481,"Assists: ";A(16);
1520 PRINT#513,"Draw Offensive Fouls: ";A(17);
1530 PRINT#545,"Steals: ";A(18);
1540 PRINT#577,"Blocked Shots: ";A(19);
1550 PRINT#609,"Fouls: ";A(20):RETURN
1560 CLS:OPEN "I",3,"GAMES/TEXT"
1570 FOR Y1=1 TO G:INPUT#3,OS$,D$,H$,SU,ST:PRINT Y1;OS$," - ";H$,:NEXT Y1
1580 CLOSE:RETURN
1590 IF F2=1 THEN LPRINT CHR$(18):RETURN
1600 RETURN

```

Listing continued on p. 134



Illustration by Roger Layonmark

# WINDOW SCREENS

by Glen E. Sparks

## Simultaneously display multiple windows of text or graphics with BasicG and a high-resolution board.

Everywhere you look these days, you see programs that use windows and pull-down menus. Everywhere, that is, except in Model III/4 Basic. But you Basic programmers needn't feel left out—with a high-resolution graphics board and BasicG, you can simulate a windowing environment in your own programs. You get the ability to display several windows of data or graphics simultaneously, manipulate pull-down menus, and create some dramatic animated graphics.

I'll explain how the windowing technique works, and how to use the commands available to you. For illustration, I'll also present a complete application program, a pie chart generator, that uses four windows and a pull-down menu.

### RAM with a View

The key to creating windows on the Models III and 4 is BasicG's View command. (BasicG is the graphics Basic that comes with Radio Shack's high-resolution board.) Essentially, this command makes your computer act as though a portion of the screen, called a viewport or window, is in fact the entire screen. Therefore, you can erase or change a window without affecting the rest of the screen. You can write to, draw on, or clear only the last viewport you defined.

When you clear a viewport, it erases everything underneath. You can define and clear viewports all day long if you want, stacking each new viewport on top of the last. Program Listing 1, Sinewave, and Program Listing 2, Prism Ring, create three-dimensional graphics effects using this technique (see Photos 1 and 2). You can also divide the screen and display windows next to each other.

Program Listing 3, Viewport, illustrates using windows to display data. It paints the entire screen with a pattern, defines the center of the screen as a viewport, clears the viewport, and displays a message there. Then it repeats the process for a second viewport below and to the right of the first (see Photo 3).

Notice that when text reaches the border of a viewport, it wraps around, just as it normally does at the edge of the full-width screen. Also notice that the two viewports aren't the same size. This means the text wraps around sooner on one than on the other. In your own pro-

grams, you'd have to include a subroutine to check the size of the viewport and split words logically where needed.

In BasicG, you use the GLOCATE(X,Y),0 statement instead of PRINT@ to display text at a specific place on the screen. GLOCATE defines the coordinates, and the command PRINT#-3 does the printing. The syntax is the same whether you're printing over the entire screen or in viewports. However, once you've defined a viewport, the coordinate system becomes relative to that viewport. In Listing 3, even though the windows aren't in the upper left-hand corner of the screen, the windows' upper left coordinates are 1,1 (line 210). You can therefore use the same subroutine to put data in any window by addressing the same X,Y coordinates.

There's one hitch to all this: Because the computer treats a viewport as an entire screen, you get an error message if you try to write past the parameters of the last viewport you defined. To avoid this problem, I suggest you redefine the entire screen as a viewport when you exit a program that uses viewports.

### Overwriting Concerns

As I mentioned above, defining a new window destroys anything under it on the screen. However, if you've seen commercial programs that use windows or pull-down menus (menus that slide down, covering a portion of the screen without destroying it), you probably noticed that the areas underneath appear to be intact. You can do the same trick with BasicG's Get and Put commands. (In this case, Get and Put don't work as they do with random-access files; they're special BasicG graphics commands.)

The statement GET(X1,X1)-(X2,Y2),VAR% stores a section of the screen in an array (VAR%) that you dimension earlier. Unlike the View command, this doesn't affect the screen. Also unlike View, this is a memory-hungry command. You might need a dimensioned array of 2.5K to store a quarter of the screen.

Once you store a section of screen, however, you can use the Put command to display it over and over again with little memory penalty. This is useful for pull-down menus or for storing an area a viewport overwrites. Program Listing 4, Circle, shows how this works; it draws a circle inside a box in the upper right corner of the

screen, paints over it, and then restores it. Substitute PRESET for PSET in line 80 to restore the image in inverse video.

You can use this technique to restore a portion of the screen you're going to overwrite with a viewport. Figure out how much area you'll overwrite and dimension an array large enough to store it. The appropriate formula appears in your graphics Basic manual. In a Get statement, save a section of screen comparable to the area you want covered, then use a Put statement to restore it after you use the window.

If you're working with viewports, you'll have to redefine the entire screen as a viewport or redefine the section where you're restoring your data. Otherwise, you'll get an error message if you try to write past the confines of the last viewport.

This might sound complicated, but it's easier done than said. Likewise pull-down menus. You simply design a menu and GLOCATE it to the screen much as you would a block of text on the normal screen. Save the menu with the Get command in an array large enough to hold it. Erase the graphics screen and proceed with your program.

When you need a pull-down menu, save the area that the menu will cover in another array with another Get statement. The two arrays are the same size. Use the Put command with the menu array to display the menu on the screen. After the menu's INKEY\$ routine, replace the original section of the screen and erase the menu at the same time by putting the second array back where you put the menu. The menu shrinks away as if it had never been there.

Using the methods I've described, you can write your own window programs with pull-down menus. Obviously, those monster multiwindow programs for MS-DOS machines aren't written in Basic, but the logic is the same.



### System Requirements

Models III and 4

48K RAM

BasicG

High-resolution board

Printer optional

## Pie Are Not Square

Windows is a pie chart program that puts the principles described above to work (see Program Listing 5). You can display up to four pie charts at a time on its four independent windows. A pull-down menu lets you manipulate the display.

When you run Windows, you'll see the pull-down menu form on the screen and quickly disappear. The program saves it in a Get array for later use. The input routine now prompts you for the title of a pie chart; the prompt appears on the non-graphics screen (in all, you have five screens—the normal screen plus four graphics windows). Your title can be any combination of numbers and letters up to 15 characters long.

Next, Windows prompts you for the period of time the pie chart covers; the same input restrictions apply here. Then you specify how many entries, or accounts, you want to chart. The limit, nine entries, is governed by the windows' size.

Now you choose the window where you want to display your data, that is, the chart's title and raw figures (see Photo 4). Type in a number from 1 to 4. Window 1 is the screen's upper left corner, 2 is lower left, 3 is upper right, and 4 is lower right.

Next, you're prompted for the number of a window for the pie chart itself; again, type in a number from 1-4. The program does no error-checking here to see if you type in the same window number for both your data and the chart. If you indicate the same number, Windows will display the data, then immediately erase it and display the corresponding pie chart. I set up the program this way so you can display four pie charts at once, one in each window.

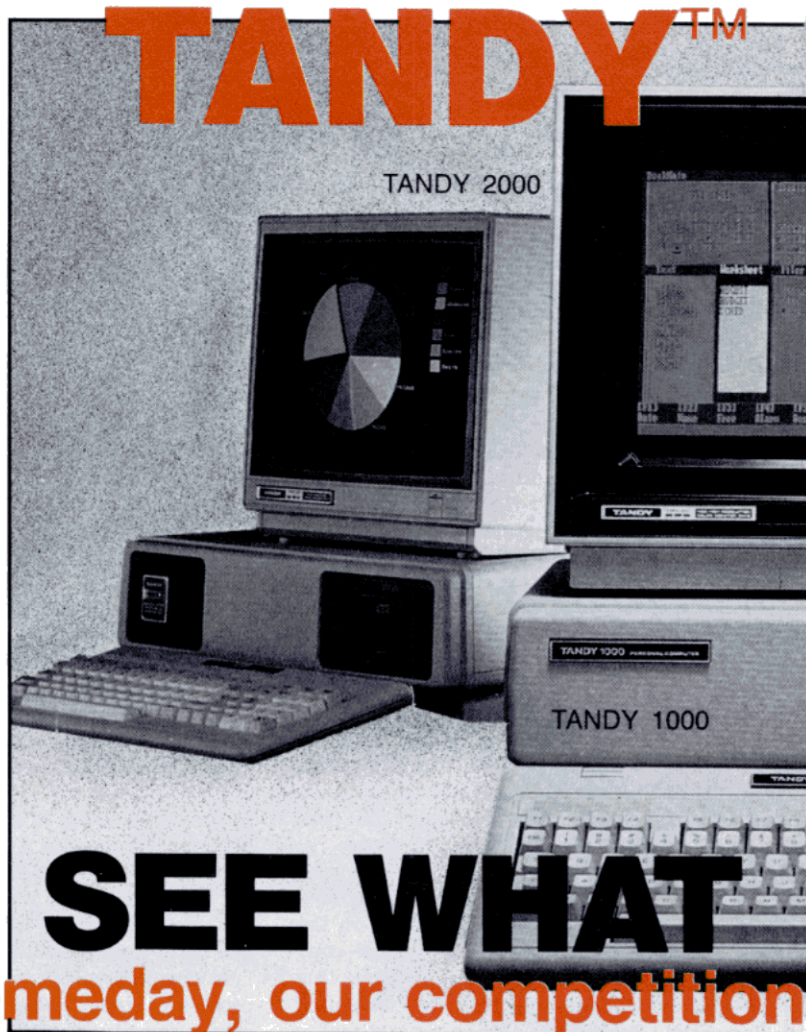
The next block of prompts repeats for each account you indicated. For each account, you type in an account name and amount. The name can be up to nine characters long. The amount's upper limit is 99,999.99. When you type in numeric data, don't use commas, since Windows reads them as delimiters.

If you need larger amounts, you can reformat the program's Print Using statements. However, you'll have less room for the account name if you do so.

The pie chart algorithm has a mechanism that excludes low amounts if the difference between amounts is great. This is necessary for clarity's sake—some slices would be comparatively too small to chart. All amounts you input are included in the total column, however. Since pie slices are numbered, you'll be able to tell which amounts didn't chart.

After you type in the last amount, Windows automatically goes to the graphics screen, draws all four windows, and displays the data and chart in the windows you specified (see Photo 4).

At this point, you can call up the pull-down menu by tapping the spacebar. It



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Delete line 160

Change line 580 to:  
580 LPRINT CHR\$(27);CHR\$(20):  
SYSTEM "GPRT2":RETURN

Insert line 615:  
615 SCREEN 1

Insert line 905:  
905 SCREEN 0

*Figure. Modifications to Program  
Listing 5 for the Model 4.*

appears in the middle of the screen as if it were on a shade that someone was pulling down (see Photo 5). Tap the spacebar again and the menu disappears.

To invoke a menu option, press the number key corresponding to the menu number on the screen. You can erase a window, dump the screen to the printer, or go back to the input subroutine. You don't have to erase a window that you plan to overwrite with a new pie chart or data; Windows does it automatically when you choose that window number during data entry.

When you send your report to the printer, you exit to BasicG in Model 4 mode or exit to TRSDOS in Model III mode.

To run Windows on a Model 4, you must modify Listing 5 as shown in the Figure.

### Charting Your Own Course

The power of a window environment lies in its ability to display different data or types of data at the same time. I set up the windows in this program for visual effect and to show that a window's placement and size is arbitrary and not restricted to any one layout. Your requirements might suggest only two windows or more than four.

I left the input section relatively simple. You have more than enough memory left over to add disk I/O routines for VisiCalc DIF files or data base management interfaces. You should have no trouble finding ways to tailor Windows to your own specifications. ■

*Glen E. Sparks is a programmer and a member of the Dearborn, MI, user's group. You can write to him at 6186 Custer, S. Rockwood, MI 48179.*

### Related Articles

Rowell, Dave, "Sifting Through GW-Basic," August, 1985, p. 46. A GW-Basic tutorial that covers the View command.

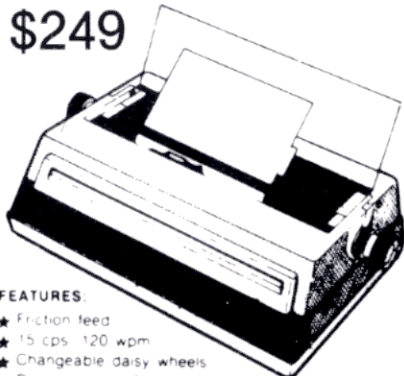
Also, see this month's installment of Dave's MS-DOS column, p. 92, for a Model 1000 conversion of the Sinewave program.

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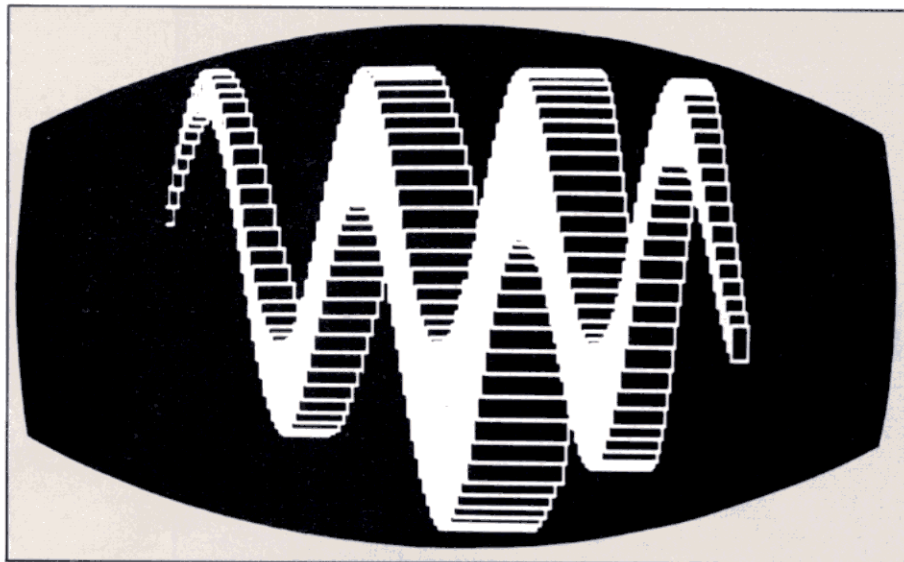


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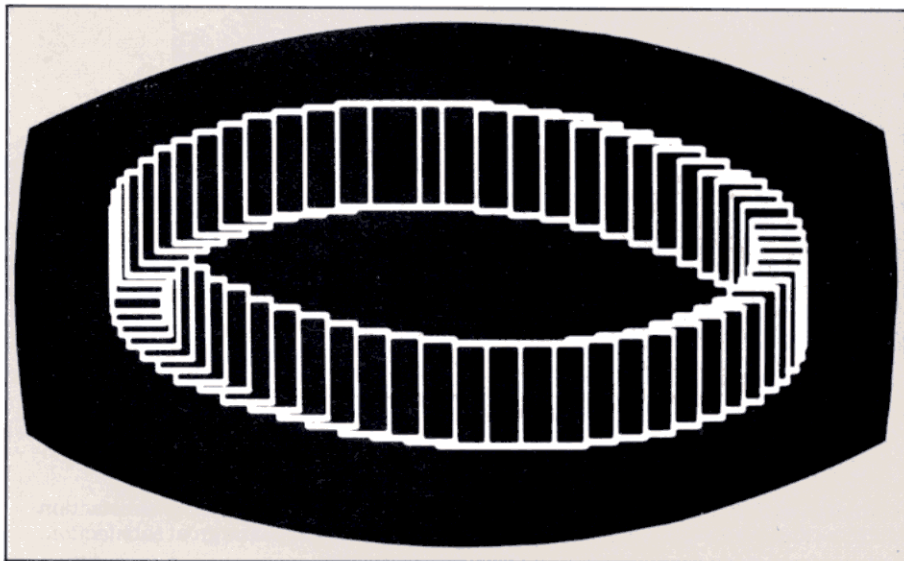


Photo 2. Prism Ring's display.

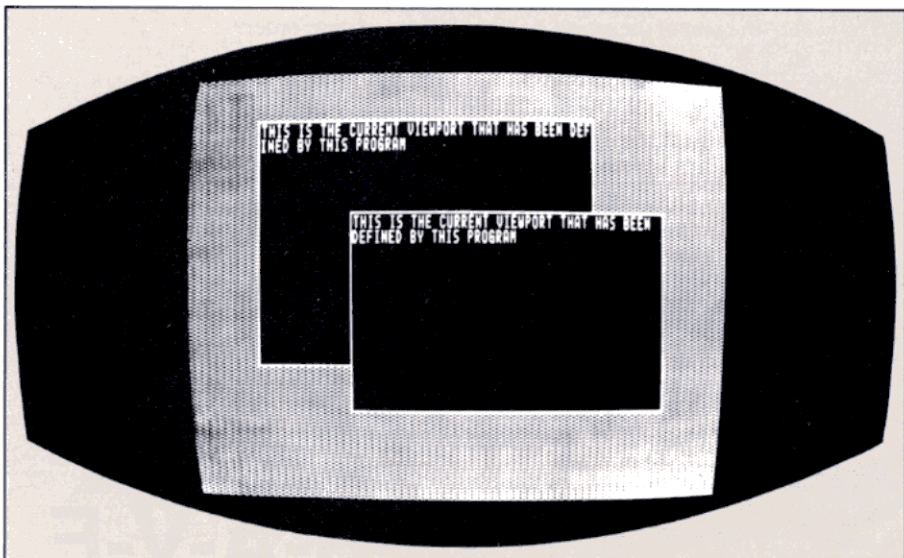


Photo 3. Viewport's display.

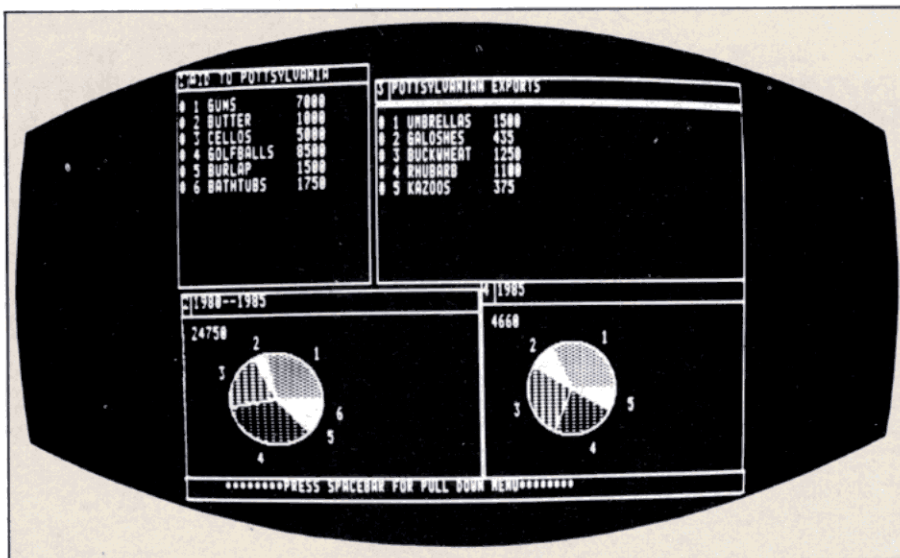


Photo 4. Windows' data displays and pie charts.

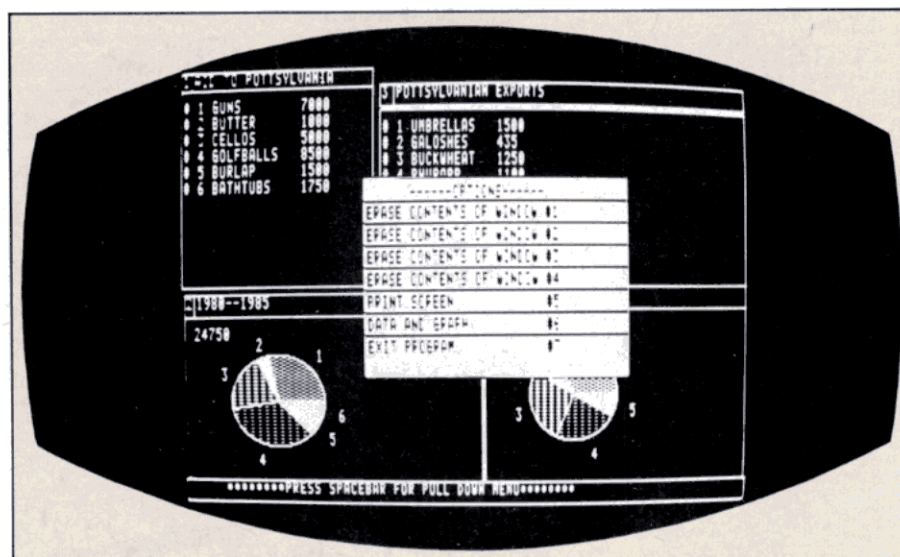


Photo 5. Windows' pull-down menu.

Program Listing 1. Sinewave.

```

10 ' SINE WAVE DESCENDS DOWN SCREEN
20 VIEW(0,0)-(639,239):CLR:SCREEN 0 'set entire graphics screen to
  viewport and clear it
30 C=55 'lower the number, the flatter the wave
40 J=0:Z1=5:Z2=.9:A=0:B=12
50 FOR X=A TO B STEP .15
60 X1=20*X:Y=SIN(X):Y1=139-C*(Y+1) 'sin wave algorithm--plot where
  boxes are to be on screen
70 IF C<0 THEN 'if C<0 then error--send to endless loop or begin
  prog over
80 IF J>0 THEN C=C-.04 'increasing minus off C increases spaces
90 IF J>0 THEN X1=X1+2:Y1=Y1-.01
100 IF X1<0 THEN X1=X1+.1
110 VIEW(X1,Y1)-(X1+Z1,Y1+Z1),,1:CLR 'draw actual viewport (box)
  and clear its contents thus removing hidden lines
120 Z1=Z1+Z2:NEXT 'make boxes in wave larger to midpoint of wave
130 Z2=-Z2:J=J+1 'if midpoint reached then make boxes smaller--J is
  counting variable for loop
140 IF J=2 THEN 160 'if second half wave made--go to screen holding
  loop
150 A=12:B=23:GOTO 50 'midpoint starting variables --execute first
  part of program with new values to make second half of wave
160 IF INKEY$="" THEN 160

```

Continued on p. 138 End

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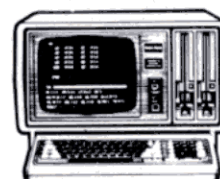
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Most Model III programmers can't take advantage of interrupts because TRSDOS 1.3 doesn't use them, except to update the internal clock. Program Listing 1, Break In, gives TRSDOS 1.3 complete interrupt-handling capability. Once you install the program, you can run up to 12 interrupt-driven tasks simultaneously.

Interrupts lend themselves to countless applications: type-ahead routines, printer spoolers, INKEY routines, and so on. I'll tell you how to write your own interrupt routines, and I'll provide you with a sample routine that adds a Scroll command to Basic.

## Clock Work

The Model III's clock hardware sends a special signal that interrupts the computer's central processing unit (CPU) so software in ROM can update the clock. These interruptions occur extremely fast—about every 33.333 milliseconds (ms.).

When a clock interrupt occurs, control jumps to location 4012 hexadecimal (hex). Under TRSDOS 1.3, location 4012 hex simply redirects the computer to 3018 hex, which updates the clock's time and takes care of other necessary chores. By changing the instruction at 4012, you can direct the computer to one of your own routines. For example, you could set up a program to trace what location in memory the CPU executes, or you could write a program that sounds an alarm at a certain time.



## System Requirements

Model III

48K RAM

TRSDOS 1.3

Assembly language

Editor/assembler

Program Listing 1. Break In.

```

00150 ;
00160 ORG 0FE00H
00170 START CALL 457 ;CLEAR SCREEN
00180 LD HL,MSG1 ;GET OPTION MESSAGE
00190 CALL 539 ;DISPLAY A LINE
00200 WAIT CALL 73 ;WAIT FOR A KEYPRESS
00210 CP 'E' ;WAS ENABLE OPTION CHOSEN
00220 JR Z,ENABLE ;IF SO, ENABLE IT
00230 CP 'D' ;DISABLE OPTION CHOSE?
00240 JR NZ,WAIT ;IF NOT, LOOP AGAIN
00250 LD A,15 ;TURN CURSOR OFF CHAR.
00260 CALL 51 ;TURN CURSOR OFF
00270 LD A,13 ;DISPLAY A CARRIAGE RETRN
00280 CALL 51
00290 LD HL,MSG3 ;GET "DISABLED" MESSAGE
00300 CALL 539 ;PRINT IT
00310 LD HL,3018H ;ORIGINAL ROUTINE ADDRESS
00320 DI ;DISABLE INTERRUPTS
00330 LD (4013H),HL ;RESTORE ORIGINAL ROUTINE
00340 EI ;ENABLE INTERRUPTS
00350 LD HL,0FFFFH ;RESET HIGH RAM MEMORY
00360 LD (4411H),HL ;LOCATION.
00370 JP 402DH ;EXIT TO TRSDOS READY
00380 ENABLE LD A,15 ;CURSOR OFF CHARACTER
00390 CALL 51 ;TURN CURSOR OFF
00400 LD A,13 ;DISPLAY A CARRIAGE RETRN
00410 CALL 51
00420 LD HL,MSG2 ;GET "ENABLED" MESSAGE
00430 CALL 539 ;DISPLAY IT
00440 DI ;DISABLE INTERRUPTS
00450 LD HL,START2 ;INTERRUPT HANDLER
00460 LD (4013H),HL ;INSTALL INTERRUPT HANDLER
00470 LD HL,START-1 ;VALUE TO PROTECT PROGRAM
00480 LD (4411H),HL ;PROTECT THE PROGRAM
00490 EI ;ENABLE INTERRUPTS
00500 JP 402DH ;EXIT - EVERYTHING WORKS
00510 MSG1 DEFB ' <E>nable or <D>isable the clock interrupt routine? '
00520 DEFB 14
00530 DEFB 3
00540 MSG2 DEFB 'The clock interrupt routine has been ENABLED!'
00550 DEFB 0DH
00560 MSG3 DEFB 'The clock interrupt routine has been DISABLED!'
00570 DEFB 0DH
00580 ORG 0FFF00H ;PROGRAM RESIDES IN HIMEM
00590 SLOW1 DEFW DEFALT ;VECTORS FOR SLOW INT'S.
00600 SLOW2 DEFW DEFALT
00610 SLOW3 DEFW DEFALT
00620 SLOW4 DEFW DEFALT
00630 SLOW5 DEFW DEFALT
00640 SLOW6 DEFW DEFALT
00650 SLOW7 DEFW DEFALT
00660 SLOW8 DEFW DEFALT
00670 FAST1 DEFW DEFALT ;VECTORS FOR FAST INT'S.
00680 FAST2 DEFW DEFALT
00690 FAST3 DEFW DEFALT
00700 FAST4 DEFW DEFALT
00710 ;
00720 ; Start of interrupt handling routine
00730 ;
00740 START2 PUSH DE ;SAVE REGISTERS
00750 PUSH AF
00760 PUSH HL
00770 PUSH BC
00780 PUSH IX
00790 PUSH IY
00800 LD DE,START3 ;RETURN LOCATION
00810 PUSH DE ;SAVE RETURN LOCATION
00820 LD A,8 ;THE FOLLOWING EXECUTES
00830 CALL FAST ;A FAST 33.33 MILLISECOND
00840 LD A,9 ;USER-DEFINED INTERRUPT.
00850 CALL FAST
00860 LD A,10
00870 CALL FAST
00880 LD A,11
00890 CALL FAST
00900 LD HL,TIMER ;INCREMENT THE 33.333
00910 INC (HL) ;MILLISECOND COUNTER

```

Listing 1 continued

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Listing 1 continued

```

00920 LD A, (HL) ;GET COUNTER VALUE
00930 AND 7 ;# OF SLOW INT. TO RUN
00940 FAST RLCA ;DETERMINE INTPT LOCATION
00950 LD L, A ;HL = ADDRESS OF NEXT
00960 LD H, 0FFH ;INTERRUPT TO EXECUTE
00970 LD E, (HL) ;DE = LOCATION OF THE
00980 INC L ;STARTING 2 BYTES
00990 LD D, (HL) ;POINTING TO YOUR INTRUPT
01000 PUSH DE ;COPY DE INTO IX
01010 POP IX ;IX CONTAINS A COPY OF DE
01020 EX DE, HL ;EXCHANGE DE AND HL
01030 LD E, (HL) ;DE = ACTUAL LOC. OF YOUR
01040 INC HL ;INTERRUPT ROUTINE
01050 LD D, (HL)
01060 EX DE, HL ;EXCHANGE DE AND HL AGAIN
01070 JP (HL) ;EXECUTE YOUR ROUTINE
01080 REMOVE LD DE, DEFALT ;INT. VECTOR RESET VALUE
01090 ADD CP ;IS TASK # > 12?
01100 RET NC ;RETURN IF MORE THAN 12
01110 RLCA ;GET OFFSET VALUE
01120 LD L, A ;HL = TASK LOCATION IN
01130 LD H, 0FFH ;THE INTERRUPT TASK TABLE
01140 DI ;DISABLE INTERRUPTS
01150 LD (HL), E ;ADD THE TASK TO TABLE
01160 INC HL ;BUMP THE POINTER
01170 LD (HL), D ;INSTALLATION COMPLETE
01180 EI ;ENABLE INTERRUPTS AGAIN
01190 CONST RET ;RETURN TO THE CALLER
01200 TIMER DEFB 0 ;33,333 MS COUNTER
01210 DEFALT DEFW CONST ;DEFAULT INT. LOCATION
01220 START3 POP IY ;RESTORE REGISTERS
01230 POP IX
01240 POP BC
01250 POP HL
01260 POP AF
01270 POP DE
01280 JP 3018H ;CONTINUE CLOCK HANDLER
01290 END START

```

End

Program Listing 2. Demo.

```

00160 ;
00170 ORG 0FD90H ;HI-RAM INTERRUPT
00180 ADDTSK EQU 0FF52H ;ADD A TASK SUBROUTINE
00190 REMTSK EQU 0FF4FH ;REMOVE A TASK SUBROUTINE
00200 TIMER EQU 0FF5FH ;LOCATION OF 33.3MS TIMER
00210 ;
00220 ; Interrupt installation procedure follows below
00230 ;
00240 START CALL 457 ;CLEAR SCREEN
00250 LD HL, MSG1 ;GET MESSAGE
00260 CALL 539 ;PRINT THE MESSAGE
00270 LD DE, MAIN ;POINTER OF INT. ROUTINE
00280 LD A, 0 ;SLOT ASSIGNMENT 0.
00290 CALL ADDTSK ;ADD THE TASK TO TABLE
00300 LD HL, 0FD8FH ;SET HI-MEMORY BELOW
00310 LD (4411H), HL ;PROGRAM TO PROTECT IT
00320 JP 402DH ;RETURN TO TRSDOS
00330 MSG1 DEFW 'Interrupt ON!'
00340 DEFB 0DH
00350 ;
00360 ; This is the actual interrupt handling routine. It is
00370 ; executed every 267.67 milliseconds, or so.
00380 ;
00390 MAIN DEFW MAIN2 ;POINT TO MAIN ROUTINE
00400 MAIN2 LD A, (15360+63) ;GET CHARACTER ON SCREEN
00410 CP ' ' ;IF CHAR. AN EQUAL SIGN?
00420 JR Z, CHANGE ;IF IT IS, CHANGE IT
00430 LD A, ' ' ;IF IT ISN'T, THEN
00440 LD (15360+63), A ;CHANGE IT TO ONE
00450 RET ;RETURN FROM INTERRUPT
00460 CHANGE LD A, ' ' ;CHANGE TO A DASH
00470 LD (15360+63), A ;CHANGE IT ON SCREEN
00480 RET ;RETURN FROM INTERRUPT
00490 END START

```

End

Program Listing 3. Scroll.

```

00170 ;
00180 SCREEN EQU 15360
00190 DSPLY EQU 539
00200 ;
00210 ; Start of Initialization Procedure
00220 ;
00230 ORG 0F200H ;INITIALIZATION AREA
00240 STARTR EI ;ENABLE INTERRUPTS
00250 LD A, (TIMER) ;GET 33.33 MS TIMER COUNT
00260 CP 0 ;IS THE INTERRUPT WORKING?
00270 JR NZ, STRT2 ;IF SO, FINISH INIT.
00280 LD BC, 25000 ;SET COUNTER TO 25000
00290 LPSTRT DEC BC ;DECREMENT COUNTER
00300 LD A, B ;GET COUNT
00310 OR C ;IS THE TIMER EQUAL TO 0?
00320 CP 0 ;FINISHED THE LOOP?
00330 JR NZ, LPSTRT ;IF NOT, CONTINUE.
00340 LD A, (TIMER) ;GET TIMER COUNT
00350 CP 0 ;STILL A ZERO?
00360 JR NZ, STRT2 ;IF NOT, THEN FINISH INIT

```

Listing 3 continued

Address (hex) Description

4012	Hook vector for interrupts. ROM hooks there every 33.333 ms. or so.
4411	A 2-byte area storing the highest usable memory location.
3018	ROM's interrupt-handling routine.
FF52	ADDTASK subrou-tine. This adds a task to the interrupt task table. DE = TCB address, A = slot assignment.
FF4F	REMTASK subrou-tine. This removes a task from the interrupt task table. A = slot assignment to remove.
FF5F	Timer location. Timer is a 33.333 ms. counter incremented about every 33.333 ms.
FF00-FF17	Interrupt task table area. FF00- FFOF are low-speed interrupts; FF10-FF17 are high-speed ones.

Table 1. Break In's routines.

Break In gives you four interrupts at 33 ms. Because this might be too fast for some applications, its remaining eight interrupts occur at a low speed of about 267.67 ms. With Break In activated, you can run up to 12 routines at the same time without really affecting the clock's time.

When TRSDOS turns off the clock interrupt, as it does for disk accesses, routines using the clock won't execute until TRSDOS turns the clock back on. Therefore, TRSDOS's clock isn't always accurate.

## Installation Plan

Break In controls your interrupt-driven routines, called tasks, via a task table containing the addresses of 12 interrupt slots. The program contains all the routines you need to add or remove a task from the task table. Table 1 shows these routines' addresses and requirements, along with some other locations worth noting. TRSDOS increments the value of a special 1-byte location, called the timer, by 1 every 33.333 ms. You could use it, for example, as a seed value for a random number generator, since it constantly changes.

Once you assemble Listing 1 to disk, Break In takes only a few seconds to install. When you run the program by typing in its /CMD file name, it asks whether you want to enable or disable the clock

interrupt routine. If you want to run interrupt-related programs, press the "E" key. If you've already enabled the routine and want to disable it, press the "D" key.

Enabling the routine activates 12 interrupts so they're ready to run your tasks. It also protects your program by setting the high-memory bytes at 4411 and 4412 hex to point to the first byte below the interrupt task table. This protects the table and the accompanying code, except in programs that erase all memory regardless of the high-memory setting.

Once you enable the interrupt-handling routine, don't use TRSDOS's Clear command, which clears all memory from 5600-FFFF hex. Before using Clear, run Listing 1 again and disable the routine.

Pressing the "D" key turns off the interrupt-handling routine and stops the 12 interrupts' operation. It resets the high-memory locations to point to the top of memory (FFFF hex).

After you run Break In, it returns you to TRSDOS. Now you can load your own task driver software. Program Listing 2, Demo, is a demonstration routine; it lets you see exactly when the interrupt executes. To run the routine, assemble Listing 2 to disk and, with Break In enabled, type in Listing 2's /CMD file name.

The message "Interrupt on!" appears on your screen. You should see a hyphen and an equals sign alternate in the screen's upper right-hand corner. The character changes each time the interrupt executes.

Demo gives you a low-speed interrupt, executing every 267.67 ms. or so. To see what a fast interrupt looks like, change line 280 of Listing 2 to LD A,8. This assigns the task to the first high-speed slot, so it operates every 33.333 ms. Now run Demo again and watch what happens. The hyphen and equals sign should alternate extremely fast.

Again, don't use the Clear command, unless you want your computer to crash. If the characters stop alternating, it means you're running a program that disables interrupts. Going back to TRSDOS Ready should enable them again.

## Driver Education

Listing 2 illustrates how to write your own task driver. To add a task to Break In's task table, you must meet the following requirements. Register DE must point to a 2-byte address called the task control block (TCB), which contains the address of the driver's entry point. Register A must contain the interrupt's slot assignment: Slots zero to 7 represent low-speed interrupts, slots 8-11 high-speed. Register HL must be destroyed after you add a task. On entry to your task driver routine, the IX register contains the TCB address.

Lines 240-320 represent Listing 2's initialization routine. They set up the interrupt-handling routine in lines 400-480 and start it running. Lines 240-260 clear the

Listing 3 continued

```

00370 LD HL,MSG1 ;GET "NOT OPERATION" MSG.
00380 CALL DSPLY ;DISPLAY IT
00390 RET ;RETURN TO CALLING PROG.
00400 MSG1 DEFM 'The interrupts have NOT been activated yet!'
00410 DEFB 0DH
00420 STRT2 LD DE,POINT ;LOC. OF ADRS OF PROGRAM
00430 LD A,11 ;LAST HIGH SPEED INTERRUPT
00440 CALL ADDTSK ;ADD TASK TO TASK-TABLE
00450 LD HL,0EFFFH ;SET HI-RAM TO EFFFH.
00460 LD (4411H),HL ;PROTECT THIS PROGRAM
00470 RET ;RETURN TO CALLING PROG.
00480 ;
00490 ORG 4174H ;HOOK FOR "CMD" COMMAND
00500 DEFW CMDHOK ;REPLACE WITH NEW HOOK
00510 ;OLD HOOK IS TO 5374H
00520 ;
00530 ; Start of Interrupt Handling Routine
00540 ;
00550 ORG 0F000H
00560 POINT DEFW START ;LOCATION OF INT. ROUTINE
00570 FLAG DEFB 0
00580 NOTIFY DEFB 0
00590 LEN DEFB 0 ;LOCATION OF MESSAGE
00600 OPRATE DEFB 0
00610 LEN2 DEFB 0
00620 COUNT DEFB 3
00630 ADDTSK EQU 0FF52H ;ADD A TASK TO TASK-TABLE
00640 TIMER EQU 0FF5FH ;33.333 MS TIMER COUNTER
00650 BUFFER EQU 0F300H ;BUFFER FOR MESSAGE
00660 START LD A,(OPRATE) ;GET OPERATION PERMISSION
00670 CP 0 ;CAN ROUTINE OPERATE?
00680 RET Z ;IF NOT, RETURN FROM INT.
00690 LD A,(16916) ;GET SCROLL PROTECT VALUE
00700 CP 0 ;IS IT A ZERO?
00710 CALL Z,PROTECT ;PROTECT FIRST LINE
00720 LD A,(COUNT) ;GET COUNT FOR SPEED
00730 DEC A ;DECREMENT COUNTER
00740 LD (COUNT),A ;SAVE COUNT
00750 CP 0 ;IS IT TIME FOR INTRPT?
00760 RET NZ ;RETURN IF NOT TIME
00770 LD A,3 ;RESET COUNTER
00780 LD (COUNT),A ;COUNTER RESET
00790 LD A,(FLAG) ;GET FLAG STATUS
00800 BIT 0,A ;BUSY PRINTING A MSG?
00810 JP Z,NOPRNT ;IF NOT, RESET FLAGS
00820 PRNTNG LD HL,BUFFER ;MESSAGE BUFFER AREA
00830 LD A,(LEN2) ;GET MESSAGE LENGTH
00840 LD C,A
00850 LD B,0 ;BC=MESSAGE LENGTH
00860 ADD HL,BC ;POINT TO CHAR. TO PRINT
00870 INC A
00880 LD (LEN2),A
00890 LD C,A
00900 LD A,(LEN)
00910 CP C
00920 CALL Z,RESFLG ;QUEUE NOW AVAILABLE
00930 LD (LEN),A
00940 LD A,(HL) ;GET CHARACTER TO PRINT
00950 LD HL,SCREEN+1
00960 LD DE,SCREEN
00970 LD BC,63 ;63 CHARACTERS TO MOVE
00980 LDIR ;SCROLL THEM
00990 LD (SCREEN+63),A ;SAVE NEW CHARACTER
01000 LD A,(FLAG) ;GET FLAG STATUS
01010 BIT 0,A ;LAST CHAR. PRINTED?
01020 RET NZ ;RETURN IF NOT
01030 LD A,(NOTIFY) ;FINISHED CLEARING SCREEN
01040 CP 2
01050 JR Z,CLRFLG ;IF SO, RESET BIT 1
01060 CALL ADJUST ;ADJUST TO CLEAR SCREEN
01070 RET ;RETURN FROM INTERRUPT
01080 CLRFLG LD A,(LEN2) ;GET CHAR. COUNT
01090 LD C,A ;SAVE IT
01100 LD A,(LEN) ;GET MESSAGE LENGTH
01110 CP C ;DONE PRINTING IT?
01120 RET NZ ;IF NOT, RETURN TILL DONE
01130 LD A,(FLAG) ;GET FLAG STATUS
01140 RES 1,A ;RESET CLEAR SCREEN FLAG
01150 LD (FLAG),A ;FLAG RESET
01160 XOR A ;ZERO A REGISTER TO
01170 LD (LEN),A ;CLEAR THIS FLAG
01180 LD (LEN2),A ;AND THIS FLAG
01190 LD (NOTIFY),A ;... AND THIS FLAG
01200 RET ;RETURN FROM INTERRUPT
01210 NOPRNT LD A,(FLAG) ;GET FLAG STATUS
01220 BIT 1,A ;BUSY, BUT AVAILABLE?
01230 JR NZ,PRNTNG ;CONTINUE PRINTING
01240 BIT 2,A ;ANOTHER WAITING QUEUE?
01250 JR Z,NONEW ;IF NOT, RESET FLAGS
01260 RES 2,A ;RESET WAITING QUEUE
01270 RES 1,A ;RESET CLEARING FLAG
01280 SET 0,A ;BUSY PRINTING A MESSAGE
01290 LD (FLAG),A ;SAVE FLAG STATUS
01300 XOR A
01310 LD (NOTIFY),A
01320 JR PRNTNG ;BEGIN PRINTING MESSAGE
01330 NONWE LD A,0 ;THE QUEUE IS EMPTY
01340 LD (NOTIFY),A ;THE QUEUE IS AVAILABLE
01350 RESFLG PUSH AF ;SAVE AF REGISTER
01360 LD A,(FLAG) ;GET FLAG STATUS
01370 RES 0,A ;NOT BUSY PRINTING
01380 RES 1,A ;NOT BUSY PRINTING
01390 LD (FLAG),A ;SAVE FLAG STATUS
01400 XOR A

```

Listing 3 continued

Listing 3 continued

```

01410 LD (LEN),A ;RESET FLAGS
01420 LD (LEN2),A ;RESET FLAGS
01430 POP AF ;RESTORE AF
01440 RET ;RETURN
01450 ADJUST PUSH HL ;SAVE REGISTERS
01460 PUSH AF
01470 LD A,64 ;GET LENGTH OF MESSAGE
01480 LD (LEN),A ;ADJUST FOR SCREEN CLEAR
01490 LD HL,BUFFER
01500 LD C,A
01510 XOR A ;ZERO A REGISTER
01520 LD (LEN2),A ;RESET THIS COUNTER
01530 LOOP1 LD (HL),20H ;FILL-IN WITH A SPACE
01540 INC HL
01550 DEC C ;BUMP POINTERS & COUNTERS
01560 LD A,C
01570 CP 0 ;COUNTER = 0 ?
01580 JR NZ,LOOP1 ;CONTINUE UNTIL DONE
01590 LD A,(FLAG) ;GET FLAG STATUS
01600 SET 1,A ;BUSY, BUT AVAILABLE
01610 RES 0,A ;QUEUE IS AVAILABLE
01620 LD (FLAG),A ;SAVE FLAG STATUS
01630 LD A,2 ;BUSY, BUT AVAILABLE
01640 LD (NOTIFY),A ;NOTIFY BASIC OF THIS
01650 POP AF ;RESTORE REGISTERS
01660 POP HL
01670 RET ;RETURN
01680 PROTCT LD A,1 ;SCROLL PROTECT 1 LINE
01690 LD (16916),A ;PROTECT IT
01700 RET ;RETURN TO PROGRAM
01710 ;
01720 ; Start of hook routine to print things using interrupt
01730 ;
01740 CMDHOK PUSH AF ;SAVE CONDITION CODES
01750 PUSH DE
01760 EI ;ENABLE INTERRUPTS
01770 LD A,(HL) ;GET COMMAND SYNTAX
01780 CP '!' ;IS IT A VALID COMMAND?
01790 JR Z,GOOD ;IF SO, EXEC NEW ROUTINE
01800 POP DE ;RESTORE REGISTERS
01810 POP AF ;RESTORE CONDITION CODES
01820 JP 5374H ;EXECUTE THE BASIC COMMAND
01830 GOOD LD A,1 ;TURN ON THE INTERRUPT
01840 LD (OPRATE),A ;SUBROUTINE
01850 GOOD2 LD A,(FLAG) ;GET FLAG STATUS
01860 BIT 0,A ;QUEUE AVAILABLE?

```

Listing 3 continued

screen and notify you that the interrupt is working. Lines 300-310 protect the interrupt from other data loading in memory.

Line 270 loads the TCB address ("Main") into DE. Line 390 shows you that Main points to Main2, the task driver's entry point.

Line 280 loads A with the task's slot assignment: You have 12 slots numbered zero to 11. In this case, the slot is zero, a low-speed interrupt. Line 290 calls the routine that adds the interrupt to the task table, which contains the 12 interrupts' TCBs. Don't fool around with these locations in memory or the program might crash. Finally, line 320 exits to TRSDOS Ready, marking the end of the initialization procedure.

Lines 400-480 make up the task driver routine. Note that when the task has executed, it must return from the interrupt. Don't ever use a jump instruction to exit the routine or your computer will bomb. Lines 450 and 480 contain the return instructions, which return the processor from the interrupt so that the program it interrupted can continue running.

To remove a task from the task table, all you have to do is specify in the A register which slot contains the task you want to remove, and call the REMTSK subroutine to do so. HL and DE are destroyed after the call to this subroutine.

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Listing 3 continued

```

01870 JR NZ,GOOD2 ;IF NOT, WAIT UNTIL IT IS
01880 CALL BUTTIN ;ABORT PRESENT DUTY
01890 LD C,0 ;ZERO THE COUNTER
01900 INC HL ;POINT TO DATA TO PRINT
01910 INC HL ;BYPASS THE "" SYMBOL
01920 LD DE,BUFFER ;POINT TO BUFFER AREA
01930 LOOP2 LD A,(HL) ;GET A DATA BYTE TO PRINT
01940 LD (DE),A ;STORE CHAR IN BUFFER
01950 INC HL ;BUMP POINTERS
01960 INC DE
01970 INC C
01980 CP 0 ;LAST CHARACTER STORED?
01990 JR Z,LOOP3 ;IF SO, THEN FINISHED
02000 CP "" ;TERMINATER?
02010 JR Z,ADJL0P ;IF SO, ADJUST HL POINTER
02020 LOOP2 ;CONTINUE UNTIL DONE
02030 LOOP3 LD A,C ;AND STORE THE COUNTER
02040 LD (LEN),A ;VALUE IN STORAGE SLOT
02050 LD A,(FLAG) ;GET FLAG STATUS
02060 SET 0,A ;WAITING FOR THE QUEUE
02070 RES 1,A
02080 RES 2,A
02090 LD (FLAG),A ;SAVE FLAG STATUS
02100 DEC HL ;CORRECT POINTER
02110 POP DE ;RESTORE REGISTERS
02120 POP AF ;RESTORE CONDITION CODES
02130 RET ;CONTINUE ON WITH PROGRAM
02140 BUTTIN LD A,(FLAG) ;GET FLAG STATUS
02150 RES 0,A ;NOT BUSY...
02160 RES 1,A ;NOT BUSY NOW...
02170 LD (FLAG),A ;SAVE FLAG STATUS
02180 XOR A ;ZERO A TO RESET
02190 LD (LEN),A ;THIS FLAG...
02200 LD (LEN2),A ;AND THIS FLAG...
02210 LD (NOTIFY),A ;AND THIS FLAG
02220 RET ;RETURN TO CALLER
02230 ADJL0P DEC DE ;POINT TO THE "" SIGN
02240 XOR A
02250 LD (DE),A ;ZERO IT OUT
02260 INC DE ;REPOSITION DE
02270 ADJL0P2 LD A,(HL) ;CONTINUE UNTIL FOUND 0
02280 INC HL ;BUMP POINTER
02290 CP 0 ;END OF COMMAND LINE?
02300 JR NZ,ADJL0P2 ;CONTINUE UNTIL DONE
02310 JR LOOP3 ;FINISHED LOOP
02320 END STARTR

```

End

## Take Command

Program Listing 3, Scroll, is a good example of a task driver's power. It adds a command to Basic, CMD!, that scrolls characters across the top of the screen. Table 2 shows Scroll's important addresses.

To install Scroll, assemble Listing 3 to disk and make sure you've enabled Break In. Now go into Basic and type in:

```
CMD"L","SCROLL/CMD":DEFUSR=&HF200:
A=USR(0)
```

This loads Scroll into memory and runs it. If you haven't enabled Break In, an error message appears and Scroll aborts.

Try out the new command by typing in:

```
CMD!"ABLE WAS IERE I SAW ELBA."
```

You should see the message scroll across the top of your screen. The program scroll-protects the screen's top line; to unprotect it, you have to turn off the Scroll function by typing in:

```
POKE &HF005,0
```

To restore scroll protection, POKE the same location with a value other than zero or invoke the CMD! command again.

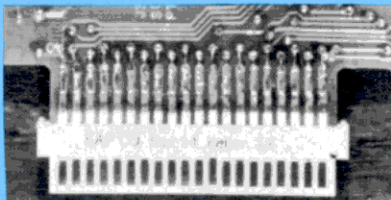
You can change the scrolling speed. For faster scrolling, POKE locations F007 and F021 with values less than 3 but not zero. The value 3 represents the original scrolling speed. To slow down the scroll, POKE the locations with a value greater than 3,

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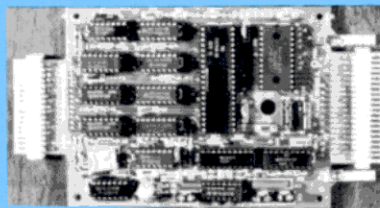
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Address (hex)	Description
F200	Start of Scroll's initialization procedure.
F000	A pointer Break In uses to find the task routine's entry point.
F002	A flag byte indicating Scroll's status.
F004	Contains the message's length.
F005	Operation permission byte. If this is anything other than 1, the program is off. If it's 1, the program is on.
4174	Hook location for Basic's new CMD! command.
F007 and F021	Changing these values speeds up or slows down scrolling.
F300-FFFF	Message buffer area.

Table 2. Scroll's routines.

but less than 256, or zero. If you decide to change speeds, be sure to POKE the same number in both memory locations.

If you type in two messages to scroll, the computer waits until the first finishes scrolling before printing the second.

Location F004 contains the length of the message being printed, which can be up to 256 characters. Location F006 contains the number of characters printed so far. When F006 equals F004, the message has finished printing.

Location F002 is a flag value containing Scroll's status. Here's a rundown on the bits in this byte:

- Bit zero If set, the program is printing a message and the queue is unavailable.
- Bit 1 If set, the program is scrolling a message off the screen, but is available to print another message.
- Bit 2 If set, another message is waiting in the queue. When the program finishes scrolling the first message, it prints the message in the queue and resets this bit.
- Bits 3-7 Scroll doesn't use these bits, so they're available for your use.

Don't touch bits zero to 2 of this byte or you could really mess things up.

Scroll keeps the message it's printing in a buffer at location F300 and reserves 256 bytes for the buffer area. The scroll interrupt occupies slot 11 of the task table, so don't use this slot for another interrupt if you want Scroll to operate concurrently.

## RAMifications

To run the Listings on a Model III with less than 48K of RAM, change their ORG

addresses to appropriate values. But make sure that no other task drivers load over Listing 1 while it's running.

You should originate Listing 1 so that the program's last byte loads into the highest possible RAM location—this gives you the maximum amount of free memory. If you do change the programs' loading addresses, the POKEs and other addresses described above won't apply. ■

*Cary Oler has been working with computers for five years. You can write to him at Box 132, Stirling, Alberta, Canada T0K, 2E0.*

## Related Articles

Fisher, Douglas C., "Interrupt Your 80," January 1983, p. 258. Maskable and non-maskable interrupts for the Model I.

Genovese, R.F., "Multi-Programming on a Micro," January 1982, p. 278. A Model I interrupt program.

Gorsky, Buzz, "Doing Two Things at Once," March 1981, p. 178. A Model I tutorial on interrupts.

Workman, Dennis, "We Interrupt This Program," November 1982, p. 396. Using interrupts to speed up the Model I.

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# The Right Address

Different versions of TRSDOS 6.X use different system memory addresses. Locator gives you the right addresses for Model 4 TRSDOS.

**F**inding a memory address in Model 4 TRSDOS is a bit like finding Main St. in five different towns; the idea is the same in each, but the location changes. So it is with memory addresses under TRSDOS 6.X—they change with each version of TRSDOS.

Locator (see Program Listing 1) determines the correct memory addresses for cursor control, scroll protection, redefinable function keys, and the keyboard for your version of TRSDOS. It does so by searching low memory for the location of \$DO and \$KI and adding displacements to these locations to get the right addresses.

You can store these addresses on disk so Basic programs can access them. Since the memory locations on disk are correct for the resident version of TRSDOS, Basic programs operating under control of the system disk will automatically use the proper PEEK and POKE addresses.

Variable	Function
LS	Scroll protection
LC	Cursor image
L1	Function key 1, lowercase
L2	Function key 1, uppercase
L3	Function key 2, lowercase
L4	Function key 2, uppercase
L5	Function key 3, lowercase
L6	Function key 3, uppercase
LK	Keyboard map

Table. Locator's subroutine saves memory addresses to these variables.

To further facilitate programming, I've included a Basic subroutine (see Program Listing 2) that copies the addresses on the system disk to the program variables indicated in the Table. To accomplish this,

you execute a GOSUB command to the subroutine.■

You can write to Maurice Dyke at P.O. Box 32077, Aurora, CO 80041.

Program Listing 1. Locator.

```

10 'LOCATOR---BASIC PROGRAM BY M. DYKE
20 N = 0: JK = 0: JV = 0
30 FOR J = 1 TO 5000
40 JP = PEEK(J)
50 IF N <> 0 THEN 150
60 IF PEEK(J) <> 84 THEN 150
70 IF PEEK(J+1) <> 82 THEN 280
80 IF PEEK(J+2) <> 83 THEN 280
90 IF PEEK(J+3) <> 68 THEN 280
100 IF PEEK(J+4) <> 79 THEN 280
110 IF PEEK(J+5) <> 83 THEN 280
120 IF PEEK(J+6) <> 54 THEN 280
130 N = PEEK(J+7)
140 GOTO 280
150 IF JP <> 36 THEN 280
160 J1 = PEEK(J+1)
170 IF JK <> 0 THEN 230
180 IF J1 <> 75 THEN 230
190 IF PEEK(J+2) <> 73 THEN 280
200 JK = J
210 IF JV <> 0 THEN 330
220 GOTO 280
230 IF JV <> 0 THEN 280
240 IF J1 <> 68 THEN 280
250 IF PEEK(J+2) <> 79 THEN 280
260 JV = J
270 IF JK <> 0 THEN 330
280 PRINT "CHECKING LOC ",J
290 NEXT J
300 CLS
310 PRINT "MEMORY SEARCH NOT SUCCESSFUL FOR OPERATING SYSTEM IN USE"
320 GOTO 520
330 CLS
340 PRINT "SOME USEFUL MEMORY LOCATIONS IN TRSDOS 6.":CHR$(N)
350 PRINT " "
360 PRINT " SCROLL PROTECTION: ";JV+7;" ( POKES 9-15 )"
370 PRINT " CURSOR CHARACTER: ";JV+11
380 PRINT " LC F1 CHARACTER: ";JK+35
390 PRINT " UC F1 CHARACTER: ";JK+36
400 PRINT " LC F2 CHARACTER: ";JK+37
410 PRINT " UC F2 CHARACTER: ";JK+38
420 PRINT " LC F3 CHARACTER: ";JK+39
430 PRINT " UC F3 CHARACTER: ";JK+40
440 PRINT "KEYBOARD MAP START: ";JK+11
450 PRINT " KEYBOARD MAP END: ";JK+18
460 LINE INPUT"ENTER Y TO SAVE ON DISK FOR USE BY OTHER BASIC PROGRAMS ";Y$
470 IF Y$ <> "Y" THEN 520
480 OPEN "O",1,"SYSLOC/TEXT:"
490 WRITE#1, JV+7,JV+11,JK+35,JK+36,JK+37,JK+38,JK+39,JK+40,JK+11
500 CLOSE 1
510 PRINT"DATA STORED IN FILE 'SYSLOC' FOR USE BY OTHER BASIC PROGRAMS"
520 END

```

End

**LOAD  
80**

## System Requirements

**Model 4/4P  
32K RAM  
TRSDOS 6.X**

Program Listing 2. Basic subroutine to copy variables.

```

65000 'PROGRAM FILE "GETLOC" A SUBROUTINE BY M. DYKE FOR INCLUSION IN OTHER BASI
C PROGRAMS TO GET MEMORY LOCATIONS STORED ON SYSTEM DISC BY PROGRAM "LOCATOR"
65010 'LC=CURSOR LS=SCROLL PROTECTION L1=F1LC L2=F1UC L3=F2LC L4=F2UC L5=F3LC
L6=F3UC LK=KEYBOARD MAP
65020 ON ERROR GOTO 65030: OPEN "I", 1, "SYSLOC/TEXT:0": ON ERROR GOTO 0: INPUT #
1, LS,LC,L1,L2,L3,L4,L5,L6,LK: CLOSE 1: RETURN
65030 PRINT"PROGRAM 'LOCATOR' MUST BE EXECUTED BEFORE CURRENT PROGRAM CAN BE RUN
": RESUME 65040
65040 END

```

End

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# Rembrandt Redux

Our hi-res MacPaint-like program revisited—with screen dump routines for Epson printers and some TRSDOS 1.3 patches to BasicG.

I like 80 Micro's high-resolution MacPaint-style graphics program, Rembrandt, ("Drawing in Detail," September 1985, p. 56), but Model III owners can't execute BasicG's GSAVE, GLOAD, or GPRINT commands from within Rembrandt; it returns control to TRSDOS 1.3 if you do so. In addition, you can't use Rembrandt with an Epson printer. I'll show you how you can do both.

To fix Rembrandt for operation under TRSDOS 1.3, add these lines to the program:

```
1 GOTO 5
2 FOR I=1 TO LEN(FI$):POKE -249+I-1,ASC
  (MID$(FI$,I,1)):NEXT X=USR(0):RETURN
5 CLEAR500:FOR I=0 TO 6:READ A:POKE
  &HFF00+I,A:NEXT:DEFUSR=&HFOO
  :DATA 33,7,255,205,156,66,201
```

Also, you have to change some Rembrandt lines to those in the Figure. This adds a small machine-language program that uses the CMDOS call (429CH) to execute a TRSDOS command. You should set memory size to 61439 (OF00H) since this is where the graphics routines load.

The screen print routines that come with BasicG don't work with Epson printers. I modified the routines in the BasicG manual to work on the Epson MX-80 and FX-80. Program Listing 1 prints the screen with the X axis down the page and the Y axis across it; i.e., I rotated the screen 90 degrees. The routine prints the dots on the Y axis twice.

Program Listing 2 prints the X axis across the page and the Y axis down it. Neither of these routines use BasicG's screen, ROM, or supervisor calls.

The routine to initialize the Model III graphics board is in the *TRS-80 Computer Graphics Operation Manual*, Radio Shack catalog #26-1125, pp. 89 and 90. Insert lines 125-154 from the manual where indicated in Listings 1 and 2. ■

You can write to Dale Elton Rogerson at 1123B McMillan St., Atlanta, GA 30332.



## System Requirements

Model III  
64K RAM  
BasicG

High-resolution board

Program Listing 1. Epson screen dump routine that prints the X axis down a page and the Y axis across. N.B.: You must insert several lines where indicated from an initialization routine in your BasicG manual.

```
00000 *****
00001 * EPSON SCREEN DUMP 1 *
00002 * by *
00003 * Dale Rogerson *
00004 * March 84 *
00005 * For Hi-Res Board (III) *
00006 * Complete re-write of GPRINT. *
00007 * Dumps screen to an Epson printer: *
00008 * FX-80,MX-80,RX-80 or compatible. *
00009 * Prints Y axis across page with *
00010 * each screen line printed twice. *
00011 * This dump fills a whole page. *
00012 *****
00013
00014
F000 00015 ORG 0F000H
F000 E5 00016 GPRINT PUSH HL ;Save the Regs
F001 D5 00017 PUSH DE
F002 C5 00018 PUSH BC
F003 DDE5 00019 PUSH IX
F005 CD0000 00020 CALL INITG ;Initialize Graphics
F008 3E51 00021 LD A,81 ;01010001H Inc X on Read & write
F00A D383 00022 OUT (STATUS),A ;Set Status
F00C 2195F0 00023 SETUP LD HL,NUMPIN ;Set Printer for 8 pins
F00F 0603 00024 LD B,3 ;3 bytes
F011 CD45F0 00025 SETUP2 CALL PRINTA ;Print byte
F014 23 00026 INC HL ;Get next byte
F015 10FA 00027 DJNZ SETUP2 ;Go print again
F017 0650 00028 FORX LD B,80 ;B=number of columns to Print
F019 2192F0 00029 LD HL,BUFFER;HL=> Buffer
F01C 78 00030 FORX2 LD A,B ;A=B
F01D 3D 00031 DEC A ;Column # = B-1
F01E D380 00032 OUT (X),A ;Set X position
F020 AF 00033 XOR A ;A=0
F021 4F 00034 LD C,A ;C= line # (screen)
F022 D381 00035 OUT (Y),A ;Set Y position to 0
F024 C5 00036 PUSH BC ;Save # of columns
F025 CD4FF0 00037 CALL GRAMOD ;Put printer in Graphics mode
F028 DB02 00038 FORY IN A,(GRAPH) ;Get Byte
F02A CD5DF0 00039 CALL REVERS ;Byte backwards-Reverse
F02D 77 00040 LD (HL),A ;Put Byte into HL
F02E CD45F0 00041 CALL PRINTA ;Print Byte
F031 CD45F0 00042 CALL PRINTA ;Print Byte again
F034 0C 00043 INC C ;Inc Line #
F035 3EF0 00044 LD A,240 ;A=last screen line #
F037 B9 00045 CP C ;At last screen line?
F038 20EE 00046 JR NZ,FORY ;If not print next byte
F03A 360A 00047 LD (HL),0AH ;Print a line feed
F03C CD45F0 00048 CALL PRINTA
F03F C1 00049 POP BC ;Get counter
F040 10DA 00050 DJNZ FORX2 ;Do next printer line
F042 C378F0 00051 JP BYE ;Finished so go end it
00052 ;-----Print a Byte
F045 DBFB 00053 PRINTA IN A,(251) ;Check Printer Status
F047 FE3D 00054 CP 61 ;Ready?
F049 20FA 00055 JR NZ,PRINTA ;Check again if not
F04B 7E 00056 LD A,(HL) ;Print Byte
F04C D3FB 00057 OUT (251),A
F04E C9 00058 RET ;Return
00059 ;-----Put Printer in Graphics Mode
F04F E5 00060 GRAMOD PUSH HL
F050 218EF0 00061 LD HL,BGMODE
F053 0604 00062 LD B,4
F055 CD45F0 00063 GRA001 CALL PRINTA
F058 23 00064 INC HL
F059 10FA 00065 DJNZ GRA001
F05B E1 00066 POP HL
F05C C9 00067 RET
00068 ;-----Reverse the Byte in A
F05D 3298F0 00069 REVERS LD (XLOC),A ;Save the byte
F060 AF 00070 XOR A ;ZERO A
F061 0601 00071 LD B,1
F063 118000 00072 LD DE,80H ;D = New Byte/E = Mask Byte
F066 3A98F0 00073 START LD A,(XLOC);Get byte back
F069 A3 00074 AND E ;Use mask to get bit
```

Listing 1 continued

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### Listing 1 continued

```

F06A EA70F0 00075 JP PE,NXTONE;Go if bit not set
F06D 78 00076 LD A,B ;Get Mask Byte
F06E B2 00077 OR D ;Merge with New Byte
F06F 57 00078 LD D,A ;Put New byte into D
F070 CB0B 00079 NXTONE RRC E ;Mask next bit
F072 CB0B 00080 RLC B ;Done all bits and back to 7?
F074 30F0 00081 JR NC,START;Go to start if not all done
F076 7A 00082 LD A,D ;Put new byte into A
F077 C9 00083 RET ;Return
00084 ;-----Return Printer to Normal & End Program
F078 2193F0 00085 LD HL,EGMODE ;Set printer to Normal
F07B 0602 00086 LD B,2
F07D CD45F0 00087 CALL PRINTA
F080 23 00088 INC HL
F081 10FA 00089 DJNZ BYE2
F083 3EFC 00090 LD A,0FCH ;Set Options
F085 D383 00091 OUT (STATUS),A
F087 DDE1 00092 POP IX ;Get Regs
F089 C1 00093 POP BC
F08A D1 00094 POP DE
F08B E1 00095 POP HL
F08C AF 00096 XOR A
F08D C9 00097 RET
00098 ;-----Data
00099 X EQU 80H
00100 Y EQU 81H
00101 GRAPH EQU 82H
00102 STATUS EQU 83H
F08E 1B 00103 BGMODE DEFB 27 ;Graphics mode
F08F 4B 00104 DEFB 'K'
F090 E0 00105 DEFB 224
F091 01 00106 DEFB 1
0001 00107 BUFFER DEFB 1
F093 1B 00108 EGMODE DEFB 27 ;Normal Mode
F094 4B 00109 DEFB 'g'
F095 1B 00110 NUMPIN DEFB 27 ;Set number of Pins
F096 41 00111 DEFB 'A'
F097 0B 00112 DEFB 8
F098 00 00113 XLOC DEFB 0
00114 ;-----Initialize Graphics Board-Found in Manual
00115 ; Insert lines 125-154 of the Initialization routine
00116 ; page 89-90 of the TRS-80 Computer Graphics Operation
00117 ; Manual. Radio Shack Catalog # 26-1125.
F000 00155 END GPRINT
  
```

End

Program Listing 2. Epson screen dump that prints the X axis across page and the Y axis down. N.B.: You must insert several lines where indicated from an initialization routine in your BasicG manual.

```

00000 ;*****
00001 ;*****
00002 ; EPSON SCREEN DUMP 2
00003 ; by
00004 ; Dale Rogerson
00005 ; May 85
00006 ; For Hi-Res Graphics board (III)
00007 ; Complete re-write of GPRINT.
00008 ; Dumps screen to an Epson Printer
00009 ; FX-80,MX-80,RX-80 or Compatible.
00010 ; Prints X axis across page.
00011 ;*****
00012 ;
F000 00013 ORG 0F000H
F000 E5 00014 GPRINT PUSH HL ;Save registers
F001 D5 00015 PUSH DE
F002 C5 00016 PUSH BC
F003 DDE5 00017 PUSH IX
F005 CD0000 00018 CALL INITG ;Initialize Graphics
F008 3ED1 00019 LD A,209 ;11010001B - inc y on read
F00A D383 00020 OUT (STATUS),A ;Set options
F00C 210DF1 00021 SETUP LD HL,NUMPIN ;HL=> ESC'A8'
F00F 0603 00022 LD B,3 ;Sets # of pins to 8
F011 CDD9F0 00023 SETUP2 CALL PRINTA ;Send to printer
F014 23 00024 INC HL
F015 10FA 00025 DJNZ SETUP2
F017 DD2112F1 00026 LD IX,SCRBUF ;IX = 8 byte buffer
F01B 0E82 00027 LD C,82H ;PORT
F01D AF 00028 XOR A ;Zero A
F01E 3211F1 00029 LD (POSY),A ;Set Y position to 0
F021 061E 00030 LD B,30 ;NUMBER OF PRINTER LINES
F023 C5 00031 OUT PUSH BC ;SAVE NUMBER
F024 CDE3F0 00032 CALL GRAMOD ;Printer in Graphics mode
F027 211AF1 00033 LD HL,PRTBUF ;HL
F02A AF 00034 XOR A ;ZERO X POSITION
F02B 3210F1 00035 LD (POSX),A ;SAVE IT
F02E 0650 00036 LD B,80 ;B=# of Columns to Print
F030 C5 00037 MIDDLE PUSH BC ;Save count
F031 3A10F1 00038 LD A,(POSX) ;Get X-position
F034 D380 00039 OUT (80H),A ;Set it
F036 3A11F1 00040 LD A,(POSY) ;Get Y-position
F039 D381 00041 OUT (81H),A ;& set it
F03B ED78 00042 IN A,(C) ;Get byte at screen loc
  
```

Listing 2 continued

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65DB8

## Listing 2 continued

```

F03D DD7700 00043 LD (IX),A ;Save it in buffer
F040 ED78 00044 IN A,(C) ;get byte 2
F042 DD7701 00045 LD (IX+1),A ;save it
F045 ED78 00046 IN A,(C) ;get byte 3-8
F047 DD7702 00047 LD (IX+2),A ;& store them
F04A ED78 00048 IN A,(C)
F04C DD7703 00049 LD (IX+3),A
F04F ED78 00050 IN A,(C)
F051 DD7704 00051 LD (IX+4),A
F054 ED78 00052 IN A,(C)
F056 DD7705 00053 LD (IX+5),A
F059 ED78 00054 IN A,(C)
F05B DD7706 00055 LD (IX+6),A
F05E ED78 00056 IN A,(C)
F060 DD7707 00057 LD (IX+7),A
F063 0608 00058 LD B,8
F065 1608 00059 ROTATE LD D,128
F067 AF 00060 XOR A ;D is mask bit
F068 DDCB0006 00061 RLC (IX) ;Zero A
F06C 3001 00062 JR NC,$+3 ;Rotate byte 1
F06E B2 00063 OR D ;Bit set?
F06F CB0A 00064 RRC D ;If so set same bit on A
F071 DDCB0106 00065 RLC (IX+1) ;D is now bit 6
F075 3001 00066 JR NC,$+3 ;Rotate Byte 2
F077 B2 00067 OR D ;Is it set
F078 CB0A 00068 RRC D ;If so Set bit on A
F07A DDCB0206 00069 RLC (IX+2) ;Set bit 5 on D
F07E 3001 00070 JR NC,$+3
F080 B2 00071 OR D
F081 CB0A 00072 RRC D
F083 DDCB0306 00073 RLC (IX+3)
F087 3001 00074 JR NC,$+3
F089 B2 00075 OR D
F08A CB0A 00076 RRC D
F08C DDCB0406 00077 RLC (IX+4)
F090 3001 00078 JR NC,$+3
F092 B2 00079 OR D
F093 CB0A 00080 RRC D
F095 DDCB0506 00081 RLC (IX+5)
F099 3001 00082 JR NC,$+3
F09B B2 00083 OR D
F09C CB0A 00084 RRC D
F09E DDCB0606 00085 RLC (IX+6)
F0A2 3001 00086 JR NC,$+3
F0A4 B2 00087 OR D
F0A5 CB0A 00088 RRC D
F0A7 DDCB0706 00089 RLC (IX+7)
F0AB 3001 00090 JR NC,$+3
F0AD B2 00091 OR D
F0AE 77 00092 LD (HL),A ;A= New Byte, Store it
F0AF CDD9F0 00093 CALL PRINTA ;Print Byte
F0B2 10B1 00094 DJNZ ROTATE ;Do 8 in all
F0B4 3A10F1 00095 LD A,(POSX) ;Get x position
F0B7 3C 00096 INC A ;Inc it
F0B8 3210F1 00097 LD (POSX),A ;Save it
F0BB C1 00098 POP BC ;Get column count
F0BC 05 00099 DEC B ;Decrement
F0BD AF 00100 XOR A ;Zero A
F0BE B8 00101 CP B ;Done Last Column?
F0BF C230F0 00102 JP NZ,MIDDLE ;Go if not
F0C2 360A 00103 LD (HL),0AH ;Print a Line feed
F0C4 CDD9F0 00104 CALL PRINTA
F0C7 3A11F1 00105 LD A,(POSY) ;Get Y position
F0CA C608 00106 ADD A,8 ;Add 8
F0CC 3211F1 00107 LD (POSY),A ;save it
F0CF C1 00108 POP BC ;Get count
F0D0 05 00109 DEC B ;Decrement count
F0D1 AF 00110 XOR A ;A=0
F0D2 B8 00111 CP B ;Check count
F0D3 C223F0 00112 JP NZ,OUT ;Cont. not zero
F0D6 C3F1F0 00113 JP BYE ;Quit if Zero
F0D9 DBFB 00114 ;-----Print Routine
F0DB FE3D 00115 IN A,(251) ;Get printer Status
F0DD 20FA 00116 CP 61 ;Is it ready?
F0DF 7E 00117 JR NZ,PRINTA ;If not wait
F0E0 D3FB 00118 LD A,(HL) ;Get char in HL
F0E2 C9 00119 OUT (251),A ;Send to Printer
F0E3 E5 00120 RET ;Return
F0E4 2107F1 00121 ;-----Put Printer in Graphics Mode
F0E7 0604 00122 GRAMOD PUSH HL ;Save HL
F0E9 CDD9F0 00123 LD HL,BGCODE ;Get Printer Codes
F0EC 23 00124 LD B,4 ;4 bytes
F0ED 10FA 00125 GRA001 CALL PRINTA ;Print them
F0EF E1 00126 INC HL ;Next byte
F0F0 C9 00127 DJNZ GRA001 ;Repeat
F0F1 210BF1 00128 POP HL ;Get HL
F0F2 0602 00129 RET ;Return
F0F3 23 00130 ;-----End Program/Return Printer to Normal
F0F4 0602 00131 LD HL,EGMODE ;Get Printer Codes
F0F6 CDD9F0 00132 LD B,2 ;2 bytes
F0F9 23 00133 BYE2 CALL PRINTA ;Print One
F0FA 10FA 00134 INC HL ;Get next
F0FC 3EFC 00135 DJNZ BYE2 ;Go print it
F0FE D383 00136 LD A,0FCH ;No inc/dec, waits, board off
F100 DDE1 00137 OUT (STATUS),A ;Set Graphics Options
F102 C1 00138 POP IX ;Get regs
F103 D1 00139 POP BC
F104 E1 00140 POP DE
F105 AF 00141 POP HL
F106 C9 00142 XOR A ;Zero A
RET ;Return to Caller

```

Listing 2 continued

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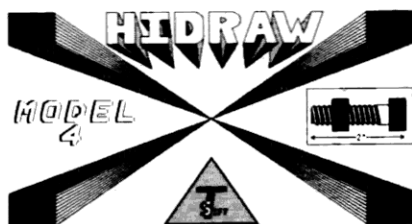
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#### Listing 2 continued

```

0083      00144 ;-----Data
F107 1B   00145 STATUS EQU      83H
F108 4C   00146 BGMODE DEFB     27
F109 80   00147 DEFB     'L'
F10A 02   00148 DEFB     128
F10B 1B   00149 DEFB     2
F10C 40   00150 EGMODE DEFB     27
F10D 1B   00151 DEFB     '0'
F10E 41   00152 NUMPIN DEFB     27
F10F 08   00153 DEFB     'A'
F110 00   00154 DEFB     8
F111 00   00155 POSX  DEFB     0
0008      00156 POSY  DEFB     0
0002      00157 SCRBUF DEFS     8
          00158 PRBUF  DEFS     2
          00159 ;-----Initialize Graphics Board-Routine found in Manual
          00160 ; Insert lines 125-154 of the Initialization routine
          00161 ; page 89-90 of the TRS-80 Computer Graphics Operation
          00162 ; Manual. Radio Shack Catalog # 26-1125
F000      00190      END      GPRINT

```

End

```

1770 IF FF<28 THEN 1790 ELSE POKE 120,135:GOSUB 1970 :PUT(X1,Y1
),CU,XOR:VIEW(0,0)-(639,239):CLS:SCREEN1:INPUT"READY PRINTER
& PRESS 'ENTER'";ZZ$:GOSUB 1990:IF PEEK(120)=135 THEN SYSTEM
PR$ ELSE FI$=PR$ + CHR$(13):GOSUB 2
1790 IF FF<29 THEN 1810 ELSE POKE 120,135:GOSUB 1970:VIEW(0,0)
-(639,239):CLS:SCREEN1:INPUT"ENTER FILENAME";FI$:GOSUB 1990
:FI$=GSAVE "+FI$+ CHR$(13)":GOSUB 2
1810 IF FF<30 THEN 1830
1820 PUT(X1,Y1),CU,XOR:VIEW(0,0)-(639,239):CLS:GOSUB 1970:SC
REEN1:PRINT:PRINT:INPUT"ENTER FILENAME";FI$:FI$="GLOAD "+FI
$+CHR$(13):GOSUB 2:RC=1:GOSUB 2340:RC=0:SCREEN0:POKE120,13
4:GOTO180

```

Figure. Change Rembrandt's lines to those listed above.

### The answers to the TRS-80 trivia quiz (Sidetracks, p. 8):

1. The Model I with Level I Basic; WHAT?, HOW?, and SORRY.
2. Start up an Exatron Stringy-Floppy.
3. RVEJARAJ.
4. The sentence reads, "Joe, you rummy buzzard!" It was used in a prototype format program's verification utility and got inserted at the end of each sector in the early TRSDOS 1.3 disks. The format program was later changed to insert "(c) 1980 Radio Shack."
5. The Inventory Control program for Radio Shack stores, modified to feed itself nonsense data.
6. International Jewelers Guild.
7. TRSDOS 1.3.
8. ULTRADOS.
9. A\$ and B\$: 16 characters.
10. It was a tape-based program that used Disk Basic verbs for mostly graphics-oriented functions. Its features included a timed Input statement, where you could set a time interval in which response had to occur before the program took a branch elsewhere.

### TIDBIT #29

It isn't easy to hide information like a serial number or surprise message in Basic program lines. Here's a quick and dirty way to give Model I/III Basic code a little privacy; it depends on a quirk in the Basic line editor. Follow these seven steps carefully:

1. Type in your line of Basic code as usual. Shorter lines work best; you must have some room at the end of the line. Press the enter key.
2. Get into Basic's edit mode by typing in EDIT and the line number, then press the enter key.
3. Press the "X" key to get to the end of the line.
4. Extend the line by typing in a colon and REM (:REM) or a colon and an apostrophe (:').
5. Press and hold the shift key. At the same time, press the left-arrow key. Each time you press the left arrow, the cursor backspaces once without erasing the character under it. Backspace to the beginning of the message or code you want to hide.
6. Now type in a new message. This will cover the original code. For example, you might want to cover GOTO 500 with PRINT A\$. You can use spaces if you can't think of anything else.
7. Press the enter key to lock in the new code. When you list the line, the display shows

only the new information. Actually, Basic displays the original code and immediately covers it up; you should avoid long cover-ups as they might jitter on the screen.

When would you use this technique? You might want to hide a serial number contained in a program. If the original code were SN = 25, you could cover the 25 with 38. A user of the program would see the second number but Basic would use the first. The Remark statement prevents any of the cover-up code from executing.

You could cover a GOTO 500 with GOSUB 650—have fun following that program! Or you could hide a surprise message by covering :PRINT "YOU LOSE, TURKEY" with :REM END OF GAME ROUTINE. Or try hiding something like IF N\$ = "ANDY" THEN CMD"S", where N\$ is the name of a friend. Your friend will be puzzled because the program will list properly but will always seem to reboot—on him or her only.

Andy Levinson  
 Studio City, CA

Trying to read a long file as it whizzes by your screen is a study in frustration. To properly inspect file lines, you need a program that writes files to your screen in small, controllable pieces. Page, a Model 4 Assembly-language program, displays files either a screenful at a time or line by line.

Type in the code in Basic, run it, and it will write the file Page/CMD to disk. To use Page, type in PAGE FILE NAME at TRSDOS Ready. Page lists a screenful of the indicated file's code and pauses for a response. Pressing the spacebar writes the next screenful of code, and pressing the enter key writes the file's next line.

If you press the break key or control-C, you exit the program. Of course, Page also stops at the end of the file. Since I designed this program for standard text files only, you must save Basic programs in ASCII format, using the SAVE FILE NAME, A option.

Dan Velting  
Kentwood, MI

*Editor's note: We have published the accompanying listing in Basic data statements. The Basic program and /CMD file are available on Load 80.*

#### Program Listing. Page.

```
10 OPEN "O",1,"PAGE/CMD"
20 FOR I% = 1 TO 652
30 READ X%
40 PRINT #1, CHR$(X%);
50 NEXT I%
60 CLOSE 1
70 END
100 DATA 1,2,0,48,0,205,119,84,212,141,84,220,157,84,205,119,84,195,141
110 DATA 84,205,157,84,14,6,205,119,84,212,141,84,220,157,84,201,33,168,84
120 DATA 9,78,35,70,35,94,66,106,241,201,205,65,73,205,115,58,205,232,57
130 DATA 254,34,40,4,254,39,32,110,71,205,219,57,205,219,57,42,160,105,43
140 DATA 43,229,184,14,0,40,11,12,205,219,57,254,13,40,9,184,32,245,205
150 DATA 164,57,184,40,239,205,232,57,205,115,58,254,44,40,9,254,59,40,5
160 DATA 184,40,2,254,13,225,34,160,105,32,50,121,254,2,56,45,205,214,57
170 DATA 71,205,219,57,205,219,57,24,23,85,115,97,103,101,58,32,112,97,103
180 DATA 101,32,102,105,108,101,13,0,40,8,205,164,57,254,44,40,135,201,205
190 DATA 161,68,24,129,205,229,61,245,58,60,106,183,250,1,71,241,205,37,69
200 DATA 121,254,44,202,4,85,201,205,67,78,245,120,230,131,196,159,51,241,201
210 DATA 205,65,73,205,115,58,254,34,40,5,254,39,196,114,51,79,175,245,205
220 DATA 219,57,254,13,202,1,71,185,32,6,205,164,57,185,32,10,71,241,197
230 DATA 183,196,161,68,241,24,228,193,245,120,135,120,40,1,2,0,49,5,246
240 DATA 128,205,161,68,241,254,44,40,197,201,205,65,73,205,34,86,205,225,84
250 DATA 121,254,44,32,9,213,205,229,61,67,209,195,3,86,58,231,108,183,40
260 DATA 22,6,0,122,179,200,27,42,44,106,35,34,44,106,58,70,105,183,196
270 DATA 45,74,24,236,42,44,106,25,58,43,106,71,195,52,84,205,153,85,58
280 DATA 70,105,183,192,58,107,106,254,85,192,60,50,107,106,201,205,65,73,205
290 DATA 225,84,205,67,78,205,24,70,121,254,44,40,239,201,58,77,105,61,250
300 DATA 110,86,71,50,77,105,58,78,105,61,184,32,3,58,78,105,58,78,105
310 DATA 144,159,60,58,130,105,205,153,86,50,79,105,195,242,57,205,119,51,201
320 DATA 58,79,17,81,40,6,0,126,254,13,202,179,49,254,32,202,179,49,18
330 DATA 35,19,4,195,161,49,62,13,10,120,254,0,194,194,49,62,1,183,195
340 DATA 197,49,62,0,183,194,80,50,33,81,48,17,105,48,62,78,239,33,156
350 DATA 48,6,0,62,59,239,202,226,49,79,203,241,62,26,239,33,0,48,17
360 DATA 105,48,6,80,62,3,239,194,0,50,230,127,119,35,254,13,202,251,49
370 DATA 16,239,54,0,62,0,183,1,126,0,50,194,101,50,33,0,48,78,121
380 DATA 6,0,184,202,21,50,62,2,239,35,202,6,50,58,137,48,61,50,137
390 DATA 48,58,137,48,6,0,184,204,40,50,195,226,49,62,1,239,254,32,202
400 DATA 66,50,254,13,202,72,50,254,128,202,106,50,254,3,202,106,50,195,40
410 DATA 50,62,23,50,137,48,201,58,137,48,60,50,137,48,201,33,138,48,78
420 DATA 121,6,0,184,202,98,50,62,2,239,35,202,83,50,195,121,50,254,28
430 DATA 194,115,50,17,105,48,62,60,239,202,121,50,79,203,241,62,26,239,62
440 DATA 22,239,2,2,156,49
```

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# Making TRS-80 Assemblers Toe the Hex/ASCII Line

**W**hen you build a hardware project, your software has to work with it. But the output from TRS-80 assemblers, such as EDTASM and ALDS, doesn't conform to the industry-standard Intel hexadecimal/ASCII absolute object code format, which lets you easily load and transfer microprocessor object files.

Since I use the hex/ASCII format for much of my development debugging equipment, I wrote a program that converts TRS-80 object files to hex/ASCII. I can download such files to my emulator (such as the Huntsville Microsystems Z80 emulator in the Photo) and Sunrise Electronics EPROM programmer. The DR800 single-board computer in the April (p. 82) and May (p. 78) columns also accepts code in the hex/ASCII format.

I can also easily send them over telephone lines using a modem. Hex/ASCII has several advantages. First, it includes object location (addressing) information so the system must know where in memory to put the code. Second, it includes a data integrity check (checksum) so you can transfer data reliably to another system. Finally, it uses only printable ASCII characters and a carriage return at the end of each line, avoiding special control characters that the receiving system might not understand.

## TRS-80 Absolute Object File Format

Before describing the Intel hex/ASCII format, I'll discuss the TRS-80 absolute object file format. This is essential to understanding my conversion program.

I have experience with the formats produced by Radio Shack's EDTASM editor/assembler (running under NEW-DOS/80) and with Radio Shack's Assembly Language Development System (ALDS), which I use on my Model 4P. In



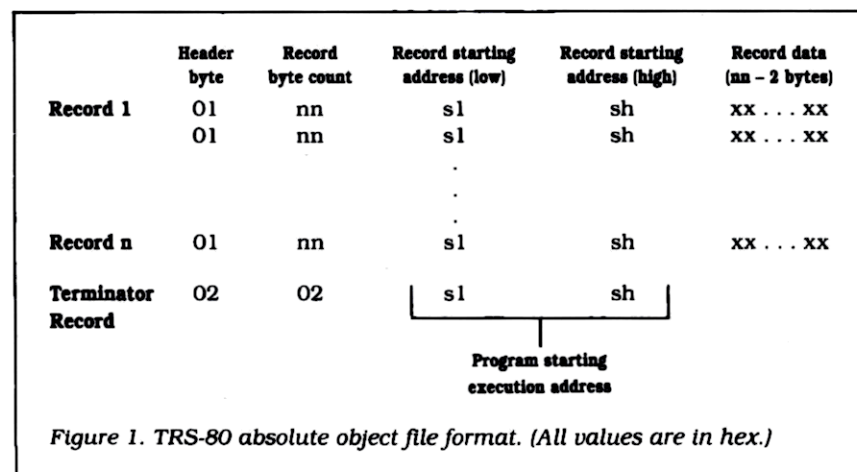
Photo. The Huntsville Microsystems Z80 emulator.

general, EDTASM and ALDS generate the same format for an executable object file, but ALDS' format is slightly different under certain conditions.

Figure 1 shows the general format for Radio Shack's absolute object files. The first byte is a record header and is always a 1 (01 hex) as long as the file has at least 1 byte of code. The second byte is a count value, indicating the number of data bytes in the record plus the number of address bytes (there are always 2 address bytes). The next 2 bytes indicate

the starting memory address for the object bytes in the current record; the low-order byte is first, followed by the high-order byte. The address bytes are then followed by the specified number of data (object code) bytes, which are to be placed into memory. All values are in binary, not ASCII.

As many of these 01 hex type records follow as is necessary to hold all of the object code bytes. Once all of the bytes have been included in these records, the assembler puts a terminator at the end



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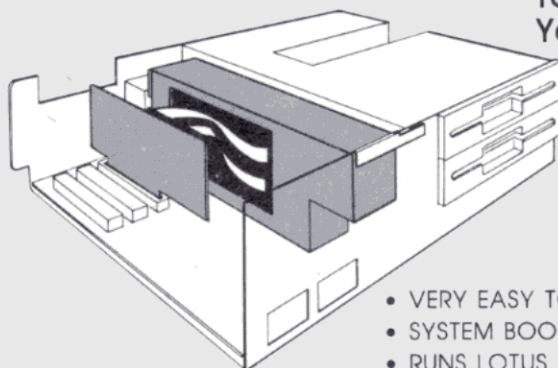
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of the file. The first byte of the terminator record, the record header, is always a 2 (02 hex), as is the second byte (the record byte count). The final 2 bytes of the record, bytes 3 and 4, are the execution starting address of the program, which can be (and often is) different from the starting address where the object code is loaded into memory. Again, the address bytes are in low-byte/high-byte order.

ALDS modifies this format slightly if you assemble your program absolutely (by specifying the starting address as an operand to the PSECT pseudo-op and avoiding program-linking); it adds one record at the beginning of the file. The record's format is shown in Fig. 2. This is not clearly indicated in the ALDS manual. The record header is a 5 (05 hex) byte. This is followed by a record byte count byte, which is followed by the specified number of data bytes. The program's starting address is, however, in-

cluded in this record (bytes 4 and 5), though it seems redundant, since it is also in the initial data record. You can discard this extra record without losing any information.

A sample Z80 Assembly-language program in Program Listing 1 (from ALDS) is written like an interrupt service routine. It saves the CPU registers by swapping register banks, causes a time delay by counting down a value in the HL register pair, and then restores the registers and enables interrupts before exiting via a Return instruction.

This sample program is 14 bytes long, and specifies the label DELAY as the execution starting location. If you assemble and link the file starting at address 7000 hex, the label DELAY is assigned the value 7002 hex and the absolute object file generated by ALDS looks like that shown in Fig. 3. Note that it is a binary file and all values are given in hex.

## The Intel Hex/ASCII Format

While the TRS-80 format is adequate for many uses, it isn't flexible enough for general-purpose object files. In particular, it lacks a checksum and a way to easily transfer files. While an internal system checksum verifies the object information as it loads from the disk, there isn't one for transferring files.

When you transfer the object file from one computer to another over an RS-232C serial line, the receiving system probably tries to interpret some of the bytes being received, since many of them are defined as ASCII control characters.

To avoid this problem, the hex/ASCII format contains only printable ASCII characters (except for the carriage return at the end of lines, as mentioned earlier).

As in the TRS-80 object file format, the hex/ASCII format has two basic record types: data records and a terminator record. Figure 4 shows the formats for the hex/ASCII data and terminator records. Note that all characters and object information are now ASCII characters, not binary values shown in hex. Each byte of information in the data record is actually stored as 2 hex/ASCII bytes in memory, in the hex range of zero to 9 and A to F. For example, the bytes 38 90 BA 2C would be stored in memory (or on disk)

Header byte	Record byte count	Record information (nn bytes)
05	nn	xx . . . xx

Figure 2. ALDS assembler object file record addition for absolutely assembled programs. (All values are in hex—base 16.)

Tandy Corp. ALDS ALASM copr. 1982,83 v.03.02.00 Page 1 08/27/85  
Assembly Listing of HEXASCII/SRC:1

```

E Addr  Obj  Fl Ln #      Source Line
0000'          00001 EXAMPL PSECT
          00004 ;      LAST MODIFICATION DATE: 08/25/85
          00005 ;
          00006 ;*****
          00007 ; FILE: HEXASCII/SRC
          00008 ;
          00009 ; AUTHOR: Roger C. Alford
          00010 ;
          00011 ; MODULE DESCRIPTION:
          00012 ;      This program is merely an example program for the Project 80
          00013 ;      discussion of Intel Hex/ASCII object code format.
          00014 ;
          00015 ;
0000' D9      - 00016 EXAMPL EXX          ;SWAP THE MAIN CPU REGISTERS
0001' 08          00017 EX          AF,AF' ;SWAP AF TO SAVE IT TEMPORARILY
0002' 213412    00018 DELAY LD      HL,1234H ;LOAD THE DELAY COUNT VALUE INTO HL
0005' 2B          00019 LOOP DEC     HL      ;DECREMENT THE DELAY LOOP COUNT VALUE
0006' 7C          00020 LD        A,H      ;IS THE COUNT VALUE ZERO YET?
0007' B5          00021 OR        L
0008' 20FB      00022 JR        NZ,LOOP ;IF NOT, LOOP AGAIN
000A' 08          00023 EX          AF,AF' ;RESTORE REGISTERS A AND F
000B' D9          00024 EXX         ;REGISTER THE MAIN CPU REGISTERS
000C' FB          00025 EI          ;ENABLE Z80 MASKABLE INTERRUPTS
000D' C9          00026 RET         ;RETURN FROM THIS SERVICE ROUTINE
          00027 ; END OF SERVICE ROUTINE: EXAMPL.
          00028 ;
0002'          00029 END      DELAY      ;START EXECUTION AT LOCATION 'DELAY'

```

No Assembly Errors

Time = 0:01  
Bytes = 14  
Lines = 27

Program Listing 1. Sample Z80 Assembly-language program.

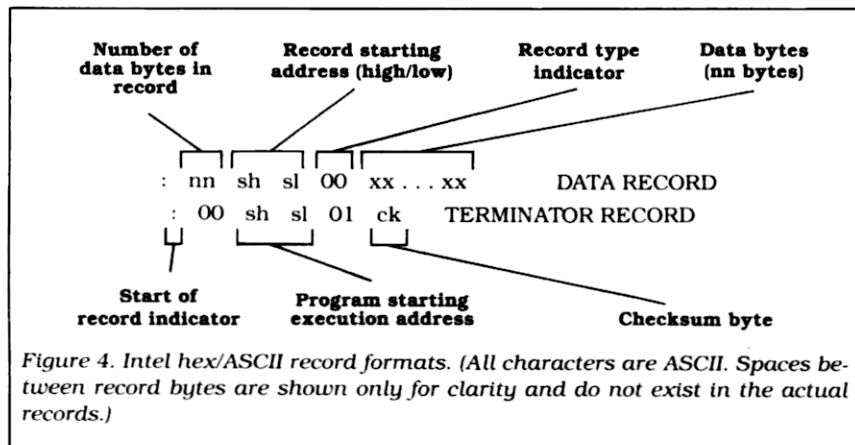
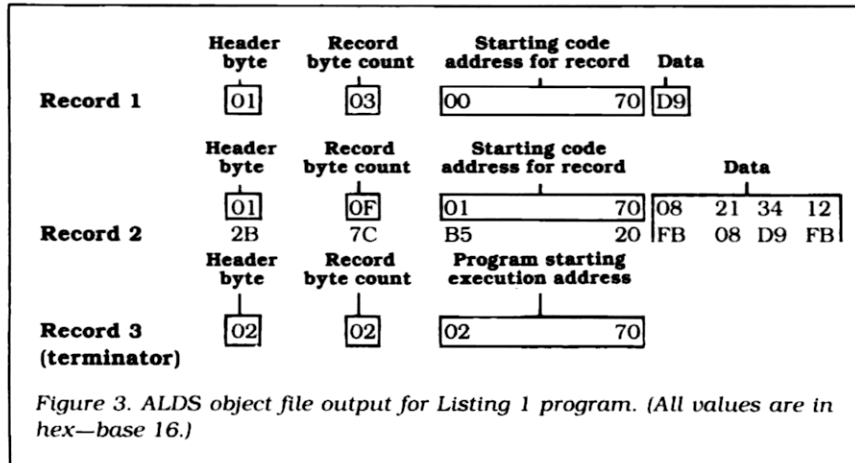
as 33H 38H 39H 30H 42H 41H 32H 43H.

Notice how 2 bytes are stored in memory for each information byte in the hex/ASCII data record. This is the hex/ASCII format's main disadvantage: It isn't very memory efficient.

The first character in every hex/ASCII record is the colon (:); it has a value of 3A hex and is the start-of-record indicator character. The first byte (two ASCII char-

acters) following the colon indicates the number of data bytes in the record (all values are in hex). The next 2 bytes indicate the starting memory address for the data bytes in that record (high byte first). The fourth byte is the record type indicator, which is always 00 for a data record and 01 for a terminator record.

The object data for the record, if any, follows the record type indicator byte.



```
:01700000D9B6
:0D700100082134122B7CB520FB08D9FBC9F7
:007002018D
```

Figure 5. Hex/ASCII object file printout for program in Program Listing 1.

#### TRS-80 filespec entered

```
TESTFILE
TESTFILE/
PROJECT80:1
PROJECT80:2
MICRO80/ABS
MICRO80/ABS:1
```

#### Conversion program interpretation

```
TESTFILE/CMD:0
TESTFILE:0
PROJECT80:1
PROJECT80/CMD:2
MICRO80/ABS:0
MICRO80/ABS:1
```

Figure 6. Interpretation of entered object file filespecs for hex/ASCII conversion program.

Terminator records have no data bytes, but data records should always have at least 1 data byte. A checksum byte follows the data bytes. When all of the bytes in the record are added together, including the checksum byte (ignoring any carries above 8 bits), the result is 00. The checksum totals include only the hex values displayed, not the ASCII numeric values. For example, a data record containing :0100040023D8 (all characters are ASCII) would have the checksum D8, since  $01 + 00 + 04 + 00 + 23 + D8 = 00$  (carry ignored).

The resulting final data record is :0100040023D8 (again, with all characters in ASCII).

The terminator record always has a 00 length specification, as mentioned above, since the terminator record includes no data bytes. The address value included in the terminator record specifies the execution starting address for the program.

With the conversion program, you can generate the hex/ASCII object file for the example program in Listing 1 with a printout (Fig. 5).

One final note about the hex/ASCII format. Systems reading in or receiving object information from a hex/ASCII file are supposed to look for the start-of-record character (colon). All characters before the first colon are to be ignored. Thus you can store information in the hex/ASCII object file before the data records. You can use this feature to store the symbol table for the program (with only ASCII characters and no colons, of course), which lets you load the symbol table with the object file for symbolic debugging.

### The Conversion Program

The conversion program (Program Listing 2) is in Model 4 Basic. It will run under Model I/III Basics if you change the long variable names to one- or two-character names and change the INSTR functions in lines 40, 100, and 160 to subroutine calls. You can do this by using the assignment  $SV\$ = "\text{":}$  or  $SV\$ = "/"$  (whichever is appropriate) and calling the subroutine in Program Listing 3. For example, line 40 would become

```
40 SV$ = "\text{":GOSUB 8000:DRVPOS = SV.
```

You might also need to change line 10030, which returns you to DOS, depending on what DOS you're using.

Lines 5–12 are the comment header and startup message for the program. Lines 13–14 dimension and initialize the HEXVAL\$ array, which holds the 16 hex/ASCII characters in numerical order.

Lines 20–340 acquire the filespec for the TRS-80 object file and determine the filespec of the output hex/ASCII file. You can enter the TRS-80 object filespec in

one of several ways. If you don't include an extension, the default is /CMD. If you include the file name with a "/" suffix, without any extension characters, the program will assume that the file name has no extension. Or you can give the file an extension of your choice. The drive is zero unless you specify otherwise. Figure 6 shows several possible filespecs, along with the actual filespec interpretation by the conversion program.

The hex/ASCII output file has the same filespec as the input file, except that it gets a /HEX extension. You're prompted for the drive number for the hex/ASCII file: press the enter key for the default drive (the same number as the input file) which is in parentheses, or enter the desired drive number.

Lines 400-550 initialize the variables and open the files. The variable TOTALBYTECOUNT is the accumulator to count the total number of data (object code) bytes in the file. OBJFILE\$ is the input file and HEXFILE\$ is the output file. The input file is a random-access file with a record length of one, whereas the output file is a sequential file. OBJDATA\$ stores the input records.

Lines 560-1340 do most of the file processing. Lines 592-598 cause the extra ALDS record (with the 05 hex header byte) to be ignored, if present. The program converts the remaining object data to hex/ASCII format and writes it to the output file. Lines 2000-2280 generate the terminator record, close the files, and exit through line 10030, which is currently a return to DOS.

The program displays the number of object code bytes, along with the program's starting execution address.

Lines 3000-3040 add the decimal value in DECNUM to the running checksum accumulator, CHKSUM.

The subroutine at lines 4000-4100 converts the decimal (base 10) value in DECNUM to a hex/ASCII character in HEXNUM\$, using the HEXVAL\$ array.

The subroutine at lines 5000-5060 increments the address variables ADDR1 and ADDR2, which keep track of the current object byte address for the hex/ASCII file. The subroutine at lines 6000-6100 calculates the checksum byte for the current hex/ASCII record and writes it to the output file.

The subroutine at lines 9000-9020 retrieves the next byte from the input file, and updates the input file record pointer, OBJPTR%. Lines 10000-10020 generate a data read error message and close the files if a data error is detected. ■

Write to Roger C. Alford at P.O. Box 2014, Ann Arbor, MI 48106. Please enclose a self-addressed, stamped envelope for a reply.

#### Program Listing 2. Model 4 hex/ASCII conversion program.

```

5 *****
6 ' THIS PROGRAM CONVERTS ALDS ABSOLUTE OBJECT FILES TO INTEL HEX/ASCII *
7 ' FORMAT. THE OUTPUT FILENAME IS THE SAME AS THE INPUT FILENAME, BUT *
8 ' HAS THE EXTENSION "/HEX". *
9 ' *****
10 ' *** CREATED BY Roger C. Alford 08/04/85 ***
11 CLS:PRINT "TRS-80 BINARY TO INTEL HEX/ASCII FORMAT CONVERSION PROGRAM"
12 PRINT "by Roger C. Alford Version 1.2 08/25/85":PRINT
13 DIM HEXVAL$(16):FOR I%=0 TO 15:READ HEXVAL$(I%):NEXT I%
14 DATA "0","1","2","3","4","5","6","7","8","9","A","B","C","D","E","F"

20 INPUT "ENTER OBJECT FILENAME (/CMD) ";OBJFILE$
30 IF LEN(OBJFILE$)=0 THEN 20
40 DRVPOS=INSTR(OBJFILE$,":")
60 IF DRVPOS=0 THEN OBJDRIVE$="0":GOTO 100 ELSE OBJDRIVE$=MID$(OBJFILE$,DRVPOS,
2)
80 OBJFILE$=LEFT$(OBJFILE$,DRVPOS-1)
100 EXTPOS=INSTR(OBJFILE$,"/")
120 IF EXTPOS=0 THEN OBJFILE$=OBJFILE$+"/CMD":GOTO 160
140 IF EXTPOS=LEN(OBJFILE$) THEN OBJFILE$=LEFT$(OBJFILE$,EXTPOS-1)
160 EXTPOS=INSTR(OBJFILE$,"/")
180 IF EXTPOS<>0 THEN HEXFILE$=LEFT$(OBJFILE$,EXTPOS-1) ELSE HEXFILE$=OBJFILE$
200 HEXFILE$=HEXFILE$+"/HEX"
220 OBJFILE$=OBJFILE$+OBJDRIVE$
240 PROMPT$="ENTER DRIVE NUMBER TO STORE HEX FILE ("&RIGHT$(OBJDRIVE$,1)&") "
260 PRINT PROMPT$;
280 INPUT HEXDRIVE$
300 IF LEN(HEXDRIVE$)=0 THEN HEXDRIVE$=OBJDRIVE$:GOTO 340
320 IF LEN(HEXDRIVE$)=1 THEN HEXDRIVE$="."&HEXDRIVE$ ELSE GOTO 260
340 HEXFILE$=HEXFILE$+HEXDRIVE$

400 TOTALBYTECOUNT=0
500 OPEN "R",1,OBJFILE$,1
520 FIELD 1,1 AS OBJDATA$
540 OBJPTR=1
550 OPEN "O",2,HEXFILE$

560 GOSUB 9000
570 OBJRECTYPE=ASC(OBJDATA$)
580 IF OBJRECTYPE<>1 AND OBJRECTYPE<>2 AND OBJRECTYPE<>5 THEN 10000
585 GOSUB 9000
590 OBJRECLN=ASC(OBJDATA$)-2
592 IF OBJRECTYPE<>5 THEN 600
594 FOR I%=1 TO OBJRECLN+2
596 GOSUB 9000:NEXT I%
598 GOTO 560
600 GOSUB 9000
620 ADDR1=ASC(OBJDATA$)
640 GOSUB 9000
660 ADDR2=ASC(OBJDATA$)
680 IF OBJRECTYPE=2 THEN 2000
1000 TOTALBYTECOUNT=TOTALBYTECOUNT+OBJRECLN
1010 IF OBJRECLN>=16 THEN DATACNT=16 ELSE DATACNT=OBJRECLN
1020 PRINT #2," ";
1040 CHKSUM=0
1060 DECNUM=DATACNT:GOSUB 3000:GOSUB 4000
1080 PRINT #2,HEXNUM$;
1100 DECNUM=ADDR2:GOSUB 3000:GOSUB 4000
1120 PRINT #2,HEXNUM$;
1140 DECNUM=ADDR1:GOSUB 3000:GOSUB 4000
1160 PRINT #2,HEXNUM$;
1180 PRINT #2,"00";
1200 FOR I=1 TO DATACNT
1220 GOSUB 9000:OBJRECLN=OBJRECLN-1
1240 DECNUM=ASC(OBJDATA$):GOSUB 3000:GOSUB 4000
1260 PRINT #2,HEXNUM$;
1280 GOSUB 5000
1300 NEXT I
1320 GOSUB 6000
1340 IF OBJRECLN<>0 THEN 1010 ELSE 560

2000 PRINT #2,"":00";
2020 CHKSUM=0
2040 DECNUM=ADDR2:GOSUB 3000:GOSUB 4000
2060 ADDR2=HEXNUM$
2080 PRINT #2,HEXNUM$;
2100 DECNUM=ADDR1:GOSUB 3000:GOSUB 4000
2120 ADDR1=HEXNUM$
2140 PRINT #2,HEXNUM$;
2160 PRINT #2,"01";
2170 DECNUM=1:GOSUB 3000
2180 GOSUB 6000
2200 CLOSE
2220 PRINT:PRINT "THE TOTAL NUMBER OF PROGRAM BYTES IS: ";TOTALBYTECOUNT
2240 PRINT "THE EXECUTION STARTING ADDRESS IS: ";
2260 PRINT ADDR1;ADDR. $; " (HEX)":PRINT
2280 GOTO 10030

3000 *****
3010 ' THIS SUBROUTINE ADDS THE "DECNUM" VALUE TO "CHKSUM"
3020 CHKSUM=CHKSUM+DECNUM
3040 RETURN

4000 *****
4010 ' CONVERT DECNUM (BASE 10) TO HEXNUM$ (BASE 16)
4020 IF DECNUM>255 THEN PRINT "***** DECNUM ERROR *****":CLOSE:GOTO 10030
4040 LONBYBLE=DECNUM AND 15
4060 HINYBBLE=(DECNUM AND 240)/16
4080 HEXNUM$=HEXVAL$(HINYBBLE)+HEXVAL$(LONBYBLE)
4100 RETURN

```

Listing 2 continued

## PROJECT 80

Listing 2 continued

```

5000 '*****
5010 ' UPDATE "ADDRL" AND "ADDRH" ADDRESS COUNTERS
5020 ADDRL=ADDRL+1
5040 IF ADDRL=256 THEN ADDRL=0:ADDRH=ADDRH+1
5060 RETURN

6000 '*****
6010 ' CALCULATE LINE CHECKSUM AND WRITE TO HEX FILE
6020 CHKSUM=CHKSUM AND 255
6040 IF CHKSUM=0 THEN DECNUM=0 ELSE DECNUM=256-CHKSUM
6060 GOSUB 4000
6080 PRINT #2,HEXNUM$
6100 RETURN

9000 '*****
9010 ' GET NEXT RECORD (BYTE) FROM OBJECT FILE
9020 GET #1,OBJPTR:OBJPTR=OBJPTR+1
9040 RETURN

10000 '*****
10010 ' COME HERE FOR DATA READ ERRORS
10020 PRINT:PRINT "***** DATA READ ERROR *****"
10030 CLOSE

10030 SYSTEM
10040 END
    
```

End

Program Listing 3. Subroutine for Model I/III Basics.

```

8000 '*****
8010 ' THIS SUBROUTINE SIMULATES THE "INSTR" FUNCTION
8020 SV=0
8030 FOR I=LEN(OBJFILES) TO 1 STEP -1
8040 IF MID$(OBJFILES,I,1)=SV$ THEN SV=I$
8050 NEXT I$
8060 RETURN
    
```

End

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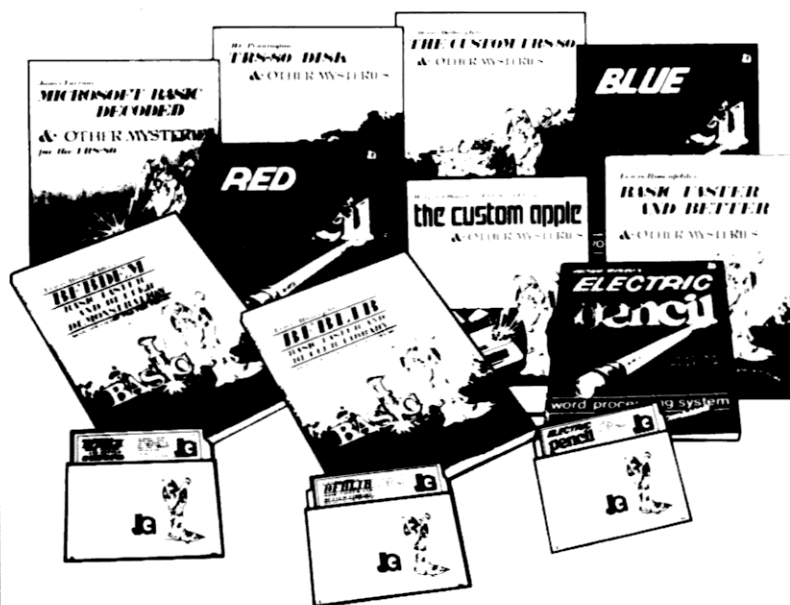
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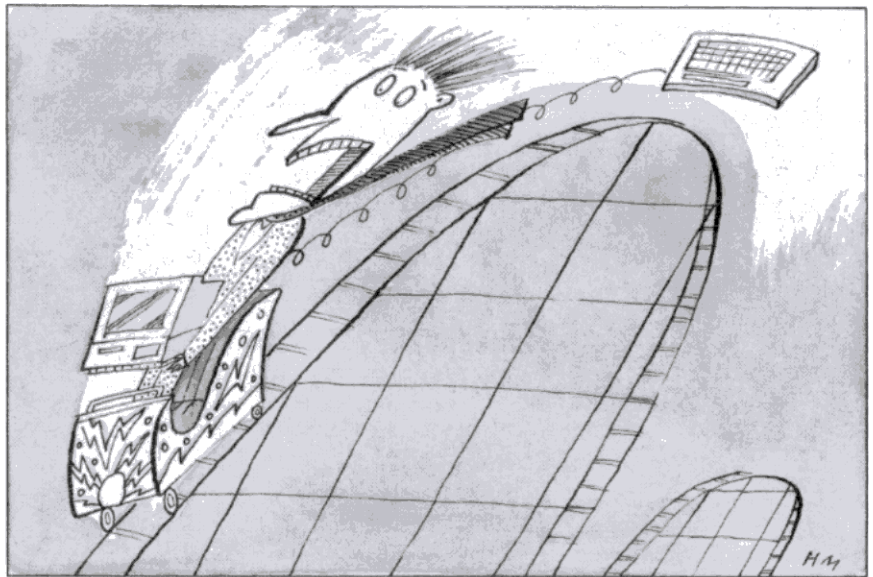
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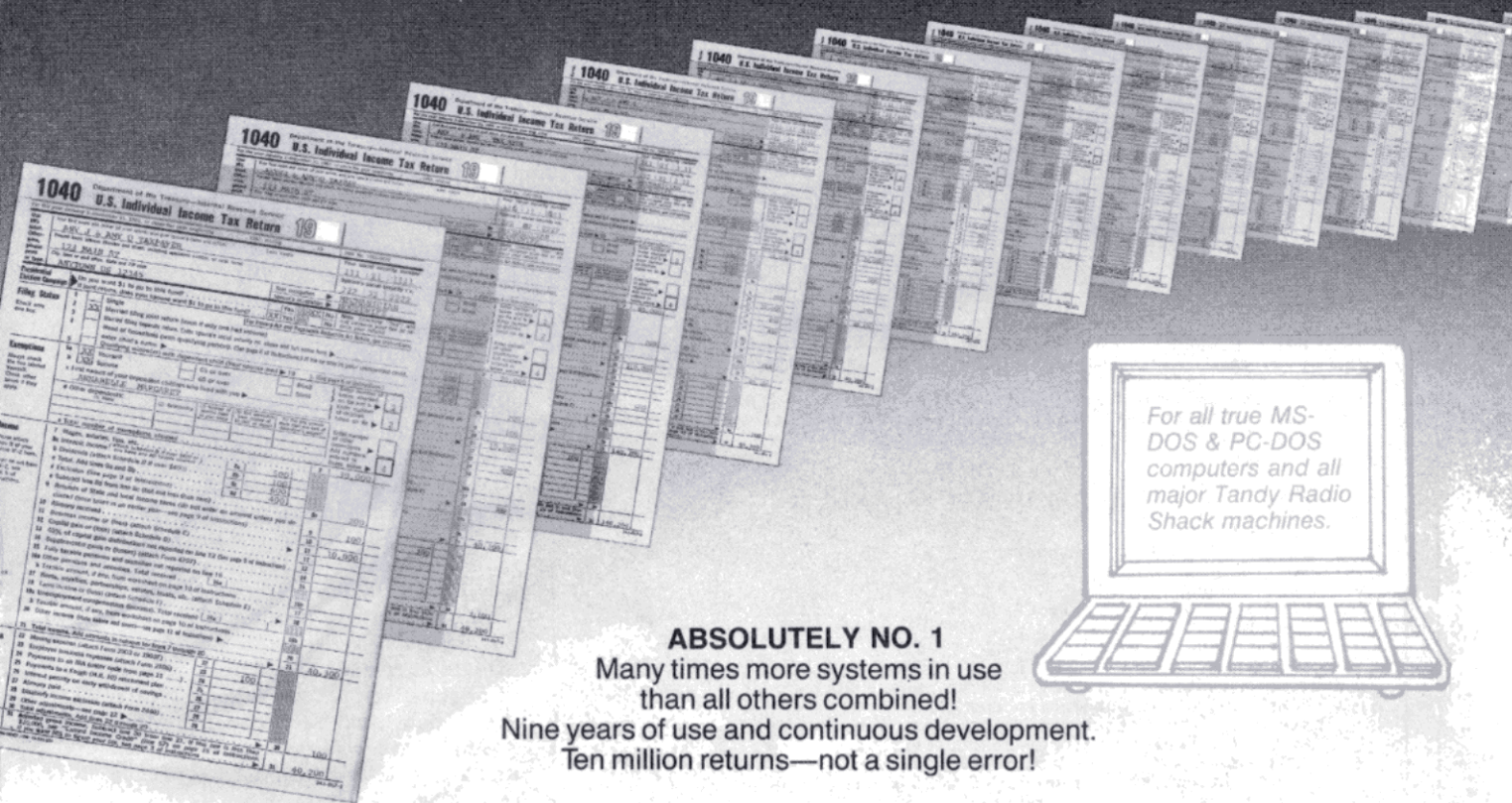
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## Program Listing 1. Sinewave Basic program for the Tandy 1000.

```

; WINDOW clears a rectangular area of the screen (to background)
; in Basic screen mode 6 (high res, 4 colors). The x and y
; coordinates of the upper-left and lower-right corners are
; passed in the Call statement (IX1%,IY1%,IX2%,IY2%).
;-----
code segment

window proc far
    public window
    assume cs:code, ds:code
    org 2000H ;start at 2000 Hex within Basic's space
start:
    jmp short pastdata

; data
xl dw ?
yl dw ?
x2 dw ?
y2 dw ?
leftedge dw ?

pastdata:
    push bp ;save Basic's BP, then use it to
    mov bp,sp ;point to passed variables on stack
    push es ;segment registers must be restored

; get variables from stack, check bounds, and store
    mov di,offset xl ;bx points to location of xl storage
    mov si,[bp+12] ;location of xl on stack
    mov ax,639
    call bounds
    mov si,[bp+10] ;location of yl
    mov ax,199
    call bounds
    mov si,[bp+8] ;location of x2
    mov ax,639
    call bounds
    mov si,[bp+6] ;location of y2
    mov ax,199
    call bounds

; determine left and right byte masks, store word position within
; line and count for columns in row (-2)
    mov ax,xl ;get left margin for division
    mov dx,0ff00H ;premask for left edge
    call wmask ;determines mask word
    mov leftedge,ax ;number of word within line (0-79)
    mov xl,dx ;store mask in xl
    mov ax,x2 ;get right margin for division
    mov dx,007fH ;premask for right edge
    call wmask
    mov x2,dx ;store mask in x2
    sub ax,leftedge ;subtract left word from right
    jl leave ;if xl>x2 then get out
    dec ax ;fudge
    mov si,ax ;si stores col. count

; determine memory location of first row (in section 1,2,3 or 4) and
; number of rows
    mov ax,yl ;get top y dimension
    mov cl,4
    div cl
    mov bx,ax ;temporary storage of results
    mov al,ah
    cbw ;ax has word remainder
    mov cx,2000H
    mul cx ;ax has video block memory location
    push ax ;save it
    mov al,bl ;quotient in al
    mov cl,160
    mul cl ;ax has offset in video block
    pop bx ;put vid block addr in bx
    add ax,bx ;ax has start video line address
    mov bx,ax ;keep in di
    mov ax,y2 ;get lower bound
    sub ax,yl ;subtract upper bound
    jl leave ;if yl>y2 then abort mission
    inc ax ;fudge
    mov cx,ax ;use number of lines as count

; point ES to video memory (B800H) and set up loop parameters
    mov ax,B800H ;start of video memory
    mov es,ax ;es points to it
    cld ;inner loop (string move) increments

loop1: ;outer loop - set row; do left edge

```

Listing 2 continued

aside the 32,768 bytes of high RAM needed for one screen of high-resolution, four-color graphics. Above Basic's reduced work area, and below the overgrown video RAM, is room for the machine-code subroutine, even with a 128K 1000. Changing from screen mode zero to 6 clears the screen rapidly. Waiting for the screen to clear in mode 6 induces sleep.

The DEFINT statement in line 15 and the variable assignments in line 105 ensure that the subroutine receives the window corner coordinates as integers (much easier to deal with). Line 20 POKes the 231 bytes of 8088 machine code (lines 1000-1190) into memory, starting at offset 2000 hex in Basic's data area (protected by the Clear statement). The Call statement (line 110) sends execution to that memory offset, stored in variable I, and pushes the locations of the four passed variables onto the stack. The Call offset must be a variable. The subroutine replaces the sluggish CLS statement.

You can use two methods to reserve memory for machine-language subroutines in Basic. You can use the /M: parameter to make space for your subroutine above Basic. It's invoked when loading Basic, and controls the size of Basic's data area—the default is the maximum of 64K. Or you can use the Clear statement to reserve space within Basic's data area. There's an important difference: a machine-language subroutine loaded above Basic isn't protected from a "child" process called by the Basic Shell command. If you use Shell to load Debug above Basic, it'll load over any code Basic has put there. Use both if you want to shrink Basic's work space and protect your subroutine from a child process.

### Subroutine Source

I used the Tandy 2000 version of MASM to assemble the source code on my 1000 and the MS-DOS linker to create an EXE file. Use the MASM assembly listing to get the actual code for the Basic Data statements. You can list it in hex format, e.g., &HFF. I converted hex to decimal for easier typing.

When accessed by a Basic Call, your subroutine should first set up the BP register to point to the passed variable locations on the stack. The Basic manual explains this process. Remember that the values stored on the stack are not the variables themselves, but their offset in Basic's data segment. The locations are on the stack last in/first out, but above the 4-byte return address and the 2-byte BP register you've pushed onto the stack. The far return that ends the subroutine must throw off the number of

Continued on p. 98

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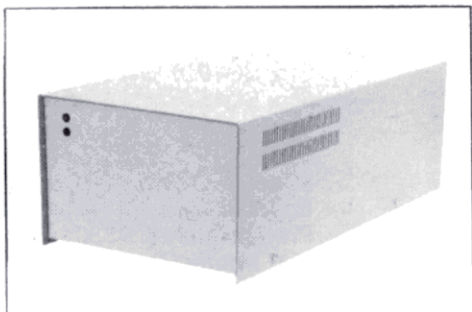
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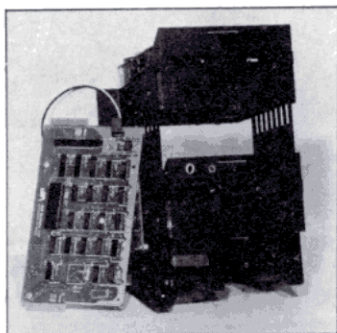
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Listing 2 continued

```

mov di,bx          ;start of row
add di,leftedge    ;start in row in words, but
add di,leftedge    ;must be in bytes
mov ax,xl          ;get leftmask
and es:[di],ax     ;do left edge of row
inc di            ;point to next column
inc di            ;which is next word

; inner loop - print row (center bytes if any)
push cx           ;save outer loop counter
mov cx,si         ;number of inner columns
mov ax,0          ;things will be black
rep stosw         ;shove those words
pop cx           ;recover outer loop counter

; display right byte (leave outside of rectangle untouched)
mov ax,x2         ;get right mask
and es:[di],ax    ;do right edge

; adjust for next row
add bx,2000H      ;point to next video block
cmp bx,7f3fH      ;is it above video memory
jbe continue     ;if not then cont.
sub bx,8000H      ;if yes then put it in lower block
add bx,160        ;and point to next row
continue:
loop loop1
leave:
pop es            ;restore registers for Basic
pop bp
ret 8             ;discard 4 passed words and return (far)

window endp
;-----
; near subroutine to check bounds of passed variable and store it

bounds proc near
mov dx,[si]       ;si points to Basic variable
cmp dx,0          ;is variable greater than 0?
jge pos
mov dx,0          ;if not, then make it 0
pos: cmp dx,ax    ;does variable exceed limit?
jle less
mov dx,ax         ;if greater than set at limit
less:
mov [di],dx       ;store variable
inc di           ;point to next storage area
inc di
ret
bounds endp
;-----
; near subroutine to determine mask word for left or right edge

wmask proc near
mov bl,8          ;premask in dx, x-coord. in ax
div bl            ;divide x-coord. by 8
mov cl,ah         ;put remainder in counter
cbw              ;ax has quotient (word in line)
shr dx,cl         ;right byte of ax is mask
mov dh,dx         ;both bytes of mask are the same
ret
wmask endp
;-----
code ends
end start

```

End

bytes used to pass the variable locations—RET 8 in this case—or your computer will hang up.

Storing data in the subroutine code, as I have, creates complications. The machine-language instructions are all position-independent; the data is not. The ORG 2000H directive provides that data offsets correspond to where they're POKEd in Basic's data segment (starting at 2000 hex). When the machine code requests the word stored at offset 2002 hex, it'll be there.

I also put DS in the Assume directive so the assembler doesn't add a CS: prefix to every data reference be-

cause an extra byte for each reference adds up. The first Jump instruction (past the data) just makes it easier to call the subroutine; the first instruction is the entry point. I could have put the data at the end.

The interfacing approach I took, storing the subroutine in Basic's data area, is the most flexible when you want to run a program on differently configured machines. Because the subroutine's loaded relative to Basic's data area, it isn't set at any specific memory location. If you use only one memory configuration, and know where Basic loads (see below), you can put your code at a specific memory

location above Basic by POKing data in a loop, or by BLOADing a binary file. In either case, you must first change the CS register (with DEF SEG) to point to the desired memory location. Remember that the value in a DEF SEG statement is a segment address, i.e., the actual address divided by 16.

If you load your subroutine at a set address, and have a data area in your subroutine, you can usually save some bytes by using DS to reference the data locations. As in Listing 1, include DS in the Assume directive so the assembler doesn't add a CS: override to each reference. Because you're not using Basic's data area in this case, you must load the DS register with the contents of CS (after saving DS, of course). But remember that the variable location offsets passed in the stack are in Basic's data segment. You can use an ES override prefix to get these values after loading ES with the Basic data segment. You must restore all segment registers other than CS before return.

Beware of the Tandy 1000 Basic manual on this point. It's sprinkled with statements that DEF SEG alters the DS register. This just isn't true; only the CS register changes. If you disregard this rather fundamental error and consult the IBM manual, the Tandy manual is quite helpful.

## Memory Mapped

I used direct video memory addressing to clear the desired screen area. BIOS calls that set pixels, though easier to code, aren't fast enough. The screen modes and addressing are exactly like the PCjr's. Location of video memory in RAM depends on memory size, but you can always address it through a 32K window beginning at memory location B8000 hex (segment B800). You pay no time penalty for addressing video memory through this window, and it's always at the same location. I used the String Store command (STOSW) to move zeros quickly to areas of video memory, blacking them out. Therefore, I set the destination segment register (ES) to B800 hex, the video window.

I chose the most complicated graphics mode to get high-resolution and color, too. It takes 2 bits per pixel to code for four colors, but the two pixels are in different bytes of video RAM. Every 2 consecutive bytes code for eight pixels with corresponding bits in the 2 bytes coding the color of one pixel.

If the left-most bit (7) of hex bytes B800:0000 and 0001 is set, the pixel in the upper left screen corner is white (default palette). If both bits are zero, the upper left pixel is black. Combinations of set and unset bits produce cyan and magenta pixels. Bit 6 of those 2 bytes codes for the next pixel in the top row.

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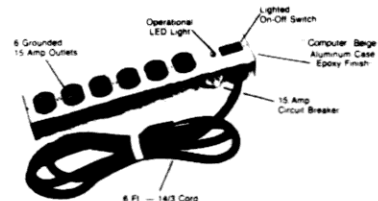
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Because the 8088 CPU deals in bytes and words, complicated graphics involves lots of bit manipulation.

To further complicate things, the 160-byte rows are not arranged contiguously in memory. The 32K video space is divided into 8K sections, every section containing every fourth screen row, but not the same rows as any other section. B800:0000-1F3F contains rows zero, 4, 8, 12, and so on through 196. The next section has rows 1, 5, 9, 13, and so on through 197.

I used 2-byte masks to And the left and right edges of the window being cleared. Both bytes in a mask are the same, and zeros in the mask correspond to pixels to be blacked out inside the window. The area in a row between the masked edges comprises whole words representing eight-pixel groups. You can quickly clear these by loading the corresponding words with zeros via a String command. Most of the program determines which row to start on and how many rows, which word in each row is the left edge and how many words to the right edge, and what masks to use on the left and right edges.

## Debugging from Basic

Debugging Basic machine-language subroutines on the 1000 isn't easy. GW-Basic is an EXE file and can load anywhere in memory (but always in the same place under given conditions). You can find Basic's data segment from Basic by executing the following line right after loading it:

```
PRINT HEX$(PEEK(&H04A6)); HEX$(PEEK(&H04A5))
```

Basic will use the 64K area starting at this memory segment as long as you don't add a driver or memory-resident program. With this information you can determine where in memory to put a subroutine, or know exactly where yours loads if it's in Basic's data segment. You can then load Debug via the Shell statement and explore your subroutine *in situ*.

I have yet to figure out how to load Basic from Debug and run it with a stop point set at a subroutine, as I can on an IBM. It just doesn't stop. Let me know if you've found a way.

## Sorry DeskMate

DeskMate doesn't work as an all-purpose text editor (I'm embarrassed to discover now). DeskMate can't write batch files or source files for Microsoft's assemblers and compilers.

GW-Basic is very forgiving, however, and takes listings DeskMate writes. DeskMate requires that you end text file names with the DOC extension or it won't load them.

I'll summarize. DeskMate text files are pure ASCII files with code 26 (1A hex) ending files. In true Tandy style, however, DeskMate's text editor uses only carriage return (ASCII 13) to end lines, and not CR/LF (13/10) as do MS-DOS programs. Edlin, MASM, and the DOS batch file processor expect 10 to follow every 13, but they'll take any character—I mean any—in its place. If you write a batch file with DeskMate and start each line after the first with a space, it'll run because they assume the extra character is 10. When DeskMate loads a text file written by Edlin (or others), it

replaces the line feed code (10) with an ASCII space. Leave it there so Edlin will think it's a line feed character.

GW-Basic loads a program whether or not it finds the line feed code as is or replaced with a space. Don't try to load files created with the Copy command (COPY CON file name) with DeskMate because they don't end with an ASCII 26 (code for end-of-file). So you can use DeskMate if you're in a bind. ■

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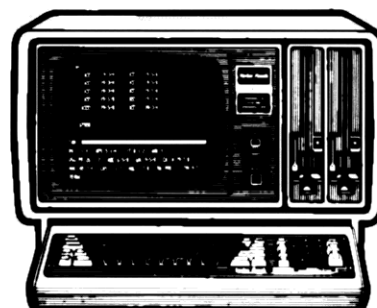
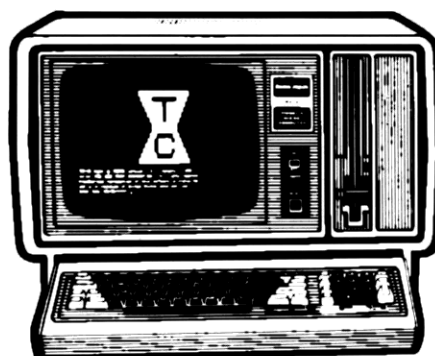
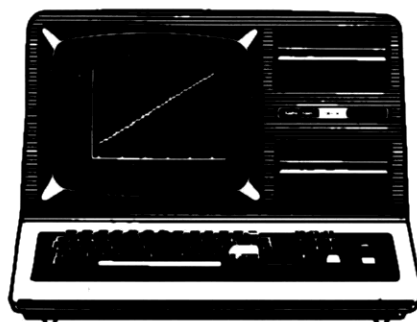


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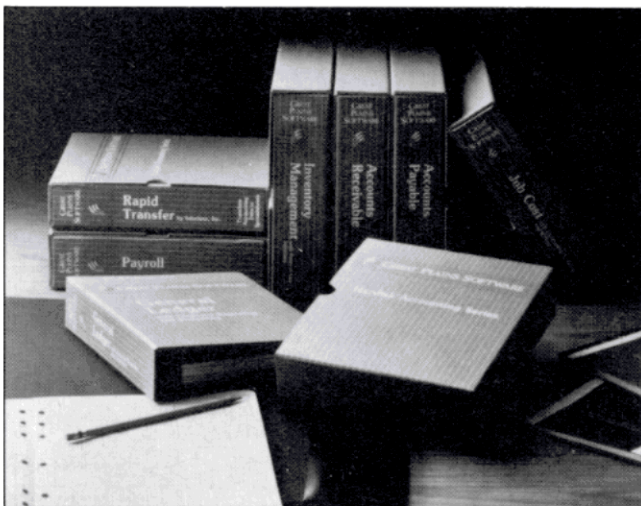
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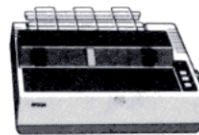
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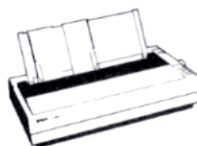
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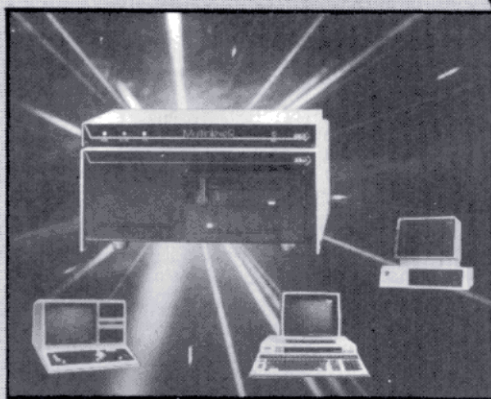
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# They Went Thataway: Controlling Program Flow With If...Then Tests

If the payroll wagon arrives by noon, we'll stick up the mine office at 12:30, when the guards go eat," a burly bandit told his gang of B-western heavies on my TV the other night.

"But boss, what if the wagon's late?" asked one of the less dim-witted ones.

"Then we'll get some vittles, too, and pull the holdup at 1:30. If the wagon ain't here by then, we'll wait in the shade."

Mutters of approval. Break for a commercial.

I was charmed by this exchange, for it was a perfect example of an If...Then proposition in Basic. You could write a simple Basic listing to simulate the events of the gang's plan.

## The Decision-Maker

In Basic, you use If...Then tests to trigger new events if current events fulfill stated conditions. This test opens nearly infinite possibilities: If a specified Basic event occurs, then you can do anything else of which Basic is capable. And I mean anything!

Let's start small:

```
100 CLEAR:CLS
110 FOR X = 1 TO 10
120 PRINT X
130 IF X = 5 THEN END
140 NEXT X
150 END
```

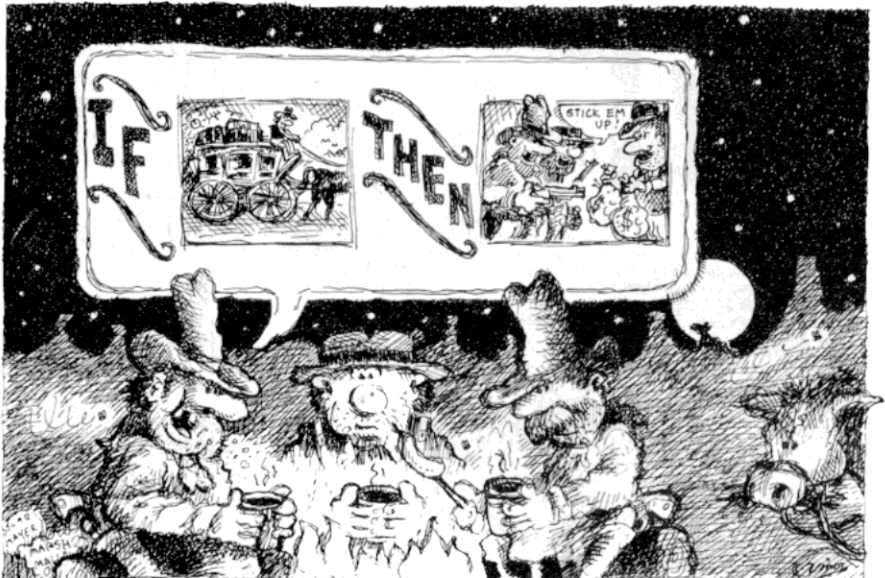
The key to this program lies in line 130. If X has attained a value of 5, then the program ends. You could change line 130 to anything else in Basic:

```
IF X = 1 THEN A$ = "IT'S 1 P.M.": IF X = 3
THEN Y = 2:
IF X > 1 THEN GOSUB 1000
IF X < > 5 THEN PRINT "X IS NOT EQUAL TO
5"
IF X = Y THEN A$ = A$ + STR$(Y)
```

The If statement tests any Basic event, and the Then statement fosters any Basic event:

## System Requirements

**Models I, III, 4, 100, 1000, 1200,  
and 2000  
Basic**



```
IF A$ = "APPLESAUCE" THEN PRINT "I
WANTED ICE CREAM."
IF Z$ = "Y" THEN MERGE "CUSTER/BAS"
IF L = 1 THEN PRINT "I'M SORRY. THAT IS
WRONG."
IF INKEY$ < > " " THEN PRINT "HEY, I TOLD
YOU NOT TO TOUCH THAT KEYBOARD!"
```

You should realize that when program values fulfill an If test, everything requested past the Then will happen. Should conditions not meet the test, Basic ignores the Then events. This exemplifies a common If...Then programming mistake: making essential program code dependent on the If test. Here's an example:

```
100 CLEAR:CLS
110 FOR X = 1 TO 5
120 PRINT X
130 IF X > 3 THEN PRINT X "IS MORE THAN
3": NEXT X
140 END
```

The intent of this program is to go through a For...Next loop from 1 to 5, each time printing the value of X and noting when the value exceeds 3. It won't work because the NEXT X happens only if X is more than 3, and the incorrect If...Then test thwarts that possibility. To fix it, remove the NEXT X from the end of line 130 and give it its own line: 135 NEXT X.

Any time you get crazy results with an If...Then test, check whether you've in-

cluded some event fundamental to program flow in the realm of Then events. And remember that everything past the Then statement occurs only when program conditions meet the If test.

## Multiple Events

So far, I've covered one-element If tests. An If test can also stipulate multiple events, all of which must be met for the program to execute the event:

```
IF X = 1 AND Y = 2 AND B$ = "ZINGER" THEN
PRINT "YOU WIN.": END
```

An If test can trigger a Then result if a program meets either of two or any of many tests:

```
IF X = 1 OR Y < = 30 OR G$ = "GOLLY" THEN
PRINT "TEST MET.":
```

You can combine these two forms:

```
IF X = 1 AND Y = 2 OR Z = 3 THEN PRINT "OK"
```

In this example, Basic prints "OK" if Z equals 3. It also prints "OK" if X equals 1 and Y equals 2. Consider another form of the If...Then test:

```
IF X = 1 OR Y = 2 AND Z = 3 THEN PRINT "OK"
```

In this example, Basic prints "OK" if X equals 1 or if Y equals 2 and Z equals 3. To understand these concepts better, think of the Or statement as a wall between possibilities, and the And statement as a bridge.

## Program Listing 1. Factors.

```

100 REM * FACTORS
110 CLEAR: CLS
120 FOR X=1 TO 25
130 PRINT "Factors of "X
140 FOR Y=1 TO X
150 IF X/Y=INT(X/Y) THEN PRINT Y;
160 NEXT Y: PRINT
170 PRINT "TAP A KEY TO CONTINUE"
180 X$=INKEY$
190 IF X$="" THEN 180
200 CLS: NEXT X: END
220 CLEAR: CLS

```

End

## Program Listing 2. Heads-Tails.

```

100 REM * Heads-Tails
110 CLEAR: CLS
120 A=RND(2)
130 IF A=1 THEN H=H+1: GOTO 120
140 IF H>S THEN S=H: PRINT S
150 H=0: GOTO 120
160 END

```

End

You can put a series of If...Then tests on one program line. Any time the programs fails to meet a test, it falls through to the next line for further instructions. As long as a program meets conditions of the tests, it gives Then results and makes subsequent If tests.

Here's an example:

```

IF X=1 THEN PRINT "YES": IF Y=1 THEN
PRINT "SI": IF Z=1 THEN PRINT "JA"

```

The program won't test for Z unless X and Y both equal 1. It won't test for Y unless X is 1. And nothing happens if X doesn't equal 1. You'll find cases in which it's useful to isolate fall-through tests such as these on the same line.

## Putting If...Then to Work

One of the best uses of an If...Then test is in working with factors, numbers evenly divisible into larger ones. Program Listing 1, Factors, uses If...Then to test and print factors for the numbers 1-25. The crucial test occurs in line 150. In another If...Then test, line 190 keeps the current results on-screen until you tap any key to continue.

Factors represents an example of letting a computer do the drudge work while you relax. You could amend it to print out the factors for the numbers from 1 to as high as the computer accepts. And I hope it suggests some possibilities for problem-solving and answer-finding using programs that automatically seek, sift, save, compare, contrast, and so on.

Program Listing 2, Heads-Tails, uses two If...Then tests. Line 120 simulates the flip of a coin. In line 130, if A equals 1, the program accepts it as heads and increments the heads total (variable H) by 1. I wrote this line to accept only con-

## Program Listing 3. Alphabytes.

```

100 REM * Alphabytes *
110 CLEAR: CLS
120 FOR X=1 TO 2
130 INPUT "Type a word and press Enter";A$(X)
140 NEXT X
150 IF A$(1)<A$(2) THEN PRINT A$(1); ELSE PRINT A$(2);
170 PRINT " is alphabetically first"
180 END

```

End

secutive occurrences of heads. If you get a tail, line 140 tests whether you set a record for a consecutive run of heads and, if so, assigns a new high score to variable S. When you run this program, it's unlikely you'll get more than seven or eight straight occurrences of heads, unless you let the program run a long time.

## A Matter of Relations

I was amazed when I realized that programmers write most If...Then tests with just a few relational operators. They are equal to (=), less than (<), and greater than (>). In combining these we come up with not equal to (<> or ><), less than or equal to (<= or <=), and more than or equal to (>= or >=).

You can use these symbols to test numbers and strings. You probably have a good command of number tests, but consider how you can use string tests.

An alphabetical sort program works by comparing the ASCII values of character strings. Try Program Listing 3, Alphabytes. (A true sort program is more complex than Alphabytes: it passes through a list of words many times, swapping values until the list is in order.)

An If...Then test that also includes the Basic command Else gives you a way for either of two Then events to occur—one when the program meets the If test, the other when it doesn't:

```

IF X=1 THEN PRINT "YES" ELSE PRINT
"NO"

```

You can also obtain multiple Else results:

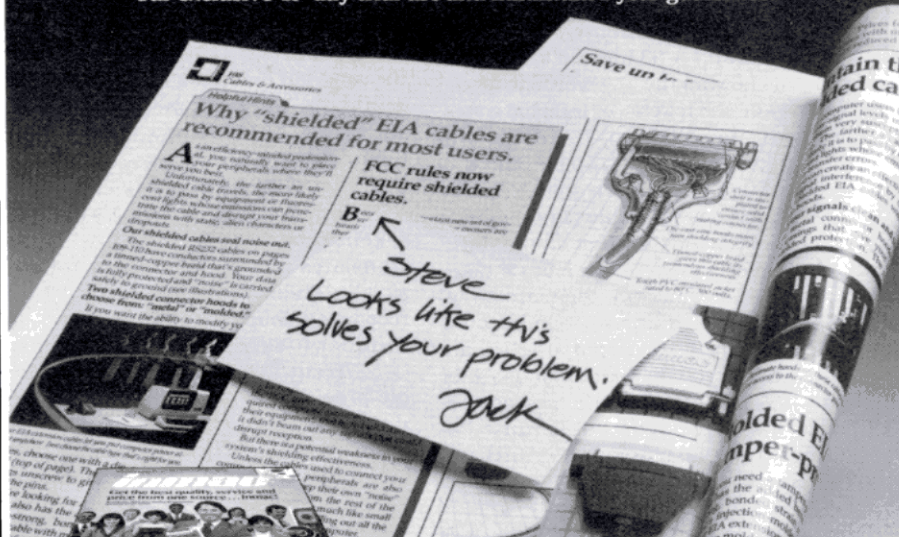
```

IF X=1 THEN PRINT "ONE" ELSE IF X=2
THEN PRINT "TWO" ELSE IF X=3 THEN
PRINT "THREE"

```

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# Putting the Squeeze On Model 4 Programs

Many books and articles have spread the common misconception that Basic is a purely interpretive language. According to this point of view, Basic interprets program code as it executes each line.

Basic is indeed interpretive, but what it interprets while it executes a program or a direct command looks nothing like the code you write. As you type in each line of a program, Basic transforms it and, in a sense, precompiles it so that the computer can execute the line more quickly.

If you use Model I (Level II) or Model III Basic, either cassette- or disk-based, the computer translates the key words in each line into one of 128 possible tokens as soon as you press the enter key. This tokenizing scheme lets Basic execute a program relatively quickly because it already knows the commands in each line and doesn't have to look each one up in a table. Model I/III Basic represents each token within Basic as a single value between 80 and OFF hexadecimal (hex).

Model 4 Basic needs more than 128 key words, and therefore needs to extend this translation scheme somewhat. Pages A-82 and A-83 in the TRSDOS 6.2 manual show all the key words in Model 4 Basic and the tokens, or internal codes, for each. Basic internally represents those tokens with values above 65000 as a byte of OFF hex, which signals an extended-code key word, plus another byte specific to that key word or command.

You never notice the time Basic takes to translate the line you type into an internal, tokenized line of code because you type slowly by a computer's standards. When you do notice a pause after entering or editing a line, it's not because of interpretation but because Basic moves around program lines in memory. However, if Basic had to decipher



each command in each program line during execution, your programs would run much more slowly than they do.

## Basic Differences

Model I/III Basic translates each key word into a token and leaves the rest of the program line unchanged. Basic's execution, or run-time, module must then do the rest of the necessary interpretations every time it executes each line.

Model 4 Basic operates differently. Not only does it translate all key words into tokens when you enter a line, it also translates all numeric values into Basic's internal format. Model I/III Basic recognizes four types of numbers: line numbers (zero to 65529), integers (-32768 to 32767), and single- and double-precision floating-point numbers. However, Basic holds all numbers in their literal, ASCII format inside program lines and translates them into an internal form during execution.

Model 4 Basic changes all numbers to an internal format at the same time it tokenizes each line; that is, when you enter the line. It recognizes nine types of numbers and uses a separate internal form for each. Except for one-character values (zero to nine) and numbers in data statements, Model 4 Basic adds a prefix to each numeric value to show what type of number it is (see the Table).

Model 4 programs seem to list more slowly than their Model III counterparts partly because Basic must translate all numbers from their internal representations back to their external ASCII form.

Because Model 4 Basic translates numbers into and out of internal format, a line sometimes appears to have changed after you enter it. For example, the line:

```
10 A = &H000F : B = 12.0
```

will list as:

```
10 A = &HF : B = 12!
```

Basic hasn't changed either value, but the ASCII representation of each is different. The exclamation point at the end of the line shows that Basic interprets that 12 as a single-precision floating-point number rather than as an integer.

Model I/III Basic recognizes only the first two characters of a variable name as significant. Model 4 Basic recognizes the first 40 characters of the name as significant so that, for example, it sees PRICE and PROFIT as different variables. It also lets you include key words in variable names. A variable named FORM would be impossible in Model I/III Basic since it contains the key words FOR and OR; it is perfectly acceptable in Model 4 Basic.

To distinguish between true key words and key words accidentally included in



## System Requirements

**Model 4**  
**Disk Basic 01.01.00**  
**Assembly language**  
**Editor/assembler**

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

59 WACC	Weighted average cost of capital
60 COMBAL	True rate on loan with compensating bal. required
61 DISCBAL	True rate on discounted loan
62 MORGANAL	Merger analysis computations
63 FINRAT	Financial ratios for a firm
64 NPV	Net present value of project
65 PRINDLAS	Laspeyres price index
66 PRINDPA	Paasche price index
67 SEASIND	Constructs seasonal quantity indices for company
68 TIMETR	Time series analysis linear trend
69 TIMEMOV	Time series analysis moving average trend
70 FUPRINF	Future price estimation with inflation
71 MAILPAC	Mailing list system
72 LETWRT	Letter writing system-links with MAILPAC
73 SORT3	Sorts list of names
74 LABEL1	Shipping label maker
75 LABEL2	Name label maker
76 BUSBUID	DOE business bookkeeping system
77 TIMECLK	Computes weeks total hours from timeclock info
78 ACCTPAY	In memory accounts payable system-storage permitted
79 INVOICE	Generate invoice on screen and print on printer
80 INVENT2	In memory inventory control system
81 TELDIR	Computerized telephone directory
82 TIMUSAN	Time use analysis
83 ASSIGN	Use of assignment algorithm for optimal job assign.
84 ACCTREC	In memory accounts receivable system-storage ok
85 TERMSPAY	Compares 3 methods of repayment of loans
86 PAYNET	Computes gross pay required for given net
87 SELLPR	Computes selling price for given after tax amount
88 ARBCOMP	Arbitrage computations
89 DEPRSF	Sinking fund depreciation
90 UPSZONE	Finds UPS zones from zip code
91 ENVELOPE	Types envelope including return address
92 AUTOEXP	Automobile expense analysis
93 INSFILE	Insurance policy file
94 PAYROLL2	In memory payroll system
95 DILANAL	Dilution analysis
96 LOANAFD	Loan amount a borrower can afford
97 RENTPRCH	Purchase price for rental property
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Token	Meaning	Internal Form	ASCII Example
0A hex	(Line feed)		
0B hex	Octal number	0B nn nn	\$01234
0C hex	Hex number	0C nn nn	&H1234
0D hex	(Carriage return)		
0E hex	Line number	0E nn nn	GOTO 1234
0F hex	Single byte (10-255)	0F nn	123
10 hex	(Apparently unused)		
11 hex	Single digit numbers	11	0
12 hex	.	12	1
.	.	.	.
19 hex	.	19	8
1A hex	.	1A	9
1B hex	(Apparently unused)		
1C hex	2-byte integer	1C nn nn	1234
1D hex	4-byte single-precision floating point	1D nn nn nn nn	1234.5
1E hex	(Apparently unused)		
1F hex	8-byte double-precision floating point	1F nn nn nn nn nn nn nn nn	1234.5#
20 hex	(ASCII space)		

Negative numbers use the same representation but are prefixed with the token for a minus sign, 0F4 hex.

Numbers in Data statements are stored unchanged in their original ASCII format.

Table. Model 4 Basic's internal representation of numeric values.

## Program Listing. Squeeze filter.

```

00100 ;-----
00110 ; Utility to SQUEEZE all unneeded spaces from
00120 ; a BASIC program in memory. Also removes
00130 ; remarks and linefeed characters. Does not
00140 ; alter literal strings.
00150 ;
00160 ; For BASIC 01.01.00 only!
00170 ; Tested with TRSDOS 6.2 (see text)
00180 ;-----
00190 ;
00200 ; SVCs used:
00210 @DSPLY EQU 0AH
00220 @CHNIO EQU 14H
00230 @EXIT EQU 16H
00240 @GTMOD EQU 53H
00250 @HEXDEC EQU 61H
00260 @HIGH$ EQU 64H
00270 @FLAGS EQU 65H
00280 ;
00290 ; Other constants (see text):
00300 ;
00310 PRG_TBL EQU 71A5H ;==> Basic's program table
00320 VAR_TBL EQU 719FH ;==> variable table
00330 ARR_TBL EQU 71A1H ;==> array table
00340 FRE_SPC EQU 71A3H ;==> free space
00350 ;
00360 OCT EQU 0BH ;Octal number token
00370 HEX EQU 0CH ;Hex number token
00380 LINE EQU 0EH ;Line number token
00390 BYTE EQU 0FH ;Byte value token
00400 INTEGER EQU 1CH ;Integer value token
00410 SINGLE EQU 1DH ;Single-prec. value token
00420 DOUBLE EQU 1FH ;Double-prec. value token
00430 ;
00440 LF EQU 0AH ;Linefeed character
00450 CR EQU 0DH ;Carriage return character
00460 SPACE EQU 20H ;Space character
00470 REMARK EQU 8FH ;REM token
00480 EXTEND EQU 0FFH ;Extended command token
00490 ;
00500 SIGNAL EQU 0F3H ;<clear><Shift><S>
00510 ;
00520 ; Macro instructions
00530 ;
00540 SVC MACRO #NUM ;This is pre-defined in ALDS
00550 LD A,#NUM
00560 RST 28H
00570 ENDM

```

Listing continued

variable names. Model 4 Basic requires that you separate each key word and variable with some type of delimiter. You can use any character not allowed in a variable name—including a space, a comma, a parenthesis, an equals sign, and the math and relational operators—as a delimiter. The result is that Model 4 Basic programs tend to contain many more spaces than Model III programs.

I almost always use extra spaces, tabs, line feeds, and comments when I write a program to make debugging easier. However, Basic stores each of these characters according to its internal representation, making programs longer than needed both in memory and on disk. Some long programs begin to run out of memory space in the Model 4. One solution for that is a utility that condenses a debugged program into the least possible space to allow as much room as possible in memory when you run the program. Squeeze is such a program; it removes all spaces, all line feeds, and the text of all remarks (see the Program Listing). It does not, however, affect literal strings in your program.

## The Big Squeeze

To use Squeeze, you must first install it with the Set command at TRSDOS Ready and use the Filter command to link it to the keyboard driver. If you assemble the program as Squeeze/FLT, you would install it with the following two lines:

```

SET *SQ SQUEEZE
FILTER *KI *SQ

```

The program will report that it has successfully installed itself and then relocate itself to protected high memory. You invoke it by pressing clear/shift-S when you want to compress a Basic program in memory.

Squeeze displays each line number as it compresses your program. If these numbers are out of order, something has gone wrong and you should reload your Basic program from disk before trying again. If the numbers are in order, Squeeze has successfully compressed the program.

If you list a compressed program, you might be surprised to see that it apparently still contains some spaces. The internal representation of the program won't have any, but Basic's listing module will put spaces wherever necessary in the version it shows you. What you see is the minimum number of spaces you could use to enter the program.

Also, Squeeze removes the text of all remarks, but keeps the Remark statements in case you have a GOTO or GO-SUB to a line that begins with a remark. Any remark that originally began with an apostrophe will be shown as REM.

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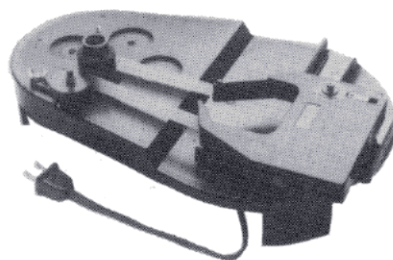
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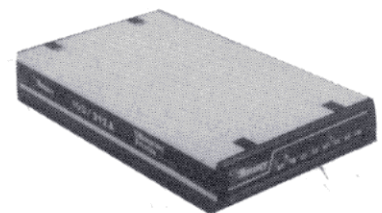
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Listing continued

```

00580 ;
00590 STORE MACRO ;Saves contents of DE in (HL)
00600 LD (HL),E
00610 INC HL
00620 LD (HL),D
00630 ENDM
00640 ;
00650 ;-----
00660 ; Memory-resident code
00670 ;-----
00680 ;
00690 ORG 3000H ;Use PSECT 3000H with ALDS
00700 ;
00710 ; Filter header:
00720 ;
00730 BEGIN JR START ;Jump over header
00740 OLDHI DEFW $-5 ;2-bytes for old HIGH$
00750 DEFB MODDCB-BEGIN-5 ;Length of module name
00760 DEFM 'SQUEEZE' ;Module name
00770 MODDCB DEFW $-5 ;2-bytes for DCB address
00780 DEFW 0 ;Reserved by TRSDOS
00790 ;
00800 ; Storage area
00810 ;
00820 NUMBUF DEFS 5 ;5 spaces for ascii numbers
00830 DEFB 0DH ;End with carriage return
00840 BASMSG DEFM 'BASIC is not loaded!'
00850 DEFB 0DH
00860 ERROR DEFM 'Program pointer error'
00870 DEFB 0DH
00880 ;
00890 ; Basic Signature at 3000H:
00900 ;
00910 SIGNAT DEFB 0E4H,0E2H,27H,0F1H,0E0H,2EH,0F1H
00920 ;Use separate DEFB statements
00930 ;For assemblers other than EDAS
00940 ;
00950 ; Link to *KI driver:
00960 ;
00970 CHAIN PUSH IX ;Save old value
00980 LD IX,(MODDCB) ;Get our DCB address
00990 REL1 EQU $-2
01000 SVC @CHNIO ;Move down chain
01010 POP IX ;Recover old value
01020 RET
01030 ;
01040 ; Start of filter code:
01050 ;
01060 START JR NC,CHAIN ;Go if not GET request
01070 CALL CHAIN ;Else go and return
01080 REL2 EQU $-2
01090 RET NZ ;Return if no key
01100 PUSH AF ;Else save char & flags
01110 CP SIGNAL ;Our turn?
01120 JR Z,GO ;Yes -- start our routine
01130 POP AF ;Else recover flags
01140 RET ;And leave
01150 ;
01160 ; Our routine has been invoked:
01170 ;
01180 GO PUSH BC ;Save all registers
01190 PUSH DE
01200 PUSH HL
01210 PUSH IX
01220 PUSH IY
01230 ;
01240 LD HL,3000H ;HL==> beginning of program area
01250 LD DE,SIGNAT ;DL==> signature comparison table
01260 REL3 EQU $-2
01270 LD B,8 ;Bytes to check
01280 CKLOOP LD A,(DE) ;Get signature byte
01290 CP (HL) ;Okay?
01300 JR NZ,NOBAS ;Go if not
01310 INC HL ;Else bump pointers
01320 INC DE
01330 DJNZ CKLOOP ;Check 8 bytes
01340 JR OKAY ;And go
01350 ;
01360 ; Basic is not resident
01370 ;
01380 NOBAS LD HL,BASMSG ;Point to message
01390 REL4 EQU $-2
01400 DEFB 0DDH ;LD IX prefix
01410 INTERR LD HL,ERROR ;Point to message
01420 REL5 EQU $-2
01430 SVC @DSPLY ;Display it
01440 JP OUT ;And leave
01450 REL6 EQU $-2
01460 ;
01470 ; Basic is in memory -- start squeeze
01480 ;
01490 OKAY LD IX,(PRG_TBL) ;IX==> User program
01500 LD IY,(PRG_TBL) ;IY==> User program
01510 CALL BUMP1 ;Move byte from (IX) to (IY)
01520 REL7 EQU $-2
01530 OR A ;Was it 00 line separator?
01540 JR NZ,INTERR ;No -- Report error & stop
01550 ;

```

Listing continued

which looks like a mistake but isn't. Basic normally stores an apostrophe used as a Remark command as 3 bytes: a colon to indicate a new command, a remark token, and a special token for the apostrophe itself. The compression utility removes the apostrophe token and all the text that follows the remark symbol, but leaves the colon and first remark token in place so that the program runs without error.

If you save a compressed program to disk in normal, tokenized form, it won't have any spaces. If you save it in ASCII form, it will contain the spaces you see when you list it. You can, of course, reload and run either form. If you edit a compressed line, the editor will put the spaces back in and you might want to compress the program again.

Before you assemble the Listing, you need to check the four values in lines 310-340. These are the addresses where Basic stores pointers to its program table (the list of program lines precompiled into internal format), its variable table, its array table, and the beginning of free space. To check those values, type in the following, beginning at TRSDOS Ready. End each line by pressing the enter key:

```

DEBUG (E)
BASIC.BASIC
G
10 *****

```

Now hit the break key, type in D8000, and press the enter key.

You have just entered a short Basic program that consists of a line number, a remark, and six asterisks, then entered Debug to see where the program resides. (You can return from Debug to Basic at any time by typing in G and pressing the enter key.)

You should see asterisks in the middle of the Debug display. If not, press the plus sign until the asterisks appear. When they do, look for the three 00 bytes that precede the asterisks and write down the memory address of the last of those three bytes.

Now type in D7100. Starting at 71A7 hex should be a series of 26 bytes of 04 hex. These indicate that all variables default to type 4, single-precision numeric. If you use a DEFINT, DEFSTR, or DEFDBL command in your program, some or all of those bytes will change.

The 2 bytes immediately before the series of 04s should contain the address you just wrote down, but in reverse order. For example, if you wrote down 8135, you should see 35 81. If that value resides at 71A5 and 71A6 hex, you can assemble the program without change. If it isn't, you'll have to search through memory (use the plus and minus keys) looking for the 26 04s immediately preceded by the address you wrote down. When you find

## The squeeze filter checks the area starting at 3000 hex to see if you have Basic active.

it, you need to change the values in lines 310-340. Line 310 contains the address of the pointer to the beginning of your program. Lines 320, 330, and 340 are the addresses of three pointers that immediately precede that one. You probably won't have to change anything if you're using TRSDOS 6.2 and Basic 1.1.0.

To understand how Squeeze works, you need to know how Basic stores program lines internally. Each line begins with the 2-byte address of the next line, which gives the program the form of a forward-linked list. Following that are 2 bytes that contain the line number in normal LSB/MSB (least-significant byte/most-significant byte) form. The tokenized form of the contents of the line follow the line number. Basic separates each line from the next with a single 00 byte. The entire program ends with 3 successive bytes of 00: The first is the line separator; the next two (which would normally be the link field) show that the line links to no other line.

I've used two macro instructions in this program. The first makes using supervisory calls easier, the second stores the contents of the DE register pair at the address to which HL points. If your assembler doesn't support macros, you can easily expand each by hand. Next month, I plan to discuss macros in detail, including methods of expansion.

### Program Operation

The code beginning in line 730 represents a standard TRSDOS memory header that allows TRSDOS to find modules in memory, and perform link, route, and filter operations successfully. Following that is a small buffer for converting line numbers to ASCII and two brief error messages.

Line 910 (you might have to write several separate DEFB statements with some assemblers) contains the first 8 bytes of the Basic/CMD program (you can verify they are correct with Debug) stored at 3000 hex. Most programs load into memory starting at 3000 hex and the Squeeze filter checks that area to see if you have Basic active. However, it is possible for those bytes to still reside in memory after you load and then leave

Listing continued

```

01560 LOOP1  PUSH    IY                ;Save address of memory link
01570        LD      B,2                ;Get 2 characters
01580        CALL    BUMP              ; from (IX) to (IY)
01590 REL8   EQU     $-2
01600        OR      A
01610        JP      Z,DONE            ;Last one 00?
01620 REL9   EQU     $-2                ;Yes -- we're done
01630 ;
01640        LD      L,(IX)             ;Get LSB of line number
01650        LD      H,(IX+1)           ;Get line number
01660        LD      DE,NUMBUF          ;DE==> buffer for ascii value
01670 REL10  EQU     $-2
01680        SVC     @HEXDEC            ;Convert to decimal
01690        LD      HL,NUMBUF          ;HL==> ascii string
01700 REL11  EQU     $-2
01710        SVC     @DSPLY             ;Display on screen
01720        LD      B,2                ;Move 2-byte line number
01730        CALL    BUMP              ; from (IX) to (IX)
01740 REL12  EQU     $-2
01750 ;
01760 ; Now scan line of Basic until line separator is found
01770 ;
01780 LOOP2   LD      A,(IX)             ;Get next byte
01790        OR      A
01800        JR      Z,EOL              ;Is it 00 line separator?
01810        CP      REMARK              ;Yes -- go
01820        JR      Z,REM              ;REM token?
01830        CP      '"'                ;Yes -- go
01840        JR      Z,STRING            ;Beginning a string?
01850        CP      EXTEND              ;Yes -- go
01860        JR      NZ,GOL              ;2-byte verb token?
01870        LD      B,2                ;No -- jump ahead
01880        CALL    BUMP              ;2 bytes to transfer
01890 REL13  EQU     $-2                ; from (IX) to (IY)
01900        JR      LOOP2              ;And loop back
01910 GOL    CP      SPACE              ;A space?
01920        JR      NZ,GOL              ;No -- jump ahead
01930 GO2    INC     IX                ;Bump source pointer
01940        JR      LOOP2              ;And loop back
01950 GO3    JR      NC,XFER            ;Go if greater than a space
01960        CP      LF                  ;Line feed character?
01970        JR      Z,GO2              ;Yes -- go
01980        CP      OCT                 ;Octal token?
01990        JR      Z,INT              ;Yes -- transfer 3 bytes
02000        CP      HEX                ;Hex token?
02010        JR      Z,INT              ;Yes -- transfer 3 bytes
02020        CP      LINE               ;Line number token?
02030        JR      Z,INT              ;Yes -- transfer 3 bytes
02040        CP      BYTE               ;Byte token?
02050        JR      Z,BYT              ;Yes -- go
02060        CP      INTEGER            ;Integer token
02070        JR      Z,INT              ;Yes -- go
02080        CP      SINGLE             ;Single-precision token
02090        JR      Z,SING             ;Yes -- go
02100        CP      DOUBLE             ;Double-precision token
02110        JR      NZ,XFER            ;No -- transfer one byte
02120        LD      B,9                ;Bytes to transfer
02130        JR      XFERB              ;And go
02140 SING   LD      B,5                ;Transfer single-precision
02150        JR      XFERB              ;And go
02160 INT    LD      B,3                ;Transfer integer
02170        JR      XFERB              ;And go
02180 BYT    LD      B,2                ;Transfer byte value
02190 XFERB  CALL    BUMP              ;Transfer number in B
02200 REL14  EQU     $-2
02210        JR      LOOP2              ;Scan some more
02220 ;
02230 XFER    CALL    BUMP1             ;Move one byte from (IX) to (IY)
02240 REL15  EQU     $-2
02250        JR      LOOP2              ;And scan some more
02260 ;
02270 ; Transfer a string
02280 ;
02290 STRING  CALL    BUMP1             ;Move opening quote
02300 REL16  EQU     $-2
02310 STR1   CALL    BUMP1             ;Move one character
02320 REL17  EQU     $-2
02330        OR      A
02340        JR      Z,EOL1             ;EOL Mark?
02350        CP      '"'                ;Yes -- go
02360        JR      NZ,STR1            ;Closing quote?
02370        JR      LOOP2              ;No -- loop back
02380 ;
02390 ; Transfer & Truncate a remark (leave REM token in place)
02400 ;
02410 REM    CALL    BUMP1             ;Move REM character
02420 REL18  EQU     $-2
02430 REM1   LD      A,(IX)             ;Get next character
02440        OR      A
02450        JR      Z,EOL              ;Line separator?
02460        INC     IX                  ;Go when end found
02470        JR      REM1              ;Else bump pointer
02480 ;
02490 ; Process End-of-line (EOL) mark
02500 ;
02510 EOL     CALL    BUMP1             ;XFER line separator
02520 REL19  EQU     $-2
02530 EOL1   PUSH    IY                ;Move IY address to

```

Listing continued

## Listing continued

```

02540 POP DE ; DE registers
02550 POP HL ; Recover line link address
02560 LD (HL),E ; Set LSB of link
02570 INC HL ; Bump pointer
02580 LD (HL),D ; Set MSB of link
02590 JP LOOP1 ; Process next line
02600 REL20 EQU $-2
02610 ;
02620 ; End-of-program processing
02630 ;
02640 DONE PUSH IY ; Transfer address
02650 POP DE ; to DE
02660 POP IY ; Discard old link addr.
02670 LD HL,VAR_TBL ; HL=> var. table storage
02680 STORE
02690 LD HL,ARR_TBL ; HL=> array table storage
02700 STORE ; Store address there
02710 LD HL,FRE_SPC ; HL=> free space storage
02720 STORE ; Store address there
02730 ;
02740 OUT POP IY ; Recover registers
02750 POP IX
02760 POP HL
02770 POP DE
02780 POP BC
02790 POP AF
02800 OR 1 ; Set NZ flag
02810 LD A,0 ; Return null key
02820 RET ; Return to Basic
02830 ;
02840 ; Bump and Transfer subroutine
02850 ;
02860 BUMP1 LD B,1 ; Entry for single transfer
02870 BUMP LD A,(IX) ; Get a byte
02880 LD (IX),A ; And store at new address
02890 INC IX ; Increment pointers
02900 INC IY
02910 DJNZ BUMP ; Repeat until done
02920 RET
02930 ;
02940 PLTEND EQU $-1 ; End of filter
02950 PLTLEN EQU $-BEGIN ; Length of memory-resident module
02960 ;
02970 ;-----
02980 ;
02990 ; Initialization code
03000 ;
03010 ;-----
03020 ;
03030 INIT PUSH DE ; Save DCB pointer
03040 LD (MODDCB),DE ; Stuff into filter
03050 LD HL,SGNON ; HL=> sign-on message
03060 SVC @DSPLY ; Display on screen
03070 LD DE,MODNAME ; DE=> module name
03080 SVC @GTMOD ; Already installed?
03090 JR NZ,VIASET ; Go if not found
03100 LD HL,INSTLD ; HL=> error message
03110 ERR_OUT SVC @DSPLY ; Display the message
03120 LD HL,-1 ; Set extended error
03130 SVC @EXIT ; And leave
03140 ;
03150 ; Installed with SET command?
03160 ;
03170 VIASET SVC @FLAGS ; Point IY to flags
03180 BIT 3,(IY+'C'-'A') ; Test bit 3 of C-flag
03190 JR NZ,SETHI ; Go if SET used
03200 LD HL,NOSET ; HL=> error message
03210 JR ERR_OUT ; And leave
03220 ;
03230 ; Reset HIGH$ and prepare to relocate filter
03240 ;
03250 SETHI LD HL,0 ; Function: get current value
03260 LD B,L ; B=0 >> select HIGH$
03270 SVC @HIGH$ ; Get current HIGH$ value
03280 LD (OLDHI),HL ; Save old HIGH$
03290 JR Z,RELOC ; Go if no error
03300 LD HL,MEMERR ; HL=> error message
03310 JR ERR_OUT ; And leave
03320 ;
03330 ; Move filter to high memory and protect
03340 ;
03350 RELOC LD IY,RELTAB ; IY=> Relocation table
03360 LD DE,PLTEND ; DE=> End of filter
03370 XOR A ; Reset carry flag
03380 SBC HL,DE ; Calculate distance to move
03390 PUSH HL ; and transfer to
03400 POP BC ; BC register pair
03410 LD L,(IY+0) ; Get address to change
03420 LD H,(IY+1) ; in HL
03430 LD A,H ; Pick up MSB
03440 OR A ; Is it 0?
03450 JR Z,MOVE ; Yes -- go move filter
03460 LD E,(HL) ; Move contents
03470 INC HL ; of address
03480 LD D,(HL) ; to DE reg. pair
03490 EX DE,HL ; HL has value to change
03500 ADD HL,BC ; Add the offset
03510 EX DE,HL ; New value back in DE

```

Listing continued

Basic. If you invoke the compression utility in that situation, it might run rampant trying to compress a /CMD program, garbage in memory, or even itself, and cause your computer to crash completely. Be careful!

The program begins to operate at line 1060. Since it's a keyboard filter, it must first call the keyboard driver routine to collect a keystroke. Then it compares that key to the constant signal to see if you're invoking it. If so, control passes to line 1180 where Squeeze pushes all the Z80 registers onto the stack and checks Basic's "signature." If everything is okay, compression begins at line 1490.

Throughout the program, the IX register points to the current location in the uncompressed code, and the IY register points to the current location in the compressed code. The outer program loop, which begins at LOOP1 in line 1560, executes for each line of your program. The inner loop, beginning at LOOP2 on line 1780, executes for each byte of the original program. The inner loop cannot just discard all spaces and remarks because the internal representation of numbers might contain bytes that look like spaces or remark tokens. Instead, the inner loop must copy all numbers completely, along with their tokens, and look only for bytes to discard between numbers and outside of literal strings' quotation marks.

At the end of the program (see line 2640), three of Basic's pointers need to be updated. If not, you will have a compressed program but no extra free memory because Basic still reserves memory space for your original program.

The program code following line 2920 is only to relocate and install the compression program. This is the same installation routine I've used many times and should look familiar to regular readers. The comments in the program should make most of it easy to follow.

I've used the program without problem on several Basic programs, and can usually reduce the size of a program by 25 percent or more. However, the three "apparently unused" entries in the Table bother me. They might be used for numeric types I have overlooked. If you find a program line that chokes the compression program consistently, please send it to me. You might have found a numeric token that I have overlooked, and I would like to add it to the list and publish a program patch. ■

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## THE NEXT STEP

Listing continued

```

03520      LD      (HL),D      ;Put it back
03530      DEC     HL          ; in the
03540      LD      (HL),E      ; filter program
03550      INC     IY          ;Bump IY to next
03560      INC     IY          ; entry in the table
03570      JR      RELOC1      ;Repeat until done
03580      ;
03590      ; Move module to high memory and protect
03600      ;
03610  MOVE   LD      DE,(OLDHI) ;DE==> destination address
03620      LD      HL,FLTEND      ;HL==> current end of filter
03630      LD      BC,FLTLEN      ;BC==> length of module
03640      LDDR      ;Move it all
03650      EX      DE,HL          ;Move new HIGH$ to HL
03660      LD      B,0           ;Function: select HIGH$
03670      SVC     @HIGH$        ;Set new HIGH$ value
03680      INC     HL           ;HL==> filter entry point
03690      ;
03700      ; Set type and address in filter's DCB
03710      ;
03720      POP      IX          ;Get DCB address off stack
03730      LD      (IX),01000101B ;Set as FILTER capable of
03740      ; @GET & @CTL
03750      LD      (IX+1),L      ;LSB of filter address
03760      LD      (IX+2),H      ;MSB of filter address
03770      LD      HL,SUCCESS    ;HL==> Success message
03780      SVC     @DSPLY
03790      LD      HL,0          ;Show success
03800      SVC     @EXIT          ;Back to TRSDOS
03810      ;
03820      ; Initialization messages
03830      ;
03840  MODNAME DEFM 'SQUEEZE'      ;Our filter's module name
03850      DB      0
03860  SGNON   DEFM 'BASIC Program Compression Utility'
03870      DB      CR
03880  INSTLD  DEFM 'Program already in memory -- installation aborted'
03890      DB      CR
03900  NOSET   DEFM 'Filter must be installed with SET command'
03910      DB      CR
03920  MEMERR  DEFM 'High memory not available for installation'
03930      DB      CR
03940  SUCCESS DEFM 'Installation successfully completed'
03950      DB      LF
03960      DEFM 'Use FILTER command to connect to *KI'
03970      DB      LF
03980      DEFM 'Then use <Clear><Shift><S> to invoke'
03990      DB      LF
04000      DEFM 'WARNING: Do not invoke unless Basic is Active!'
04010      DB      LF
04020      DB      CR
04030      ;
04040      ; Relocation table
04050      ;
04060  RELTAB DEFW REL1,REL2,REL3,REL4,REL5,REL6,REL7
04070      DEFW REL8,REL9,REL10,REL11,REL12,REL13,REL14
04080      DEFW REL15,REL16,REL17,REL18,REL19,REL20
04090      DEFW 0 ;Mark end with 2 bytes of 0
04100      ;
04110      END      INIT

```

End

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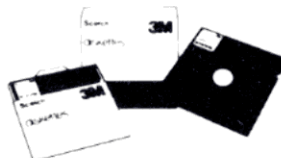
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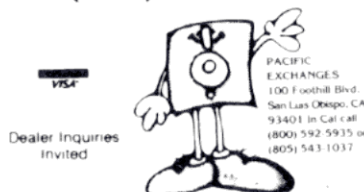
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# On Displays: Sprucing Up Your Spreadsheet

**M**ultiplan's Lookup function can give you a great deal of flexibility when you're doing calculations that must account for changing values. It will automatically go to a table, find the numbers that are right for the specified condition, and adjust its calculations accordingly.

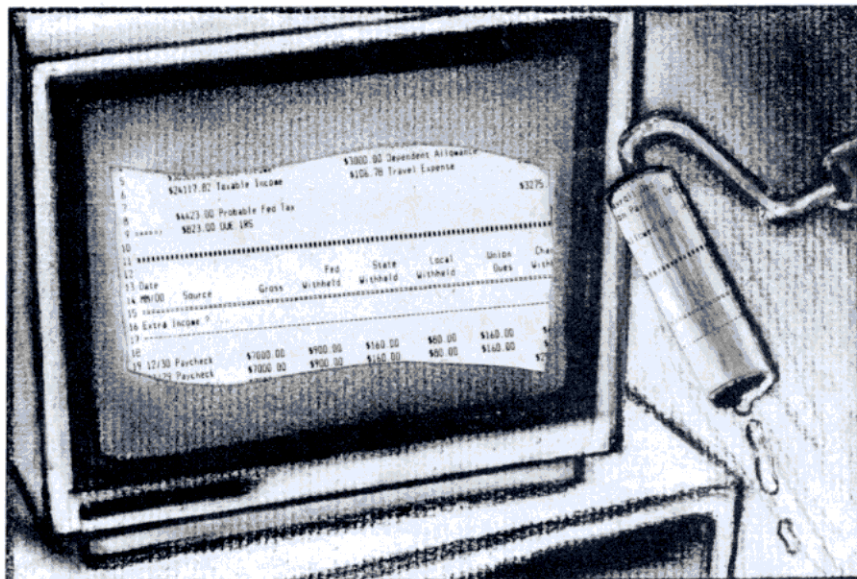
Let's look, for example, at a spreadsheet that calculates employees' income taxes (Fig. 1). The spreadsheet is for 1984, and assumes that the employees are married and filing joint returns. The equation to calculate federal taxes (column 3) is simple:  $\text{Base} + \text{Percentage} \times \text{Over-amount}$ . All three variables in the formula, however, change with the salary of the employee. How can one equation in column 3 take these changes into account?

This is where the look-up table comes in. This spreadsheet refers to three, in columns 5-7. The base comes from column 6, the percentage from column 7, and the over-amount by subtracting the minimum salary (column 5) from the actual (column 2). The tax equation becomes the Multiplan formula in Fig. 2.

Let's get a quick look at how the spreadsheet works, using an income of \$25,000 as an example.

The function Lookup (N, Table) searches for the first value (N) in the first row or column of the area specified by Table. Multiplan searches down a square or vertical table and searches left to right through a horizontal table. Lotus uses @VLOOKUP and @HLOOKUP to do the same.

Lookup searches down Salary\_table to find \$29,000 in row 13. Since this is a



1	2	3	4	5	6	7
Employee Information					Tax Tables	
EMPLOYEE NAME	SALARY	FED TAX		MINIMUM	BASE \$	PERCENT
Swanson, Clarke E.	57,825.00	14,341.50		0	0	0%
Harrell, John B.	32,469.00	5,509.32		3,400	0	11%
Harrell, J.B.	25,000.00	3,565.00		5,500	231	12%
Harrell, Bonnie S.	10,000.00	819.00		7,600	483	14%
Harrell, J. Matthew	3,000.00	0.00		11,900	1,085	16%
				16,000	1,741	18%
				20,200	2,497	22%
				24,600	3,465	25%
				29,900	4,790	28%
				35,200	6,274	33%
				45,000	9,772	38%
				60,000	15,168	42%
				85,600	25,920	45%
				109,400	36,630	49%
				162,400	62,600	50%
				999,999		

Figure 1. Spreadsheet for calculating federal taxes using look-up tables.

Multiplan formula in column 3:  
 LOOKUP(RC[-1],Base Table)  
 + LOOKUP(RC[-1],Percent-  
 age\_table)\*(RC[-1]-LOOKUP  
 (RC[-1],Salary\_table))  
 Base\_table, Percentage\_table, and  
 Salary\_table are named ranges of  
 the tax table above as follows:  
 Salary\_table—R3:18C5:5  
 Base\_table—R3:18C5:6  
 Percentage\_table—R3:18C5:7

Figure 2. Formula for spreadsheet.

Value	Color	Value	Color
0	Black	8	Gray (black on 2000)
1	Blue	9	Bright blue
2	Green	A	Bright green
3	Cyan	B	Bright cyan
4	Red	C	Bright red
5	Magenta	D	Bright magenta
6	Brown (yellow on 2000)	E	Bright yellow
7	White	F	Bright white

Figure 3. Color selections for Lotus.

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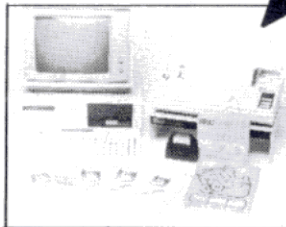
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## SPREADSHEET BEAT

single-column table, the value returned is from the preceding row—\$24,600. Lookup then searches down Base table and Percentage table, again stopping at row 12. The base, then, is \$3,465, and the over-amount is \$400 (\$25,000 – \$24,600). Plugging the numbers into our equation, the federal tax is \$3,465 plus

25 percent of \$400, or \$3,565.

Put all of this together, and you have a nice tax calculator. If you let your imagination wander, you quickly realize that the formulas for tax calculations in column 3 could be extended to use any of four table areas, depending on whether you are married or single.

### Action

DEBUG TD.DRV <ENTER>

E17D <ENTER>

WW <SPACE>

XX <SPACE>

YY <SPACE>

ZZ <ENTER>

W <ENTER>

Q <ENTER>

### Comments

Load Debug and the LOTUS text display video driver.

Begin editing memory at offset address 017DH in the driver.

Enter first color selection from Fig. 3; enter the hexadecimal digits from the color selection table in the proper order for each attribute byte.

Enter second color selection.

Enter third color selection.

Enter fourth color selection.

Write the modified TD.DRV driver back to the disk.

Exit Debug to MS-DOS.

Figure 4. Instructions for modifying colors in IBM-PC Lotus.

### Color Byte

WW

XX

YY

ZZ

### IBM PC Lotus

Used to set normal colors.

Used to set colors for the spreadsheet border.

Used to set colors for unprotected cells and help text without the cursor.

Used to set colors for unprotected cells and help text with the cursor.

### Tandy 2000 Lotus

Used to set the background colors for normal text and borders.

Used to set the foreground color for normal text and borders.

Used to set the background color for help text and unprotected cells.

Used to set the foreground color for help text and unprotected cells.

Figure 5. Description of bytes used to modify Lotus colors.

### Action

DEBUG TD.DRV <ENTER>

E18D <ENTER>

WW <SPACE>

XX <SPACE>

YY <SPACE>

ZZ <ENTER>

W <ENTER>

Q <ENTER>

### Comments

Load Debug and the LOTUS text display video driver.

Begin editing memory at offset address 018DH in the driver.

Enter first color selection from Fig. 3; enter the hexadecimal digits from the color selection table in the proper order for each attribute byte.

Enter second color selection.

Enter third color selection.

Enter fourth color selection.

Write the modified TD.DRV driver back to the disk.

Exit Debug to MS-DOS.

Figure 6. Instructions for modifying colors in Tandy 2000 Lotus.

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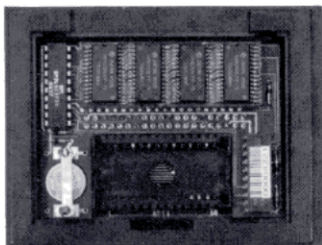
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## Lotus Land

I get bored with the color selections on the IBM and Tandy 2000 versions of Lotus 1-2-3. Color displays are meant to display color! Changing your Lotus colors takes less than five minutes and anyone can do it.

Let's tackle the IBM-PC compatibles first. Lotus sets the colors for each character by writing a distinct color attribute for each position. Color video memory is organized into pages of 4,000 bytes containing a character byte followed by an attribute byte.

The attribute byte contains two 4-bit numbers that identify the color of the character background and the color of the character itself. The foreground color can be any of the colors in Fig. 3 while the background color is limited to selections zero—7. Adding eight to the background color forces the character to blink. For example, 1F gives bright white characters on a blue background, while 9F causes the characters to blink.

Now, armed with this knowledge, select background and foreground colors for the spreadsheet border, the text on the spreadsheet, unprotected cells or unselected cursor locations in the help mode, and unprotected cells or actual

cursor location in the help mode. Write these down, remembering to organize them in each byte as background/foreground, and fire up Debug.

Place a disk containing Debug in drive B and the Lotus system disk (it must contain the file TD.DRV) in drive A. Follow the instructions in Fig. 4, entering each step just as it appears. Replace WW, XX, YY, and ZZ with your color values; see Fig. 5 for a description of each byte. When you're done, run Lotus Access; you should see the changes immediately.

The Tandy 2000 Lotus works differently on the 2000 than it does on other MS-DOS machines. The spreadsheet frame and text are displayed using some colors in the monochrome text mode.

For the Tandy 2000, the monochrome video is organized into a single page of text arranged like the IBM PC. Unfortunately, the attribute bytes don't resemble the PC's. These attributes do allow setting normal or high-intensity display, blink, underlining, and reverse video. The normal and high-intensity modes select their respective colors from the palette register contents and you can control these values. All 16 colors in Fig. 3 are allowed for setting the values.

Normal or highlight characters may

also be displayed in reverse video. Lotus uses these four combinations to display all text. While you have no control over the attributes used to display text, you can control the colors used for each mode.

Again, use Fig. 3 to select the colors you want. The first will control the background color of the normal text and the second the foreground color. These colors will also be used for the border, which is displayed in reverse video (the functions of these two colors are reversed). The third and fourth choices set the colors for the help text and unprotected cells. You enter each of these colors as a single byte; for example, bright green as byte 0A.

Figure 6 gives directions on using Debug for the Tandy 2000. Follow them as you would those for the PC-compatibles. You should immediately see your color selections when you run Lotus.

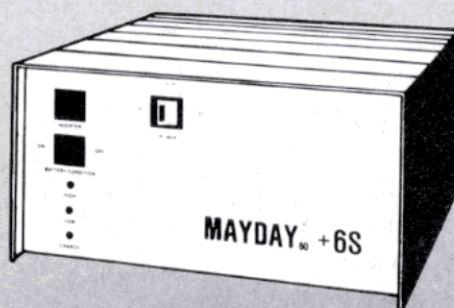
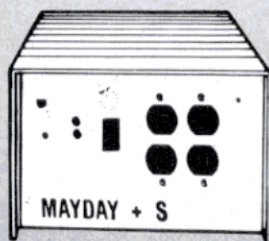
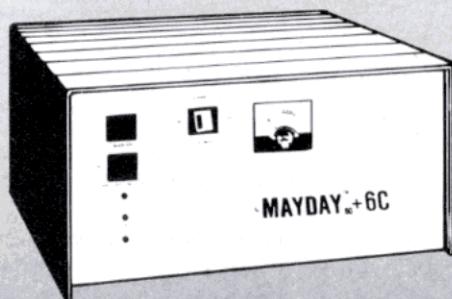
A final word of warning: You can select some bizarre color choices. You might need to experiment before you find the colors you like. ■

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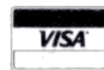
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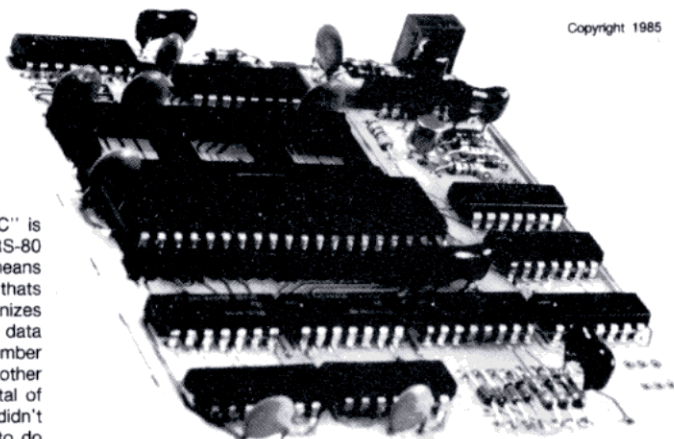
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Some products have what it takes to seem to last forever. Our "DDC" is one of those products. What it does is allow you to operate your TRS-80 Model 1 disk system in double density. In this case double density means almost doubling the storage capacity of your diskettes. Single density, that's the way Radio Shack designed your Model 1 expansion interface, organizes your disk into 10 sectors per track. Each sector contains 256 bytes of data for a total storage capacity 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, writes 18 sectors per track each containing 256 bytes for a total of 4,608 bytes or 4.5K. That is 80% more data in the same space. Why didn't Radio Shack do that in the beginning, you ask? Well it costs money to do double density because it is more difficult to do than single density and the data is harder to capture reliably. That means more cost and the Model 1 was meant to be a low-cost computer for the masses. Therefore, no double density for the original Model 1.

### The Facts

Other companies introduced double density controllers for the Model 1 but they were not so good. We waited and waited but, even new models failed to correct problems with data separation that kept cropping up. So we went to work and came up with a new design to cure the old problem. At last! A double density controller for the Model 1 with a higher probability of data recovery than with any other double density controller on the market then or since. Our analog design phase lock loop data separator has a wider capture window than the digital types the others use. This allows high resolution data centering. Our "DDC" analog circuit allows infinitely variable tuning. The attack and settling times are optimum for 5.25" diskettes. The oft-stated fears of adjustment problems rumored by digital dilettantes have been proved groundless by thousands of satisfied users the world over. The bottom line here is state-of-the-art performance and reliability.



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

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Convert your cassette Model III or 4 to disk operation with one of our complete kits. You receive our own advanced disk controller board with gold plated edge contacts capable of 4-drive operation; our own power supply; plated steel mounting towers complete with RFI shield plus all the cables and hardware necessary. Detailed instructions are included. All you need is a screwdriver and a pair of pliers. System kits come with 40 track single-side drives or just order the basic kit and pick the drives you want from the selection in the next column.

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LDOS 5.1.4 disk/manual ..... 69

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CP/M 2.2 by Montezuma Micro ..... 169

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You can add our renowned "DDC" double density controller to either the Radio Shack or the LNW Expansion Interface for 80% more storage capacity on your drive. Order it at the same time as our starter package above and we'll pay the shipping. Go ahead, you deserve increased density. See the opposite page for the latest technical details.

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Continued from p. 34

Hyperzap also lets you inspect and modify memory with string searches, CRC calculations, memory modifications, block moves, block fills, and block comparisons.

Hyperzap generates self-booting disks for either a Model I, III, or 4. Also, you can put any combination of I, III, or 4 programs on a self-booting disk, useful for anyone distributing Model I and Model III/4 versions of a program on a single disk.

Hyperzap supports a feature called autopilot, a do-file mimic for building files of multiple keystrokes. Once you build an autopilot file, or use one of Hyperzap's 17 files, you can pass control to Hyperzap and all program prompts will be answered by the autopilot file.

### Drawbacks

While all of the above may sound great, I found a number of serious problems with Hyperzap. The 39-page manual provides a good explanation of Hyperzap's many features, but it doesn't explain disk formats and structures.

Also, entering data with Hyperzap is a confusing hodgepodge. Many program prompts require a leading zero for single-digit numeric values. Others require only a single digit and produce incorrect results if you add the leading zero. While you can put most numeric responses in either decimal or hexadecimal format, some prompts accept only decimal or hexadecimal values. To aggravate the situation further, incorrect responses can sometimes crash the program.

Since Hyperzap runs independently of a disk operating system, it uses its own device driver routines. While the video and printer drivers function properly, the keyboard and disk drivers exhibit a few glitches. The keyboard driver doesn't provide enough debounce, so the keys repeat slowly. And the disk driver hangs up completely whenever you try to access a diskless drive.

My first copy of Hyperzap indicated I had numerous CRC errors on disks that I could format without problem with other operating systems. Hypersoft sent me another copy of Hyperzap that worked fine.

### Conclusion

Hyperzap offers several unique features for a zap utility, but the program's problems make it difficult to use. If Hypersoft corrected Hyperzap's weaknesses, I would give the program much higher marks. But I found the inconsistent data entry requirements confusing. With a little refinement, Hyperzap would be an excellent product. Until then, I can only consider it fair. ■

## Multilingual MULTIDOS 80/64 by Thomas L. Guindry

★★★★

**MULTIDOS 80/64** runs on the Model 4 (64K) and requires one disk drive. AlphaBit Communications Inc., 13349 Michigan Ave., Dearborn, MI 48126, 313-581-2896. \$99.95.

Easy to use: ★★★★★

Good docs: ★★★★★

Bug free: ★★★★★

Does the job: ★★★★★

As any of its fans know, MULTIDOS reads and writes practically any Model I/III DOS format. The Model 4 version of MULTIDOS, 80/64, extends this feature to include TRSDOS 6.X. MULTIDOS 80/64's main advantage, however, is its ability to run Model I/III Basic programs in Model 4 mode without conversion, at the Model 4's faster processing speed and 80-character screen width (unless the program uses machine-language subroutines or PEEKs or POKEs).

Like other versions of MULTIDOS, 80/64 touts its ability to read all disk formats for the TRS-80 series. While MULTIDOS can directly read some DOS formats (like LDOS), you have to use a program called VFU to convert TRSDOS 1.3 programs to another drive to run them. Several Model I DOSes require that you change the disk's data address marks with the MULTIDOS Convert/CMD program. As with other versions of MULTIDOS, 80/64 can read all TRS-80 disk formats. It also writes to most formats, but not to TRSDOS 1.3 and 2.3.

### Compatibility

MULTIDOS Basic uses tokens identical to those in Model I/III Basic, but TRSDOS 6.X Basic uses different tokens. Therefore, you must save Model 4 Basic programs in ASCII format before MULTIDOS can read and run them directly from a TRSDOS 6.X disk.

MULTIDOS's Basic interpreter, SuperBasic, comes with enhancements to standard Basic and debugging tools. You can trace, single-step, set breakpoints, and review variables in Basic programs. You also get a string sort similar to that in TRSDOS 1.3 Basic, with output in ascending or descending order.

Additional Basic commands include Label, Erase, Zero, Hex, Binary, Call, and WPEEK. Erase removes a variable array from RAM. Zero sets all elements of the array to zero. WPEEK PEEKs at a 2-byte value (word) that an integer points to. Some of these SuperBasic commands conflict with those in TRSDOS 1.3.

## MULTIDOS Features

While MULTIDOS 80/64's compatibility with Model I/III Basic programs is good, it is a Model 4 operating system. It resides in RAM and loads its Basic interpreter in low memory. Because of this, you can't run most /CMD files written for the I, III, or 4. MULTIDOS also doesn't support the RAM calls most commercial software packages use. For instance, I couldn't run Scripsit, LeScript, or Allwrite. Some commercial machine-language programs can access most features, but not all.

If you have a 128K Model 4, MULTIDOS lets you partition the extra memory bank as a Memdisk; you can also set aside part of high memory as a RAM disk or data disk. MULTIDOS provides a MINIDOS function accessible at all times, even while running a Basic program. It includes commands you can run before returning to the program. You can copy, kill, or list specified files; display a directory; invoke a debugging program; and select the 64- or 80-character screen widths (32 or 40 characters in enlarged-character mode).

Other useful commands available from DOS include an Unkill command and linking and routing commands. MULTIDOS's utilities let you assign function-key characteristics, edit globally in Basic, zap disks, time disk drives, filter printer codes, spool printer data, test memory, and scan/search memory for 8- or 16-bit codes.

MULTIDOS supports double-sided disk drives, but the manual provides no instructions for making a double-sided MULTIDOS system disk.

You can also format, read, and write to the reverse side of a double-sided disk as though it were a separate drive. Each side acts as an independent disk with its own directory; you refer to a two-drive system's four "drives" as 0, 0', 1, and 1'. However, you have to configure MULTIDOS to recognize double-sided disks.

### Docs and Knocks

The MULTIDOS manual is tough to get through. While it offers good technical information, you have to hunt all over for it. And I found the way it handles the different systems confusing.

I discovered only one error with MULTIDOS. The Memdisk X command is supposed to reset the Memdisk or RAM disk previously set, but I couldn't get it to work.

### Conclusion

While MULTIDOS 80/64 isn't fully compatible with Model I, III, or 4 programs, it does have some features you can't find anywhere else. MULTIDOS 80/64 has utility for a select audience and you may just be one of them. ■

## Typitall: A Script Alternative

by David Dalton

★★★★

**Typitall** runs on the Models I, III (48K) and 4/4P (64K) and requires one disk drive. Howe Software, 14 Lexington Road, New City, NY 10956, 914-634-1821. \$129.95. With spelling checker, \$179.95.

Easy to use: ★★★★★  
Good docs: ★★★★★  
Bug free: ★★★★★  
Does the job: ★★★★★

If you're a Model III Scriptit user who has moved up to a Model 4, you'll probably like Typitall, an inexpensive and capable word processor.

While Typitall uses some of the Model 4's extra features, such as the 80-column screen and the function keys, it doesn't use the extra memory available with 128K systems. Under TRSDOS 6.X, Typitall holds only 41K of text. It also doesn't use the Model 4's reverse video to highlight text, as SuperScriptit does.

### Features

Typitall adds some important features missing from Model I/III Scriptit. You can send special codes to the printer, for example, and execute DOS commands from within the program. You can even exit to DOS, do a few chores (such as formatting a disk), and return to Typitall with your text intact.

Typitall calls help files at the touch of a key, and updates a status line at the bottom of the screen after each keystroke. It displays the current line number, the length of the line, the line width, the document length, and the amount of free space in bytes.

Inserting new text within old was always a pain with Scriptit. Typitall makes it easier with the function keys. F1 opens a line for inserting text, F2 deletes one character, and F3 rejoins lines after an insert. You use control-M to switch back and forth between overstrike and insert mode.

You print files to the screen or to a disk file. Printing to the screen lets you check your format without wasting paper. You can also print to the screen using small graphics blocks instead of text, which will display how the pages will look.

One nice Typitall feature is its printer spooler. You can save a document to a disk file and have Typitall print the file while you work on something else. Typitall has some limitations here, though. It may ignore your keystrokes while it goes to the disk for the next block of text to print, and a noticeable system slow-

down signifies that you're using the spooler. Printing from TRSDOS's Memdisk isn't as slow.

### Customizing

You can modify many of the program's features and parameters and save them to disk permanently. You can, for example, change the rate at which keys repeat or set up a default file name extension.

You can also set up printer parameters, such as whether your printer expects line feeds, and send command strings to reset the printer each time you print a file. Typitall's printer support is good, but it doesn't support proportional spacing or serial printers. You can set up sequences of keystrokes and save them permanently. Thereafter, you can call often-used command routines or character strings with one keystroke. This is a good way to save printer-control lines that you use frequently.

To give you more room for your documents, Typitall uses several overlays. That means that only part of the program resides in memory at any one time. If you want to print a file, Typitall reads the printing overlay from disk, as it does the help files. You can circumvent this process by copying the overlays and help files to Memdisk and customizing Typitall so that it accesses Memdisk before loading an overlay. This makes things run faster.

### Problems

Typitall did several weird things with my documents. I was unable to reproduce the problem, but a couple of times my screen width changed of its own accord and the text became skewed, though I lost none. Sometimes an invalid command will slightly alter the appearance of your text at the cursor location.

### Spelling Checker

The spelling checker, which only costs an extra \$50, contains about 29,000 words. It's slow, awkward to use, and the size of the document that it checks is limited by available memory. The checker sorts your document to make a list of unique words, looks up the words in the dictionary, and drops them into a block at the top of your file. You use a Hunt command to find each misspelled word in your document. You can add to the dictionary and create your own special dictionaries.

### Conclusion

Typitall lacks the power of SuperScriptit, the pizzazz of LeScript, and the class of Allwrite. But not everyone can deal with Allwrite's price tag or SuperScriptit's complexity. This isn't the ultimate word processor, but a valid alternative to Scriptit. ■

## WordPerfect 4.0

★★★★★

**WordPerfect 4.0** runs on the Tandy 1000, 1200, and 2000 (256K), requires two disk drives and MS-DOS 2.X. Satellite Software International, 288 W. Center St., Orem, UT 84057. 801-224-4000. \$495 (includes mail-merge and spelling checker with 100,000-word dictionary).

I described Microsoft Word 2.0 as a "first-strike thermonuclear word processor" (August 1985, p. 114). However, I forgot that superpowers come in twos. WordPerfect 4.0, like Word, is an awesome program built for high-volume professional writing that is wasted on occasional correspondence. In many ways, it's even mightier than its Microsoft rival.

Most of WordPerfect's advantages involve extra convenience. It's not copy-protected (which I appreciate after seeing my one legal copy of Word disappear in a hard disk crash) and it can automatically save your file at specified intervals. The spelling dictionary is bigger. It can not only format columns of text but also add columns of numbers. And the screen display shows the page and line position indicator that Word inexplicably forgot.

But, WordPerfect isn't as dazzling in the "what you see is what you get" department: There's no on-screen justification or multiple windows, and less virtuosity at mixing dozens of fonts for a laser typesetter (though you can install up to five printers instead of the usual one). And it doesn't have an undelete function.

Compared to Word's layered alphabetic menus, WordPerfect's 40-plus commands (all done with the function and control, alternate, and shift keys) take extra memorization. The manual, while first-rate, is useless without the supplied function-key template.

With the color-coded template before you, you'll fly through mountainous papers or reports. Some programs can't print footnotes; WordPerfect automatically numbers and formats notes up to 16,000 lines long, not to mention doing indexes, tables of contents, and Think-Tank-style outlines. Some auxiliary programs such as SuperKey allow multi-keystroke macros and file access passwords; WordPerfect has them built in.

Once you turn off its automatic hyphenation (it brings winged thoughts to a screeching halt a dozen times per page), WordPerfect will quickly and unobtrusively do any word processing job. Microsoft Word is flashier (on-screen boldface italics edited with a mouse), but WordPerfect is an unbeatable powerhouse. It's expensive, but definitive.

—Eric Grevstad

## Telecommuter

★★★★★

**Telecommuter** runs on the Tandy 1000, 1200, and 2000 (256K) and requires one disk drive and MS-DOS 2.X. Siga Systems, Inc., 19 Pelham Road, Weston, MA 02193. 617-647-1098. Write-It \$125. XModem \$200. Standard \$200. Deluxe \$300. Plus \$400.

Telecommuter is an enhanced version of a program called Remote Control, which *80 Micro* reviewed in June 1985 (p. 113). As with Remote Control, Telecommuter provides a direct link between the Model 100/200 and a remote Tandy 1000/1200/2000 (which needs an auto-answer modem). You can access your PC over the phone to execute file transfers, DOS commands, and print documents, and even run programs. It is a significant enhancement for those who travel or use a portable when away from their PCs.

The different versions of Telecommuter are built around the same core program. Write-It only provides word-processing and fast file transfers. XModem includes protocol file transfer with the TELCOM mode. The Standard Telecommuter includes TELCOM and a host mode, and Deluxe provides access to the DOS and a multiple access level host mode. Telecommuter Plus has all the features of the other versions in one package.

The TELCOM mode is similar to the Model 100's, and there is a fast file transfer mode. The text processing mode uses many of the same commands as the 100/200's Text.

Telecommuter is better than the Remote Control program: The null modem cable is now sturdier and longer; there is single key redial in TELCOM mode from the PC; you have the option to automatically run application programs upon log-on in host mode; and there is a simulated sign-off if you lose your connection.

Also, text processing is more versatile. You can now append files to existing ones, or take them from disk and place them in text. You can divide large jobs into a series of small ones by using a command file to call files to be printed. You can write and print form letters. You can send printer output to the screen for preview or to a disk file.

Telecommuter can automatically sense whether you have a monochrome or color graphics board, but there is only one choice of display colors.

What was a very good manual is now even better. It has been split into two books, one for setting up and word processing, the other for telecommunications. The documentation leads you through the system, with many examples. Also enclosed are two reference

cards with the communications and word processing commands.

Telecommuter links your 100/200 and your PC, giving you access to the PC's power while retaining your lap-top's portability.

—Thomas L. Quindry

## How to Use Your Radio Shack Printer

★★★★★

By William Bardin Jr. 204 pp. Softcover. Tandy/Radio Shack, One Tandy Center, Fort Worth, TX 76108. Radio Shack Catalog #26-1242. \$14.95.

If you use any of the Radio Shack printers, whether it's a dot-matrix, daisy-wheel, or printer-plotter, then you need *How to Use Your Radio Shack Printer*. This book has an enormous amount of information, which at times is overwhelming. While it isn't thorough enough in some areas, no other source is as helpful for Radio Shack users.

This book covers all the printers carried by Radio Shack at the time it was printed: the CGP-115 and 220; the DMP-100, 110, 120, 200, 400, 420, 500, 2100, and 2100P; the DW I, II, and IIB; the DWP-210 and 410; the LP I, II, III, IV, V, VI, VII, and VIII; the QP I and II; the TP-10; and the Plotter/printer.

The later printers, such as the DMP-105, aren't included, but Barden notes that the newer printers can emulate at least one of the printers in the book. Even if your printer isn't listed, you can still use the book.

The book contains 12 chapters organized into three sections: Printer Basics, Printing Text, and Printing Graphics.

Printer Basics takes a brief look at the Radio Shack printer line, how printers form characters and communicate with computers, characters printed, simple programs for underlining and graphics, and a master index on the abilities of the various printers.

The next three chapters deal with printing text, first with normal text and simple word processing, then word processing functions such as wordwrap, justification, and proportional spacing. The last chapter in this section deals with such uses as mail labels, boilerplate form letters, and screen-printing text to your printer.

The final section tackles graphics: normal, screen, and creative printing. Normal printing uses the printer's built-in graphics characters to make boxes, graph forms, butterflies, and large characters.

The chapter on creative graphics shows you how to design characters and create pictures with direct dot-addressing.

There's even a short section on using daisy-wheel printers to make graphs using the period and other characters.

Barden's book is well written, with many examples and dozens of printer hints. The hints are placed into sidebars, and give information about such things as the impression level and ribbon feed in daisy-wheels, or generating Japanese Kana symbols with the LP VIII and DMP-200, 400, 420, and 500.

The book's major fault is that it attempts to cover everything, while not providing enough in-depth information about any one printer. You need your printer manual and this book side-by-side.

One other limitation is that there aren't enough examples. This is especially true in the discussions on graphics.

Despite its problems, this is one book you should have if you own a Radio Shack printer or want to write programs that use standard Radio Shack printers.

—Terry Kepner

## PRO-X-FTS

★★★★★

**PRO-X-FTS** runs on the Model 4/4P (64K), and requires one disk drive and an RS-232. Misosys Inc., P.O. Box 239, Sterling, VA 22170-0239. 703-450-4181. \$24.95.

PRO-X-FTS is an XModem file transfer utility for making error-free transmissions between computers. It's not a full-featured telecommunications program. Instead, it's meant to be used along with a program such as COMM, which is supplied with TRSDOS 6.X.X.

XModem, the Ward Christensen protocol for error-free file transfer, is a de facto standard, and you can use it to download thousands of public domain programs.

If you use TRSDOS 6.2, you execute PRO-X-FTS from within your communications program by pressing clear/shift/0. With other DOSes (6.0, 6.1, DOS-PLUS IV), you must exit your communications program, invoke PRO-X-FTS, and return to the program once the file transfer is complete.

I used the program on a Model 4 running TRSDOS 6.2 to transfer a few programs from my Compaq, and it worked well.

The PRO-X-FTS utility is well worth the price, and makes error-free transfers easily, either locally between computers or from bulletin boards. I always wondered why the authors of TRSDOS and LDOS omitted XModem from COMM. Without it, LCOMM and COMM are only half the communication programs they could be. PRO-X-FTS makes them what they should be: useful.

—Gary Shade

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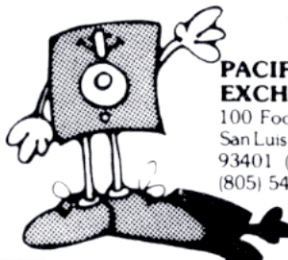
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```

858 RETURN
859
860 ' This routine handles a putchar statement. On entry, fpos will point
861 ' to the left paren of the function call.
862
863 WHILE CPROG$(FPOS) <> "(" : FPOS=FPOS+1 : WEND
864
865 C% = FPOS : ' save fpos
866 GOSUB 1828 : ' get the parameter
867 IF TOKEN.TYP < 4 THEN 908
868 FPOS = C%
869
870 WHILE CPROG$(FPOS) <> CHR$(39) : FPOS = FPOS+1 : WEND
871 FPOS = FPOS+1 : IF CPROG$(FPOS) = "n" THEN CPROG$(FPOS) = CHR$(13) ELSE IF CPROG$(FPOS) = "t" THEN CPROG$(FPOS) = CHR$(9) ELSE PRINT "Error - Illegal control character": STOP
872
873 PRINT CPROG$(FPOS) : FPOS = FPOS+1 : GOTO 1818
874
875 GOSUB 1828 : CL% = TEMPVAR.COUNT+GLOBAL.COUNT : WHILE VAR.NAMES$(CL%) <> TOKEN.VAL$ : CL% = CL%+1 : WEND : ' find var
876
877 IF CL% = 8 THEN PRINT "Putchar - Identifier not declared": STOP
878 PRINT CHR$(VAR.INT$(CL%)) :
879 WHILE CPROG$(FPOS) <> "(" : FPOS = FPOS+1 : WEND
880 RETURN
881
882 ' This routine handles a getchar statement. On entry, fpos points to the
883 ' character following the keyword getchar. The keyboard entry will be
884 ' placed into the interpreter global function return variable, Func.ret.
885 At exit, fpos will point to the character following the close paren of
886 ' the function call.
887
888 BS=INKEY$ : IF BS="" THEN 1100
889 FUNC.RET = ASC(BS)
890 WHILE CPROG$(FPOS) <> "(" : FPOS = FPOS+1 : WEND
891 RETURN
892
893 ' Routine to handle the int declaration, during a function exec
894
895 ' This routine merely places the name into the tempvar.name array, and
896 ' sets the tempvar.val to zero.
897
898 ' This routine assumes that the tempvar.name array has been initialized
899 ' to hold null strings and tempvar.count was set to zero at init
900
901 WHILE TOKEN.VAL$ <> " "
902 GOSUB 1828 : TEMPVAR.COUNT = TEMPVAR.COUNT + 1
903 VAR.NAMES$(GLOBAL.COUNT+TEMPVAR.COUNT) = TOKEN.VAL$
904 VAR.INT$(GLOBAL.COUNT+TEMPVAR.COUNT) = 0
905 GOSUB 1828
906 WEND
907
908 ' Routine to clear out the temporary variable arrays, and set local
909 ' variable count to zero.
910
911 FOR CL% = 1 TO TEMPVAR.COUNT
912 VAR.NAMES$(GLOBAL.COUNT+CL%) = "" : VAR.INT$(GLOBAL.COUNT+CL%) = 0
913 NEXT CL%
914 TEMPVAR.COUNT = 0
915
916 ' This routine gets called when the first token of a
917 ' statement is not in one of the keywords recognized. In end, it
918 ' should only be called when an identifier is located, as in an
919 ' arithmetic statement. It will be assumed here that that is why
920 ' this routine is being called.
921
922 CL% = GLOBAL.COUNT+TEMPVAR.COUNT : BS = TOKEN.VAL$ : WHILE (VAR.NAMES$(CL%) <> BS) A
923 ND (CL% > 1) : CL% = CL%-1 : WEND
924 IF CL% = 8 THEN PRINT "Statement Error - Variable Not declared": STOP
925
926 GOSUB 1828 : ' get the next token
927 IF TOKEN.VAL$ = "++" THEN VAR.INT$(CL%) = VAR.INT$(CL%)+1 : RETURN
928 IF TOKEN.VAL$ = "--" THEN VAR.INT$(CL%) = VAR.INT$(CL%)-1 : RETURN
929 IF TOKEN.VAL$ = "*" THEN PRINT "Syntax error": STOP
930 IF TOKEN.TYP < 1 THEN 1660
931
932 IF TOKEN.TYP < 1 THEN 1660
933 IF TOKEN.VAL$ = "GETCHAR" THEN GOSUB 1100 : VAR.INT$(CL%) = FUNC.RET : RETURN
934 CL% = TEMPVAR.COUNT+GLOBAL.COUNT : WHILE VAR.NAMES$(CL%) <> TOKEN.VAL$ : CL% = CL%+1 : WEND : IF CL% = 8 THEN PRINT "Variable Used - Not declared": STOP
935
936 ' This routine starts at fpos, and places the next input token
937 ' (keyword, number, token) up to a delimiter into the string tokens.
938 ' Valid delimiters are: space, (, ), {, }, and comma and <cr>.
939 ' Note that upon exit, fpos is updated to point to the next character
940 ' to be processed in the source program, following tokens.
941
942 ' Leading spaces and or tabs are ignored.
943
944 ' The delimiter reached is returned in variable delims.
945
946 ' The token.typ is either 1 = identifier, 2 = number(int), 3 = delim agn
947 ' The token.val$ will have the string of the token found.
948
949 ' token.typ of 4 = string in double quotes, 5 = string single quotes
950 ' token.typ of 99 if fpos should get greater than eofc.
951
952 DELIMS = "" : TOKEN.VAL$ = "" : TOKEN.TYP = 0
953 WHILE (CPROG$(FPOS) = " ") OR (CPROG$(FPOS) = CHR$(9)) OR (CPROG$(FPOS) = CHR$(13))
954 FPOS = FPOS + 1
955 IF FPOS >= EOFC THEN TOKEN.TYP = 99 : TOKEN.VAL$ = "" : RETURN
956 WEND
957
958 IF FPOS = EOFC THEN TOKEN.TYP = 99 : TOKEN.VAL$ = CPROG$(FPOS) : DELIMS = CPROG$(FPOS) : RETURN
959
960 IF DELIMS = CPROG$(FPOS)
961 IF CPROG$(FPOS+1) <> " " THEN 1940
962 IF DELIMS = "/" THEN 1940
963 FPOS = FPOS + 2
964 WHILE (CPROG$(FPOS) <> " ") : FPOS = FPOS+1 : WEND
965 IF (CPROG$(FPOS-1) <> " ") THEN FPOS = FPOS+1 : GOTO 1928 ELSE FPOS=FPOS+1 : GOT
966 O 1828
967
968 IF DELIMS = "(" OR DELIMS = ")" OR DELIMS = "{" OR DELIMS = "}" OR DELIMS = "<" OR DE
969 LIMS = CHR$(13) OR DELIMS = ";" OR DELIMS = "," THEN TOKEN.TYP = 3 : TOKEN.VAL$ = DELIMS :
970 FPOS = FPOS + 1 : RETURN
971
972 IF DELIMS = "+" THEN
973 THEN TOKEN.TYP = 3 : IF CPROG$(FPOS+1) = "-" THEN TOKEN.VAL$ = "-":
974 FPOS=FPOS+2 : RETURN ELSE TOKEN.VAL$ = DELIMS : FPOS=FPOS+1 : RETURN
975
976 IF DELIMS = "-" THEN IF CPROG$(FPOS+1) = "+" THEN TOKEN.TYP = 3 : TOKEN.VAL$ = "+":
977 FPOS=FPOS+2 : RETURN ELSE TOKEN.TYP = 3 : TOKEN.VAL$ = "-": FPOS=FPOS+1 :
978 RETURN
979
980 IF DELIMS = "++" THEN
981 THEN TOKEN.TYP = 3 : IF CPROG$(FPOS+1) = "--" THEN TOKEN.VAL$ = "--":
982 FPOS=FPOS+2 : RETURN ELSE FPOS=FPOS+1 : RETURN
983
984 IF DELIMS = "--" THEN
985 THEN TOKEN.TYP = 3 : IF CPROG$(FPOS+1) = "++" THEN TOKEN.VAL$ = "++":
986 FPOS=FPOS+2 : RETURN ELSE FPOS=FPOS+1 : RETURN
987
988 IF DELIMS = "*" THEN
989 THEN TOKEN.TYP = 3 : FPOS = FPOS + 1 : RETURN
990
991 IF DELIMS = "/" THEN
992 THEN TOKEN.TYP = 3 : FPOS = FPOS + 1 : RETURN
993
994 IF DELIMS = "<" THEN
995 THEN FPOS = FPOS + 1 : RETURN
996
997 IF DELIMS = ">" THEN
998 THEN FPOS = FPOS + 1 : RETURN
999
1000 IF DELIMS = "(" THEN
1001 THEN FPOS = FPOS + 1 : RETURN
1002
1003 IF DELIMS = ")" THEN
1004 THEN FPOS = FPOS + 1 : RETURN
1005
1006 IF DELIMS = "{" THEN
1007 THEN FPOS = FPOS + 1 : RETURN
1008
1009 IF DELIMS = "}" THEN
1010 THEN FPOS = FPOS + 1 : RETURN
1011
1012 IF DELIMS = ";" THEN
1013 THEN FPOS = FPOS + 1 : RETURN
1014
1015 IF DELIMS = "," THEN
1016 THEN FPOS = FPOS + 1 : RETURN
1017
1018 IF DELIMS = "<cr>" THEN
1019 THEN FPOS = FPOS + 1 : RETURN
1020
1021 IF DELIMS = "<lf>" THEN
1022 THEN FPOS = FPOS + 1 : RETURN
1023
1024 IF DELIMS = " " THEN
1025 THEN FPOS = FPOS + 1 : RETURN
1026
1027 IF DELIMS = " " THEN
1028 THEN FPOS = FPOS + 1 : RETURN
1029
1030 IF DELIMS = " " THEN
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1467 THEN FPOS = FPOS + 1 : RETURN
1467
1467 IF DELIMS = " " THEN
1468 THEN FPOS = FPOS + 1 : RETURN
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1468 IF DELIMS = " " THEN
1469 THEN FPOS = FPOS + 1 : RETURN
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1469 IF DELIMS = " " THEN
1470 THEN FPOS = FPOS + 1 : RETURN
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1470 IF DELIMS = " " THEN
1471 THEN FPOS = FPOS + 1 : RETURN
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1471 IF DELIMS = " " THEN
1472 THEN FPOS = FPOS + 1 : RETURN
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1473 IF DELIMS = " " THEN
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1474 IF DELIMS = " " THEN
1475 THEN FPOS = FPOS + 1 : RETURN
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1475 IF DELIMS = " " THEN
1476 THEN FPOS = FPOS + 1 : RETURN
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1483 IF DELIMS = " " THEN
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1490 IF DELIMS = " " THEN
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1491 IF DELIMS = " " THEN
1492 THEN FPOS = FPOS + 1 : RETURN
1492
1492 IF DELIMS = " " THEN
1493 THEN FPOS = FPOS + 1 : RETURN
1493
1493 IF DELIMS = " " THEN
1494 THEN FPOS = FPOS + 1 : RETURN
1494
14
```

Listings 1 continued

```

3338 GOSUB 3928: GOTO 3378
3348 IF HOLDI.OPRW <> "I" THEN PRINT "IF - Invalid compare operator":STOP
3358 IF VAR.INT(XLW) <> HOLDI.VAL THEN GOSUB 3478: DO:ELSE = 1: GOTO 3378
3368 GOSUB 3928: GOTO 3378
3378 HOLDI.POS2 = FPOS
3388 GOSUB 1828: ' get next token
3398 IF TOKEN.VAL <> "ELSE" THEN FPOS = HOLDI.POS2: RETURN
3408 IF DO.ELS=0 THEN GOSUB 1828:GOSUB 3478: RETURN
3418 GOSUB 1828: IF TOKEN.VAL <> "{" THEN HOLDI.EXIT$="}" ELSE HOLDI.EXIT$="}"
3428 GOSUB 3928: RETURN
3438 '-----
3448 ' This routine handles an if block or statement that is either the
3458 ' valid if part or the else part.
3468 '-----
3478 WHILE TOKEN.VAL <> HOLDI.EXIT$
3488 IF TOKEN.VAL="PRINT" THEN GOSUB 658 ELSE IF TOKEN.VAL="PUTCHAR" THEN
GOSUB 988 ELSE IF TOKEN.VAL="FOR" THEN GOSUB 2588 ELSE IF TOKEN.VAL="WHIL
E" THEN GOSUB 3578 ELSE IF TOKEN.TYP = 1 THEN GOSUB 1448
3498 GOSUB 1828: ' get next token
3508 WEND
3518 IF TOKEN.VAL$="" THEN TOKEN.VAL$="": ' fix up so do not quit yet
3528 RETURN
3538 '-----
3548 ' This routine handles the while statement. Note that only the simple
3558 ' conditional operators are allowed. No And's or Or's !
3568 '-----
3578 GOSUB 1828: ' Get the (
3588 GOSUB 1828: ' Get the variable. Note, it must be a variable name
3598 CLW$=TEMPVAR.COUNT+GLOBAL.COUNT:
WHILE (VAR.NAMES{CLW$} <> TOKEN.VAL$) AND (CLW$>=1) :
CLW$=CLW$+1:
WEND
3608 IF CLW$=0 THEN PRINT"While - Variable Not Declared":STOP
3618 CLW$ = CLW$
3628 GOSUB 1828: HOLD.OPRW$=TOKEN.VAL$: ' Get operator, check it later
3638 GOSUB 1828: IF TOKEN.TYP < 1 THEN 3668
3648 CLW$=TEMPVAR.COUNT+GLOBAL.COUNT: WHILE VAR.NAMES{CLW$} <> TOKEN.VAL$ AND CLW$
>=1:
CLW$=CLW$+1:WEND: IF CLW$=0 THEN PRINT"While - Variable not declared":STOP
3658 HOLD.VALW = VAR.INT(XLW$): GOTO 3678
3668 HOLD.VALW = VAL(TOKEN.VAL$)
3678 GOSUB 1828: ' get closing paren )
3688 GOSUB 1828: HOLD.POSW = FPOS - LEN(TOKEN.VAL$)
3698 IF HOLD.OPRW$ <> "<" THEN 3768
3708 WHILE (VAR.INT(XLW$) < HOLD.VALW)
3718 FPOS = HOLD.POSW
3728 GOSUB 1828: IF TOKEN.VAL$="{ " THEN HOLD.EXITW$="}" ELSE HOLD.EXITW$=","
3738 GOSUB 4888: ' process a block or statement
3748 WEND
3758 RETURN
3768 IF HOLD.OPRW$ <> ">" THEN 3838
3778 WHILE (VAR.INT(XLW$) > HOLD.VALW)
3788 FPOS = HOLD.POSW
3798 GOSUB 1828: IF TOKEN.VAL$="{ " THEN HOLD.EXITW$="}" ELSE HOLD.EXITW$=","
3808 GOSUB 4888: ' go process the statement
3818 WEND
3828 RETURN
3838 IF HOLD.OPRW$ <> "=" THEN 3908
3848 WHILE (VAR.INT(XLW$) = HOLD.VALW)
3858 FPOS = HOLD.POSW
3868 GOSUB 1828: IF TOKEN.VAL$="{ " THEN HOLD.EXITW$="}" ELSE HOLD.EXITW$=","
3878 GOSUB 4888: ' go process statement
3888 WEND
3898 RETURN
3908 IF HOLD.OPRW$ <> "!=" THEN PRINT "While - Invalid Conditional Operator":STOP
3918 WHILE (VAR.INT(XLW$) <> HOLD.VALW)
3928 FPOS = HOLD.POSW
3938 GOSUB 1828: IF TOKEN.VAL$="{ " THEN HOLD.EXITW$="}" ELSE HOLD.EXITW$=","
3948 GOSUB 4888: ' go process statement
3958 WEND
3968 RETURN
3978 '-----
3988 ' This routine handles the statement blocks for the while statement.

```

```

3998 '-----
4008 WHILE TOKEN.VAL$ <> HOLD.EXITW$
4018 IF TOKEN.VAL$="PRINT" THEN GOSUB 658 ELSE IF TOKEN.VAL$="PUTCHAR" THEN GO
SUB 988 ELSE IF TOKEN.VAL$="IF" THEN GOSUB 3148 ELSE IF TOKEN.VAL$="FOR" THEN GO
SUB 2588 ELSE IF TOKEN.TYP=1 THEN GOSUB 1448
4028 GOSUB 1828: ' get next token
4038 WEND
4048 IF TOKEN.VAL$="" THEN TOKEN.VAL$="": ' fix up so as not to quit
4058 RETURN
End

```

### Program Listing 2. Demo of PRINTF statement.

```

10 MAIN()
20 {
30 PRINTF("\nHello World\n"); /* PRINT A MESSAGE */
40 }
End

```

### Program Listing 3. Demo of While statement. Copies input to output.

```

10 MAIN()
20 {
30 INT INT1;
40 PRINTF("\nCopy from input to output. Note this is slow\n");
50 PRINTF("Please press any keys, wait for display, CTRL-Q to quit\n");
60 WHILE (INT1 != 17) /* LOOP UNTIL THE CTRL-Q IS PRESSED */
70 {
80 INT1 = GETCHAR();
90 PUTCHAR(INT1);
100 }
110 PRINTF("\nTest Completed\n"); /* TELL THEM WE ARE DONE */
End

```

### Program Listing 4. Demo of For loop.

```

10 MAIN()
20 {
30 INT I1,I2,I3,I4;
40 PRINTF("\nExample of a For Loop\n");
50 I2 = 2 + 13;
60 I4 = 7; /* LOOP FROM 2 TO 7 */
70 FOR (I1=I2;I1<=I4;I1++)
80 {
90 I2++;
100 PRINTF("In Loop, i1 = %d, i2 = %d\n",I1,I2);
110 }
120 PRINTF("\nOut of Loop Successfully\n");
130 }
End

```

### Program Listing 5. Demo of If statement, the single statement type.

```

10 MAIN()
20 {
30 INT IN1, IN2, IN3, IN4;
40 PRINTF("\nDemonstration of the IF Statement\n");
50 IN1 = 100;
60 IN3 = 50 + IN1;
End

```

Listing 5 continued

```

70 PRINTF("IN1 = %d, and IN3 = %d\n", IN1, IN3);
80 PRINTF("Since in3 > in1, you will see the greater message\n");
90 IF (IN3 > IN1)
100 PRINTF("\nIN3 is greater than IN1\n");
110 ELSE
120 PRINTF("\nIN3 is Not greater than IN1\n");
130 )

```

End

Program Listing 6. Demo of For loop, used to print a table of squares for 1 to 10.

```

10 MAIN()
20 {
30 INT I1, J1, K1;
40 PRINTF("\nTable of squares\n");
50 PRINTF("-----\n");
60 FOR (I1=1; I1<=10; I1++)
70 {
80 K1 = I1 * I1;
90 PRINTF("%d\t", I1, K1);
100 }
110 PRINTF("\n-----\n");
120 }

```

End

Program Listing 7. Demo of If statement nested in a For loop to display odd and even numbers between 1 and 10.

```

10 MAIN()
20 {
30 INT I1, I2, I3, I4;
40 PRINTF("\nTable of odd and even\n");
50 PRINTF("-----\n");
60 FOR (I1=1; I1<=10; I1++)
70 {
80 I2 = I1 / 2;
90 I3 = I2 * 2;
100 IF (I3 == I1)
110 PRINTF("%d\t", even, I1);
120 ELSE
130 PRINTF("%d\t", odd, I1);
140 }
150 PRINTF("\n-----\n");
160 }

```

End

Program Listing 8. Demo of While loop nested within For loop. Note that interpreter will not allow For or While loops to be nested, but will work with one of each.

```

10 MAIN()
20 {
30 INT I1, I2, I3, I4, I5;
40 PRINTF("\nDemonstration of Nested For and while loops\n");
50 FOR (I1=1; I1<=4; I1++)
60 {
70 PRINTF("In For, i1 = %d\n", I1);
80 I2 = 0;
90 WHILE (I2 < 2)
100 {
110 PRINTF("In While, I2 = %d\n", I2);
120 I2++;
130 }
140 }
150 PRINTF("\nDemo finished\n");
160 }

```

End

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```

1610 REM ** Convert buffer variables to A ( ) **
1620 GET 1, R1A(2)-CVI(0BS):A(3)-CVI(2MS):A(4)-CVI(PAS):A(5)-CVI(FPS)
1630 A(6)-CVI(FTS):A(7)-CVI(2S):A(8)-CVI(P3S):A(9)-CVI(P5S)
1640 A(10)-CVI(SAS):A(11)-CVI(OOS):A(12)-CVI(DRS):A(13)-CVI(TRS)
1650 A(14)-CVI(RAS):A(15)-CVI(TNS):A(16)-CVI(AAS):A(17)-CVI(DFS)
1660 A(18)-CVI(STS):A(19)-CVI(BSS):A(20)-CVI(POS):RETURN
1670 REM ** Subroutine to print stats from PGM to fouls **
1680 GOSUB 1230 :LPRINT USING T$; A(3);GOSUB 1230 :LPRINT USING T$; A(4);
1690 GOSUB 1230 :LPRINT USING T$; A(5);GOSUB 1230 :LPRINT USING T$; A(6);
1700 FOR Y=6 TO 17:LPRINT USING T$; A(Y);NEXT Y:GOSUB 1230
1710 LPRINT USING T$; A(8);GOSUB 1230 :LPRINT USING T$; A(9);GOSUB 1240
1720 LPRINT USING T$; A(10);GOSUB 1230
1730 FOR Y=11 TO 13:LPRINT USING T$; A(Y);NEXT Y:GOSUB 1240
1740 LPRINT USING T$; A(14);GOSUB 1230
1750 FOR Y=15 TO 20:LPRINT USING T$; A(Y);NEXT Y:LPRINT "":RETURN
1760 REM ** Convert T(X,Y) to A(Y) **
1770 FOR Y=1 TO 20:A(Y)=T(X,Y):NEXT Y:RETURN
1780 REM ** Main Menu **
1790 CLS:PRINTTAB(21);"Basketball Statistics"
1800 PRINTTAB(38);"Menu"
1810 PRINTTAB(6);"A) Initialize information for a new team"
1820 PRINTTAB(6);"B) Add a player to the roster."
1830 PRINTTAB(6);"C) Make corrections to previously entered information"
1840 PRINTTAB(6);"D) Type in statistics for a game"
1850 PRINTTAB(6);"E) Print the team record"
1860 PRINTTAB(6);"F) Print team totals (game by game - with opponents)"
1870 PRINTTAB(6);"G) Print team totals (with up-to-date totals for players)"
1880 PRINTTAB(6);"H) Print statistics for an individual player"
1890 PRINTTAB(6);"I) Print statistics for a particular game"
1900 PRINTTAB(6);"J) Exit the program"
1910 PRINTTAB(6);"K) Enter your choice (A - J) from above:"
1920 T$="":GOTO 1790
1930 POKE 16489,1:TS=INKEY$:IF LEN(T$)=0 THEN 1930
1940 T=INSTR("ABCDEFGHIJK",TS):IF T=0 THEN 1930
1950 POKE 16489,T
1960 ON T GOSUB 4590,4480,3390,1990,2510,2600,2730,2910,3120,120
1970 GOTO 1790
1980 REM ** Type in statistics for a game **
1990 CLS:PRINTTAB(23);"Update Statistics"
2000 PRINTTAB(28);"Game #:"G1:PRINTTAB(30);STRINGS(50,140):POKE 16916,4
2010 PRINT:"This section allows you to type in the statistics for"
2020 PRINT:"a game. All fields will be updated. Are you certain that"
2030 PRINT:"you wish to type in game statistics?"
2040 IF T$="N" THEN 2490
2050 G=1:GOSUB 440 :GOSUB 360
2060 PRINT:GOSUB 440 :GOSUB 360
2070 PRINT:"Please type in the following information:"
2080 PRINT:"Name of opponent":INPUT O$
2090 IF LEN(O$)>14 THEN PRINT:"Name can not exceed 14 letters.":GOSUB 160:
2100 GOTO 2060
2110 PRINT:GOSUB 440 :GOSUB 360
2120 IF LEN(D$)>8 THEN 2090
2130 PRINT:GOSUB 440 :GOSUB 360
2140 CLS:PRINT:"Now enter the statistics for each player on"
2150 PRINT:"your roster. You will be asked if you wish to update"
2160 PRINT:"each player. If you answer 'yes', then you will type"
2170 PRINT:"in the numbers for each of the 13 categories."
2180 PRINT:"Remember that you may just press <ENTER> to put"
2190 PRINT:"a zero for any category."
2200 PRINT:"When you have completed entering the statistics"
2210 PRINT:"for a player, you will be asked if these are correct."
2220 PRINT:"If you have made an error, you will need to re-enter all"
2230 PRINT:"the statistics for that player."
2240 REM ** Players Input **
2250 FOR X=1 TO P$GOSUB 510
2260 PRINT:GOSUB 510
2270 IF T$="N" THEN 2300
2280 T(X,1)=T(X,1)+1:A(1)=1
2290 PRINT:GOSUB 510 :GOSUB 510
2300 IF T$="N" THEN 2270
2310 GOSUB 660 :GOSUB 750 :GOSUB 770 :GOSUB 800 :GOSUB 880 :NEXT X
2320 REM ** Team Totals **
2330 GOSUB 900 :GOSUB 1000 :GOSUB 1100 :GOSUB 1200 :GOSUB 1300 :GOSUB 1400 :GOSUB 1500 :GOSUB 1600 :GOSUB 1700 :GOSUB 1800 :GOSUB 1900 :GOSUB 2000 :GOSUB 2100 :GOSUB 2200 :GOSUB 2300 :GOSUB 2400 :GOSUB 2500 :GOSUB 2600 :GOSUB 2700 :GOSUB 2800 :GOSUB 2900 :GOSUB 3000 :GOSUB 3100 :GOSUB 3200 :GOSUB 3300 :GOSUB 3400 :GOSUB 3500 :GOSUB 3600 :GOSUB 3700 :GOSUB 3800 :GOSUB 3900 :GOSUB 4000 :GOSUB 4100 :GOSUB 4200 :GOSUB 4300 :GOSUB 4400 :GOSUB 4500 :GOSUB 4600 :GOSUB 4700 :GOSUB 4800 :GOSUB 4900 :GOSUB 5000 :GOSUB 5100 :GOSUB 5200 :GOSUB 5300 :GOSUB 5400 :GOSUB 5500 :GOSUB 5600 :GOSUB 5700 :GOSUB 5800 :GOSUB 5900 :GOSUB 6000 :GOSUB 6100 :GOSUB 6200 :GOSUB 6300 :GOSUB 6400 :GOSUB 6500 :GOSUB 6600 :GOSUB 6700 :GOSUB 6800 :GOSUB 6900 :GOSUB 7000 :GOSUB 7100 :GOSUB 7200 :GOSUB 7300 :GOSUB 7400 :GOSUB 7500 :GOSUB 7600 :GOSUB 7700 :GOSUB 7800 :GOSUB 7900 :GOSUB 8000 :GOSUB 8100 :GOSUB 8200 :GOSUB 8300 :GOSUB 8400 :GOSUB 8500 :GOSUB 8600 :GOSUB 8700 :GOSUB 8800 :GOSUB 8900 :GOSUB 9000 :GOSUB 9100 :GOSUB 9200 :GOSUB 9300 :GOSUB 9400 :GOSUB 9500 :GOSUB 9600 :GOSUB 9700 :GOSUB 9800 :GOSUB 9900 :GOSUB 10000 :GOSUB 10100 :GOSUB 10200 :GOSUB 10300 :GOSUB 10400 :GOSUB 10500 :GOSUB 10600 :GOSUB 10700 :GOSUB 10800 :GOSUB 10900 :GOSUB 11000 :GOSUB 11100 :GOSUB 11200 :GOSUB 11300 :GOSUB 11400 :GOSUB 11500 :GOSUB 11600 :GOSUB 11700 :GOSUB 11800 :GOSUB 11900 :GOSUB 12000 :GOSUB 12100 :GOSUB 12200 :GOSUB 12300 :GOSUB 12400 :GOSUB 12500 :GOSUB 12600 :GOSUB 12700 :GOSUB 12800 :GOSUB 12900 :GOSUB 13000 :GOSUB 13100 :GOSUB 13200 :GOSUB 13300 :GOSUB 13400 :GOSUB 13500 :GOSUB 13600 :GOSUB 13700 :GOSUB 13800 :GOSUB 13900 :GOSUB 14000 :GOSUB 14100 :GOSUB 14200 :GOSUB 14300 :GOSUB 14400 :GOSUB 14500 :GOSUB 14600 :GOSUB 14700 :GOSUB 14800 :GOSUB 14900 :GOSUB 15000 :GOSUB 15100 :GOSUB 15200 :GOSUB 15300 :GOSUB 15400 :GOSUB 15500 :GOSUB 15600 :GOSUB 15700 :GOSUB 15800 :GOSUB 15900 :GOSUB 16000 :GOSUB 16100 :GOSUB 16200 :GOSUB 16300 :GOSUB 16400 :GOSUB 16500 :GOSUB 16600 :GOSUB 16700 :GOSUB 16800 :GOSUB 16900 :GOSUB 17000 :GOSUB 17100 :GOSUB 17200 :GOSUB 17300 :GOSUB 17400 :GOSUB 17500 :GOSUB 17600 :GOSUB 17700 :GOSUB 17800 :GOSUB 17900 :GOSUB 18000 :GOSUB 18100 :GOSUB 18200 :GOSUB 18300 :GOSUB 18400 :GOSUB 18500 :GOSUB 18600 :GOSUB 18700 :GOSUB 18800 :GOSUB 18900 :GOSUB 19000 :GOSUB 19100 :GOSUB 19200 :GOSUB 19300 :GOSUB 19400 :GOSUB 19500 :GOSUB 19600 :GOSUB 19700 :GOSUB 19800 :GOSUB 19900 :GOSUB 20000 :GOSUB 20100 :GOSUB 20200 :GOSUB 20300 :GOSUB 20400 :GOSUB 20500 :GOSUB 20600 :GOSUB 20700 :GOSUB 20800 :GOSUB 20900 :GOSUB 21000 :GOSUB 21100 :GOSUB 21200 :GOSUB 21300 :GOSUB 21400 :GOSUB 21500 :GOSUB 21600 :GOSUB 21700 :GOSUB 21800 :GOSUB 21900 :GOSUB 22000 :GOSUB 22100 :GOSUB 22200 :GOSUB 22300 :GOSUB 22400 :GOSUB 22500 :GOSUB 22600 :GOSUB 22700 :GOSUB 22800 :GOSUB 22900 :GOSUB 23000 :GOSUB 23100 :GOSUB 23200 :GOSUB 23300 :GOSUB 23400 :GOSUB 23500 :GOSUB 23600 :GOSUB 23700 :GOSUB 23800 :GOSUB 23900 :GOSUB 24000 :GOSUB 24100 :GOSUB 24200 :GOSUB 24300 :GOSUB 24400 :GOSUB 24500 :GOSUB 24600 :GOSUB 24700 :GOSUB 24800 :GOSUB 24900 :GOSUB 25000 :GOSUB 25100 :GOSUB 25200 :GOSUB 25300 :GOSUB 25400 :GOSUB 25500 :GOSUB 25600 :GOSUB 25700 :GOSUB 25800 :GOSUB 25900 :GOSUB 26000 :GOSUB 26100 :GOSUB 26200 :GOSUB 26300 :GOSUB 26400 :GOSUB 26500 :GOSUB 26600 :GOSUB 26700 :GOSUB 26800 :GOSUB 26900 :GOSUB 27000 :GOSUB 27100 :GOSUB 27200 :GOSUB 27300 :GOSUB 27400 :GOSUB 27500 :GOSUB 27600 :GOSUB 27700 :GOSUB 27800 :GOSUB 27900 :GOSUB 28000 :GOSUB 28100 :GOSUB 28200 :GOSUB 28300 :GOSUB 28400 :GOSUB 28500 :GOSUB 28600 :GOSUB 28700 :GOSUB 28800 :GOSUB 28900 :GOSUB 29000 :GOSUB 29100 :GOSUB 29200 :GOSUB 29300 :GOSUB 29400 :GOSUB 29500 :GOSUB 29600 :GOSUB 29700 :GOSUB 29800 :GOSUB 29900 :GOSUB 30000 :GOSUB 30100 :GOSUB 30200 :GOSUB 30300 :GOSUB 30400 :GOSUB 30500 :GOSUB 30600 :GOSUB 30700 :GOSUB 30800 :GOSUB 30900 :GOSUB 31000 :GOSUB 31100 :GOSUB 31200 :GOSUB 31300 :GOSUB 31400 :GOSUB 31500 :GOSUB 31600 :GOSUB 31700 :GOSUB 31800 :GOSUB 31900 :GOSUB 32000 :GOSUB 32100 :GOSUB 32200 :GOSUB 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```

```

3130 IF G=0 THEN CLS:PRINT"There are no games played.":GOSUB 160 :GOTO 470
3134 CLS:PRINT TAB(12) "Print Statistics for a Particular Game"
3150 PRINT TAB(29) "Games":PRINT
3155 OPEN I="3","GAMES/TEXT"
3170 FOR Y1=1 TO GINPUTP3,OS,DS,H$,$U,ST:PRINT Y1;OS;" - ";H$,
3180 IF Y1<20 THEN 3200
3190 FOR X1=1 TO IE3:NEXT X1
3200 NEXT Y1:CLOS:PRINT
3220 PRINT:PRINT"Choose the number of the game you would like to see: ";
3225 LINE INPUT T$:T1=VAL(T$)
3230 IF T1<0 OR T1>G THEN PRINT"That is not one of the choices.":GOSUB 160:
3235 IF T1<0 OR T1>G THEN PRINT"
3240 R=T1:GOSUB 1320 :GOSUB 1050 :OPEN I="3","GAMES/TEXT"
3245 FOR X=1 TO RINPUTP3,OS,DS,H$,$U,ST:NEXT X:CLOS:GOSUB 1300
3250 PRINT TAB(34) "Game #":PRINT USING T$P2,OS;H$;LPRINT"
3260 GOSUB 1130 :GOSUB 1160 :LPRINT"
3270 PRINT TAB(28) RIGHT$(T$,82)
3280 GOSUB 1180 :T$="--" + STRINGS$(24,"") + RIGHT$(T$,84):LPRINT T$
3290 FOR X=1 TO P:LPRINT USING"%%", N$(X);
3300 LPRINT USING
3310 LPRINT USING
3320 GOSUB 1620 :CLOS:GOSUB 1220 :LPRINT USING T$A(2):GOSUB 1680
3330 GOSUB 1620 :CLOS:GOSUB 1220 :LPRINT USING T$A(2):GOSUB 1680
3340 NEXT X:PRINT
3350 NEXT X/3:PRINT"
3360 NEXT X/3:PRINT"
3370 NEXT X/3:PRINT"
3380 NEXT X/3:PRINT"
3390 NEXT X/3:PRINT"
3400 NEXT X/3:PRINT"
3410 NEXT X/3:PRINT"
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3960 NEXT X/3:PRINT"
3970 NEXT X/3:PRINT"
3980 NEXT X/3:PRINT"
3990 NEXT X/3:PRINT"
4000 NEXT X/3:PRINT"

```

Circle 227 on Reader Service card.

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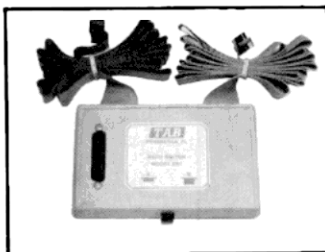
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```

4678 IF TS="N" THEN CLS: GOTO 4648
4680 CLS:PRINT133,"Now you will enter each player's name (up to"
4690 PRINT20 letters) and each player's jersey number."
4700 P=P+1
4710 PRINT323, CHR$(31);PRINTName of player $P;INPUT PS(P)
4720 PRINT45,"Name will be printed as ",LEFT$(PS(P),20)
4730 PRINT579,"Jersey Number for ",LEFT$(PS(P),20);: INPUT NS(P);GOSUB 200
4740 IF TS="N" THEN 4710
4750 IF P=20 THEN PRINT969,"No more players may be entered.";GOTO 4790
4760 IF P<5 THEN 4780
4770 PRINT6 960, CHR$(31);"Are there any more players?";GOSUB 210
4780 IF TS="Y" THEN 4700
4790 POKE 16916,0;G=0;L=0;GOSUB 250 :GOSUB 290 :GOSUB 310 :GOSUB 410
4800 RETURN
4810 REM ** Instructions **
4820 CLS:PRINT" This program keeps a record of various basketball"
4830 PRINT"statistics. It stores each individual player's statistics"
4840 PRINT"as well as team statistics in 20 categories." : PRINT
4850 PRINT" The first step in using the program is to enter information"
4860 PRINT"about your team - name of school, name of coach, names of"
4870 PRINT"players, etc. The program accommodates up to 20 players." : PRINT
4880 PRINT"Once this has been done, you may enter statistics for a"
4890 PRINT"particular game. You may just press the <ENTER> key to type in"
4900 PRINT"a zero for any category. After entering one player's"
4910 PRINT"statistics, you will be asked if the numbers just entered are"
4920 PRINT"correct. If any are incorrect, you will be asked to enter the"
4930 PRINT"information again. :GOSUB 160
4940 PRINT" The most important part of the program for the coach (and"
4950 PRINT"for the player, too) is the printout of the statistics. This"
4960 PRINT"program prints the statistics in 110 columns. You will need"
4970 PRINT"a printer with this capability. You must either use 11 x 14 in."
4980 PRINT"paper (if your printer prints 132 columns); or you must use"
4990 PRINT"condensed printing (for dot-matrix printers); or you must use"
5000 PRINT"elite printing (for daisy wheel printers). Feeding single"
5010 PRINT"sheets of 8 1/2 x 11-inch paper sideways makes excellent"
5020 PRINT"printouts on a daisy wheel." : PRINT:GOSUB 160
5030 PRINT" You may make the following printouts:"
5040 PRINT"-----"
5050 PRINT TAB(5)"1) your team record" : PRINT
5060 PRINT TAB(5)"2) your team totals in which each opponent is listed"
5070 PRINT TAB(10)"along with your team statistics for that game"
5080 PRINT : PRINT TAB(5)"3) your team totals in which each player is listed"
5090 PRINT TAB(10)"along with his totals" : PRINT
5100 PRINT TAB(5)"4) statistics for an individual player" : PRINT
5110 PRINT TAB(5)"5) statistics for a particular game" :GOSUB 160 :RETURN
5120 REM ** Housekeeping **
5130 DIM PS(22),A(20),S(20),NS(22),T(22,20):DEFINT G,W,L,R,X,Y
5140 P=0:RETURN
5150 REM ** Opening Display **
5160 CLS:FOR Y=130 TO 898 STEP 64:PRINT# Y, CHR$(191);NEXT Y
5170 PRINT# 899,STRINGS(56,176);:FOR X=6 TO 14:SET(X,10):NEXT X
5180 FOR Y=7 TO 12:SET(Y,1):NEXT Y
5190 SET(6,9):SET(7,9):SET(8,9):SET(11,11):SET(13,11):SET(12,12)
5200 FOR Y=28 TO 35:SET(105,Y):SET(106,Y):NEXT Y
5210 FOR Y=36 TO 39:SET(104,Y):SET(107,Y):NEXT Y
5220 FOR Y=39 TO 43:SET(103,Y):NEXT Y
5230 SET(108,39):SET(108,40):SET(109,40):SET(110,40):SET(111,40)
5240 FOR X=100 TO 103:SET(X,31):NEXT X
5250 SET(104,30):SET(104,29):SET(103,29):SET(102,29):SET(101,28)
5260 SET(100,28):SET(104,27):SET(105,26):SET(106,26):SET(107,27)
5270 TS="BASKETBALL STATISTICS"
5280 FOR X=1 TO 21:GOSUB 5330 :PRINT# 202, LEFT$(TS,X);NEXT X:TS="by"
5290 FOR X=1 TO 21:GOSUB 5330 :PRINT# 340, LEFT$(TS,X);NEXT X
5300 TS="David Pleacher"
5310 FOR X=1 TO 14:GOSUB 5330 :PRINT#462, LEFT$(TS,X);NEXT X
5320 FOR X=1 TO 800:NEXT X:RETURN
5330 T=0:FOR Y=1 TO 18:PRINT# T, " ";READ T:PRINT# T, MIDS(TS,X,1);
5340 FOR Y1=1 TO 21:NEXT Y1:NEXT Y:RESTORE:PRINT# 133,"":RETURN
5350 DATA 689,753,817,881,753,689,624,559,493,427,295,228,160,92,21,16,74,133
5360 REM ** Error Handling Routines **
5370 IF ERL=360 OR ERL=270 OR ERL=440 OR ERL=2650 OR ERL=3040 THEN PRINT
RESUME 70
"File has not been initialized." :PRINT"Error in line";ERL:GOSUB 160:
RESUME 70
5380 IF ERL=1020 THEN OPEN"O:3,GAMES.TXT":RESUME 1030
5390 IF ERL=3160 THEN PRINT"No games have been played." :GOSUB 160 :RESUME 70
5400 PRINT "Error in line" ERL:GOTO 120

```

End

Circle 174 on Reader Service card.

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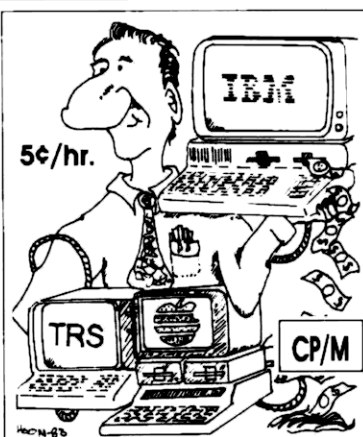
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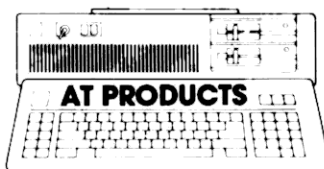
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## Program Listing 2. Prism Ring.

```

10 'PRISMATIC RING
15 '12 seconds to execute
20 VIEW(0,0)-(639,239) 'reset entire to viewport
30 CLR:SCREEN 0 'clear screen and go to graphics screen
40 X=30:Y=30:A=59.78:B=53.58:PI=3.14159
50 AN=19:SZ=24
70 FOR Z=A TO B STEP -PI/(X+.1)
80 I=330+Y*(5.6667*SIN(Z)):N=130+Y*COS(Z-AN) 'put viewpoints in circle
90 IF Y>83 THEN 120 'if ring completed go to holding loop
100 VIEW(I,N)-(I+SZ,N+SZ),1:CLR 'set viewport for size and placement
110 NEXT Z
120 IF INKEY$="" THEN 120 'hold graphics screen (SCREEN 0)
130 '**** Variables ****
140 'AN is angle of ring --causes different designs by choosing numbers between 10 and 360
150 'X is size of space between boxes (viewports)-smaller number makes larger spaces
160 'Y is size of ring-smaller number makes smaller ring
170 'A is beginning of loop (to make one complete ring)
180 'B is end of loop
190 'SZ is size of box (viewport)-larger number makes larger boxes

```

End

## Program Listing 3. Viewport.

```

10 'EXAMPLE VIEWPORTS WITH TEXT - VIEWPORT/BAS
20 A$=CHR$(#H0)+CHR$(#H0A)
30 SCREEN 0:CLR 'go to graphics screen and clear it
40 LINE(0,0)-(639,239),,B 'place outlined box around perimeter of entire graphics screen
50 PAINT(320,120),A$,1 'paint background on screen
60 VIEW(100,30)-(470,160),0,1 'define first viewport
70 GOSUB 200 'access screen writing subroutine to place data on screen in viewport
80 VIEW(200,80)-(550,185),0,1 'define second viewport
90 GOSUB 200 'same subroutine to put data in viewport
100 VIEW(0,0)-(639,239) 'define entire screen to viewport
105 IF INKEY$="" THEN 105
110 END
200 'Subroutine to write data to viewpoints
210 GLOCATE(1,1),0 'locate coordinates to place data
220 PRINT#-3, "THIS IS THE CURRENT VIEWPORT THAT HAS BEEN DEFINED BY THIS PROGRAM"
230 RETURN

```

End

## Program Listing 4. Circle.

```

10 DIM V%(530) 'use integer to save memory
20 SCREEN 0:CLR 'go to graphics screen and clear it
30 CIRCLE(50,50),20 'draw circle on screen
40 LINE(2,2)-(99,79),,B 'draw outline box just inside parameters of area captured by GET array in line 60

```

## Program Listing 5. Windows.

```

50 PAINT(5,5),1,1 'color inside of box
60 GET(1,1)-(100,80),V% 'store section of screen containing circle
70 CLR 'clear graphics screen
80 PUT(1,1),V%,PSET 'place circle and box back on screen
90 FOR K=1 TO 2000:NEXT K 'hold picture

```

Program Listing 5. Windows.

```

100 'GLEN E. SPARKS
110 '6186 CUSTER
120 'SOUTH ROCKWOOD, MI 48179
130 '
140 ' WINDOWS/BAS
150 '*** Define, initialize and dimension variables ***
160 CLEAR 1000
170 DIM V%(2100):DIM V1%(2100)
180 DIM G1(15),A$(15),PR(16),AM(15)
190 DIM PT$(15) 'Paint strings
200 PT$(0)=CHR$(#H0A)+CHR$(#H0)
210 PT$(1)=CHR$(#H0A)+CHR$(#H0F)
220 PT$(3)=CHR$(#H0A)+CHR$(#H04)
230 PT$(4)=CHR$(#H0D)+CHR$(#H0F)
240 PT$(6)=CHR$(#H0A)+CHR$(#H0C)
250 PT$(7)=CHR$(#H03)+CHR$(#H0C)+CHR$(#H30)+CHR$(#HC0)
260 PT$(8)=CHR$(#H04)+CHR$(#H3C)
270 PT$(10)=CHR$(#H29)+PT$(11)=CHR$(#H19)
280 PT$(12)=CHR$(#H0A)+PT$(13)=CHR$(#H2D):PT$(14)=CHR$(#H0F)
290 P2=2*3.14159:R=50
300 XC=100:YC=45:Q$="###,###,###"
310 CT=0 'Count the times graph redone
320 '**** Begin program ****
330 GOSUB 1520 'build and store hidden menu
340 GOSUB 590 'pie chart
350 '*** Manipulate screen and data through pull down menu ***
360 IF INKEY$="" THEN 360
370 VIEW(0,0)-(639,239):GET(200,60)-(498,168),V1%
'CAPTURE AREA UNDER WHERE MENU WILL GO
380 PUT(200,60),V%,PSET 'superimpose menu
390 CWS=INKEY$:IF CWS="" THEN 390 ELSE 400
400 PUT(200,60),V1%,PSET 'replace area covered by menu
410 CW=VAL(CWS):ON CW GOSUB 510,520,530,540,550,590
' menu choices
420 IF CW=7 THEN 450 'exit menu and hold window screen
430 IF INKEY$="" THEN 430
440 GOTO 370 'go back through menu
450 IF INKEY$="" THEN 450
460 END
470 '
480 '***** SUBROUTINES *****
490 '
'*** Subroutines to define and clear large windows ***
510 VIEW(3,11)-(210,118),0,1:CLR:RETURN 'window 1
520 VIEW(6,136)-(330,225),0,1:CLR:RETURN 'window 2
530 VIEW(220,24)-(635,118),0,1:CLR:RETURN 'window 3
540 VIEW(335,132)-(635,225),0,1:CLR:RETURN 'window 4
550 SCREEN 0:CLS:PRINT:PRINT-OUT OF REPORT -MAKE SURE PRINTER IS ON
"
560 PRINT"DO YOU WISH TO PRINT OUT REPORT NOW (Y or N)"

```

Listing 5 continued

```

570 INPUT P$:IF LEFT$(P$,1)="-Y" THEN 580 ELSE 370
580 LPRINT CHR$(27);CHR$(20);"CMD"1;"GPR2" "set printer to
condensed and print out chart
**** Pie chart and windows screen ****
590 IF CT>0 THEN TA=0 "set total to 0 for next data/chart
600 IF CT>0 THEN TA=0 "set total to 0 for next data/chart
610 --- Input data ---
620 CLS:PRINT"KEEP TITLE OF REPORT TO 25 CHARACTERS"
630 LINE INPUT"TITLE OF CHART (SALES, INVENTORY, etc.,) ";TZ$
640 IF LEN(TZ$)>25 THEN PRINT"TOO LONG A TITLE":GOTO 630
650 PRINT"PERIOD COVERED BY PIE CHART DATA"
660 LINE INPUT MNS:PRINT
670 IF LEN(MNS)>25 THEN PRINT"TOO LONG":GOTO 650
680 INPUT"NUMBER OF ENTRIES (MAX 9) ";N
690 IF N>9 THEN PRINT"ENTRIES MORE THAN 9-ACCOUNT DATA MAY NOT ALL
FIT IN WINDOW"
700 IF CT>0 THEN PRINT"LAST WINDOWS CHOSEN ";W1" AND ";W2
710 PRINT"CHOOSE WINDOW FOR ACCOUNTS (1-4) "
720 INPUT W1:IF W1>4 OR W1<1 THEN 710
730 INPUT"CHOOSE WINDOW FOR PIE CHART (1-4) ";W2
740 IF W2>4 OR W2<1 THEN 730
750 IF W1=W2 THEN PRINT"YOU HAVE CHOSEN THE SAME WINDOW-DATA WILL
BE OVERWRITTEN BY THE GRAPH":C1=1
760 PRINT"LIMIT ACCOUNT LENGTH TO 9 CHARACTERS"
770 PRINT STR$(50,"")
780 --- input chart data ---
790 FOR I=1 TO N:PRINT" ";I
800 LINE INPUT"ACCOUNT? ";AC$(I)
810 IF LEN(AC$(I))>9 THEN PRINT"TOO LONG":GOTO 800
820 INPUT"AMOUNT ";AM(I):PRINT
830 NEXT I
840 --- Calc total and slice size ---
850 FOR I=1 TO N
860 TA=TA+AM(I)
870 NEXT
880 FOR I=1 TO N
890 PR(I)=AM(I)/TA*100
900 NEXT I
910 --- Window choice and set up screen ---
920 IF CT<1 THEN GOSUB 1310
930 CH=W1:GOSUB 1710 "choose window for title
940 GLOCATE(1,5);0:PRINT#3,MNS "print month
950 CW=W1:GOSUB 1270 "set window for chart
960 --- Print out accounts ---
970 X1=1:Y1=5:FOR I=1 TO N
980 GLOCATE(X1,Y1);0:PRINT#3," ";I;AC$(I)
990 GLOCATE(X1+120,Y1);0:PRINT#3, USING Q$;AM(I)
1000 Y1=Y1+9
1010 NEXT
1020 CH=W2:GOSUB 1710 "set window for period covered
1030 GLOCATE(1,5);0:PRINT#3,MNS "print month
1040 CW=W2:GOSUB 1270 "set window for chart
1050 --- Draw chart on screen ---
1060 CIRCLE(XC,YC),R
1070 GLOCATE(1,5);0:PRINT#3, USING Q$;TA "TOTALS OF AMOUNTS
1080 FOR I=0 TO N
1090 AA=P2/100*PR(I)+AA
1100 X0=XC+R*COS(AA)
1110 Y0=YC-R*SIN(AA)*0.5
1120 AB=P2/100*PR(I+1)+AA
1130 G1(I)=(AA+AB)/2
1140 G2=((XC-L0)+(R+9)*1.15*COS(G1(I)))
1150 G3=((YC-L0)-(R+9)*1.15*SIN(G1(I))*0.5)

```

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```

1160 GLOCATE(G2,G3),0,IF PR(I+1)>1 AND I<N THEN PRINT#-3,I+1
1170 IF PR(I)>1 THEN LINE (XC,YC)-(X0,Y0)
1180 NEXT I
1190 '--- Paint slices of pie ---
1200 FOR I=0 TO N-1
1210 XL=XC+R*0.5*COS(G1(I))
1220 YL=YC-R*0.5*SIN(G1(I))*0.5
1230 IF PR(I+1)<1 THEN L250
1240 PAINT (XL,YL),FT$(I),1
1250 NEXT I
1260 RETURN
1270 '***Subroutine to choose and clear window for output***
1280 IF CW>4 THEN CW=1
1290 ON CW GOSUB 510,520,530,540
1300 RETURN
1310 '*** set up initial screen ***
1320 VIEW(0,0)-(639,239):CLR:SCREEN 0
1330 GOTO1350
1340 PAINT(320,120),CHRS(64H0)+CHRS(64H0),1
1350 VIEW(3,1)-(14,10),0,1:CLR:GLOCATE(1,5),0:PRINT#-3,"#1"
1360 VIEW(15,1)-(210,10),0,1:CLR 'message window 1
1370 GOSUB510 'clear area of window 1
1380 VIEW(6,124)-(16,134),0,1:CLR
1390 GLOCATE(1,5),0:PRINT#-3,"#2"
1400 VIEW(17,124)-(330,134),0,1:CLR 'message window 2
1410 GOSUB520 'clear window 2
1420 VIEW(2,227)-(637,238),0,1:CLR 'area for spacebar menu
1430 GLOCATE(19,5),0:PRINT#-3," *****PRESS SPACEBAR FOR PULL
DOWN MENU*****"
1440 VIEW(220,10)-(234,20),0,1:GLOCATE(10,5),0:PRINT#-3,"#3"
1450 VIEW(235,10)-(635,20),0,1:CLR 'message window 3
1460 GOSUB530 'clear area window 3
1470 VIEW(335,120)-(349,130),0,1:CLR:GLOCATE(1,5),0:PRINT#-3,"#4"
1480 VIEW(350,120)-(635,130),0,1:CLR 'message window 4
1490 GOSUB540 'clear area of window 4
1500 CT=1 'Count set at 1
1510 RETURN
1520 '***Set up hidden pull down menu and store in array***
1530 VIEW(0,0)-(639,239):CLR:SCREEN 0:LINE(2,2)-(300,110),B
1540 GLOCATE(5,7),0:PRINT#-3,"
-----OPTIONS-----"
1550 LINE(2,15)-(300,15)
1560 GLOCATE(5,18),0:PRINT#-3,"ERASE CONTENTS OF WINDOW #1"
1570 LINE(2,27)-(300,27)
1580 GLOCATE(5,30),0:PRINT#-3,"ERASE CONTENTS OF WINDOW #2"
1590 LINE(2,39)-(300,39)
1600 GLOCATE(5,42),0:PRINT#-3,"ERASE CONTENTS OF WINDOW #3"
1610 LINE(2,51)-(300,51)
1620 GLOCATE(5,54),0:PRINT#-3,"ERASE CONTENTS OF WINDOW #4"
1630 LINE(2,63)-(300,63)
1640 GLOCATE(5,66),0:PRINT#-3,"PRINT SCREEN"
1650 LINE(2,75)-(300,75)
1660 GLOCATE(5,78),0:PRINT#-3,"DATA AND GRAPH"
1670 LINE(2,87)-(300,87)
1680 GLOCATE(5,90),0:PRINT#-3,"EXIT PROGRAM"
1690 GET(2,2)-(300,110),V%
1700 RETURN
1710 '*** message windows ***
1720 ON CH GOSUB 1730,1740,1750,1760:RETURN
1730 VIEW(15,1)-(210,10),0,1:CLR:RETURN 'message 1
1740 VIEW(17,124)-(330,134),0,1:CLR:RETURN 'message 2
1750 VIEW(235,10)-(635,20),0,1:CLR:RETURN 'message 3
1760 VIEW(350,120)-(635,130),0,1:CLR:RETURN 'message 4

```

End

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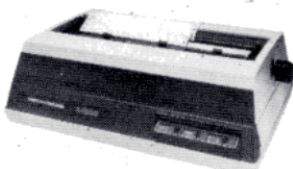
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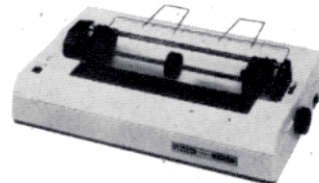
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Lake, Golden, and Lett, "Reasonable Deductions," 3:74. Home computer tax deductions explained.  
McAnaney, "Savings and Loan," 11:83. (I, III, 4, 1000, 1200) Calculate loan balances by Rule of 78s.  
Terry, "Password Bypass," 11:72. (I, III, 4, 1000, 1200) Crack protected files.  
Wallace, "Don't Be Late," 6:74 (10:25). (I, III, 4, 1000, 1200) Set up a critical path schedule.

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Shulman, "The Perfect Host," 9:41. (4). Use Memdisk to transfer data at high baud rates.

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- Lewicki and Karls, "Monster Mashing," 2:50. (III) A Dungeons and Dragons type fantasy.  
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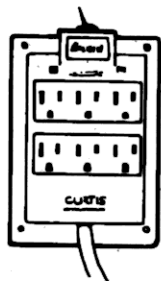
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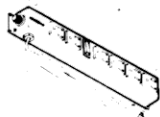
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 "Model 4 Scriptait the Write Way" (60): ScripAid, An enhancement package for Model 4 Scriptait.  
 "NovaCalc" (82): NovaCalc, A Basic spreadsheet program.  
 "Picture Perfect" (98): CHARGEN, Create your own graphics characters.  
 "On The Record" (106): RANDISK, Create and read indexed random-access disk files.  
 "Formula Solutions" (116): Cubic, Solve cubic, quadratic, and linear equations.  
 Project 80 (120): Interrupt, Use the 8259A interrupt controller with an I/O board.  
 BBS Express (132): BBS1, BBS2, A routine for locating message numbers.  
 The Next Step (140): Demo, Demonstration program to create a beep generator.

## FEBRUARY

"Picture This" (56): Graph, Create pictures and combine up to nine screens for a composite illustration.  
 "The Pecking Order" (59): NOEATERS, Gobble up the numbers on the screen to win the game.  
 "By the Numbers" (68): GraphMaster, Plot or display data in line or bar charts.  
 The Next Step (112): Demo, Use DOS exits to add commands to Basic.  
 BBS Express (104): BBS9, Sort-and-search program for your BBS.  
 Bonus program: Mail List, Model 4 mailing list.

## MARCH

"Grade-A Graphics" (44): Graph, Versatile graphics generator.  
 "A La CRT" (58): Listings 1-12, Basic subroutines that create menus.  
 "A Sort Story" (70): Sort, A string sort for Model 4 Basic.

BBS Express (88): BBS, This module gets your bulletin board up and running.  
 The Next Step (100): Helpfile, A help file generator program.  
 Bonus program: Alien Shuffle, Rearrange aliens into proper groups.

## APRIL

"Clear-Cut Trends" (40): Grapher, Draw and print out high-resolution line and bar graphs.  
 BBS Express (90): BBS, The BBS data base catalog module.  
 "Zap Master" (62): Disk Zapper, Read and modify Model 4 disk sectors.  
 The Next Step (98): Filter, A video filter program.  
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 "Restricted Entry" (70): Prompter, Predefine acceptable user input.  
 "Stationary Department" (74): Scroll, Adds scroll protection to Model 4 video display.  
 "Fractals in Focus" (58): Fractal3, Fractal4, High-resolution fractals.  
 BBS Express (92): BBS, Put the finishing touches on your bulletin board system.  
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 "Don't Be Late" (74): CPS, Develop timelines for projects.  
 The Next Step (102): Driver, DRIVETST, Add windowing capability to the Model 4.  
 Spreadsheet Beat (110): Documenter, Print SYLK files in an easy-to-read format.  
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## JULY

"Total Recall" (54): Helper, Display help screens on the Model 4.  
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 "Run-O-Matic" (78): Autorun, Load Model 4 disk files from a menu.  
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 The Next Step (100): WS, Test, WD, Part II of the windowing system.

## AUGUST

"Summer Romance" (38): Main Menu, Clock, Menu sequencing and clock display routines.  
 "The Great Divide" (62): Times2, Partition your 128K Model 4 and switch between two programs in Model III mode.  
 "Patch Work II: The Sequel" (72): Domaker, Install up to 13 TRSDOS 1.3 patches.  
 "Upgraded Graphics" (76): Pixel, Add the commands Point, Set, and Reset to Model 4 Basic.  
 The Next Step (98): WU, Window system user interface, Part III.  
 Spreadsheet Beat (108): BondYTM, Calculate bond yield-to-maturity using VisiCalc.

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"My 10 Favorite Assembly-Language Subroutines" (48): List1, List2, List3, List4, List5, Ten input and screen-handling subroutines.  
 "A Basic Programmer's Best Friend" (66): Crosscheck, Keywords, Model 4 Basic cross-reference program.  
 "Drawing in Detail" (56): Rembrandt, Screengrid, Hexagon, Computer, High-resolution icon-driven graphics editor.  
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"Files from the Crypt" (58): Restore, Retrieve killed files on the Model 4.  
 "Key Notes" (62): PF/FLT, Model 4 function key filter.  
 "Next-Generation Software" (70): Genetics, Recreate genetic experiments.  
 "Patch Maker" (76): Patcher, A patch management program.  
 The Next Step (100): File Chop, Condense random-access files.  
 Spreadsheet Beat (106): TaxEst85, Track expenses and estimate federal income tax with Multiplan.  
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"Merge Right" (54): Merge, Merge non-ASCII files on the Models I and III.  
 "Fast Figures" (60): DISQUICK, Faster reads and writes with binary I/O.  
 "Savings and Loan" (83): Loan, Calculate interest by the rule of 78s.  
 "Password Bypass" (72): UNPROT, A Model I/III/4 file protection remover.  
 The Next Step (102): List1, Strip trailing blanks, encode and decode strings.  
 Spreadsheet Beat (108): Budgeter, Maintain a monthly personal budget with Multiplan.  
 A program update: REMBRAN4, Updated version for the Model 4; first appeared on September 1985, Load 80.  
 Bonus program: SpeedDOS, 4MHz operation in the Model III mode.

## DECEMBER

"Write Away" (41): C Trainer, Basic C interpreter.  
 "Net Results" (52): Hoops, Basketball statistics program.  
 "Window Screens" (58): Sinewave, PrismRing, Windows, High-resolution graphics and pie chart application.  
 "Interrupt Anytime" (66): Break In, Scroll, Programmable interrupts for TRSDOS 1.3.  
 "The Right Address" (75): Locator, Finds TRSDOS 6.X system addresses.  
 "Rembrandt Redux" (76): List1, List2, Screen dump routines for our Rembrandt graphics editor.  
 Tidbit #30 (83): Page, File list utility.  
 Project 80 (85): Convert, Converts object files to hex/ASCII.  
 The Next Step (108): Squeeze, Condenses Model 4 programs.  
 Bonus program: Delete, Multiple LDOS 5.X kill command.

# Tandy 1000

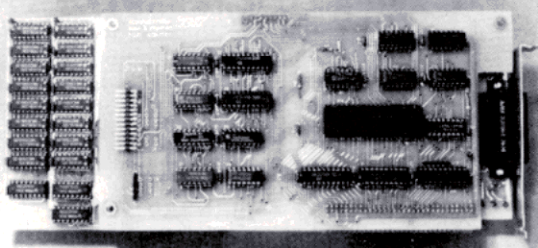
Circle 455 on Reader Service card.

## TanPak™

### The Ultimate Expansion for the Model 1000!

The TanPak expansion board has been designed to allow expansion beyond the scope of the standard Model 1000. Seven of the most needed functions/features have been combined into one package using only one expansion slot. Your remaining spaces are left free for future expansion needs. And the best part of all, it will save you money over the Tandy Boards.

TanPak™ O.k. .... \$349.



#### Functions Include:

DMA  
Serial Port  
Memory up to 512K  
Clock/Calendar  
Printer Spooler  
Memory Disk  
Expansion Port for Future Options

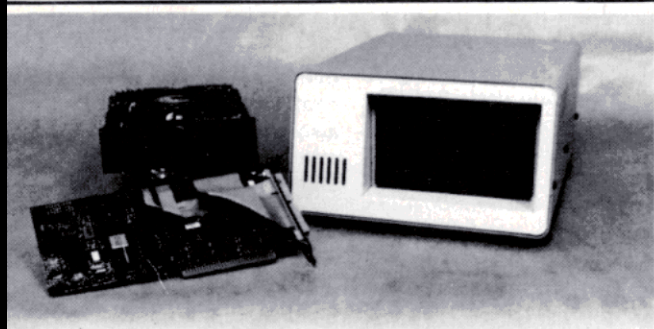
#### TanPak features include:

Gold Edge Cards  
Supporting Software  
Pre-Tested and Burned In  
Full Documentation  
One Year Warranty  
Expandable to 512K

## TanPak™ Secondary

Made to work with a Tandy 1000 memory board as the second memory board. Featuring a Serial Port, Clock/Calendar, Memory Expansion to 256K, Printer Spooler, and Memory disk.

TanPak™ Secondary ..... \$249.



## Tandy 1000 Hard Drives

HDS Hard Drives for the Tandy 1000 allow booting directly from the Hard Drive using the Tandy DOS. All units are complete with controller, ready to plug in and use. The Internal Hard Drive Units replace the top disk drive inside the 1000, or request an external unit for only \$150. more.

10 Meg Internal ..... \$549.  
20 Meg Internal ..... \$749.  
43 Meg Internal ..... \$1399.

## TanTel

Internal 300/1200 Baud Modem ..... \$249

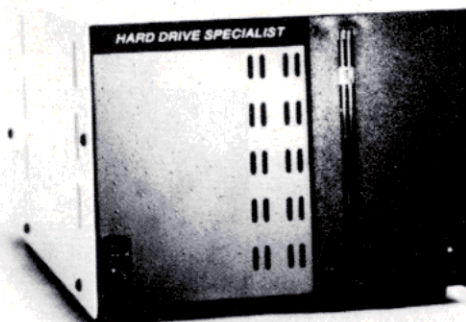
## 8087 Board

8087 Math Co-processor board for the Model 1000.

Plugs in internally but does not use one of the 3 expansion slots  
..... \$249.

(Available Fall 85')

# Model 1, 3, 4 Hard Drives



## Model 1, 3, 4 Hard Drives

	Primary	Secondary
5 Megabyte	\$795.	\$595.
10 Megabyte	\$1095.	\$895.
20 Megabyte	\$1295.	\$1095.
30 Megabyte	\$1895.	\$1695.

(Model 1 add \$50)

### Hard Disk Subsystem Features:

- All sizes rated after formatting.
- Your choice of DOSPLUG, LDOS or TRSDOS 6. x Drivers included.
- NEWDOS 80/Version 2.5 Systems Available.
- Up to two secondary drives may be added.
- Error checking and correcting controller.
- Buffered seek drives for improved access time.
- Built in power up diagnostics.
- Plated media for long disk life.
- Heavy duty power supply
- Gold connectors used throughout
- 1 year warranty

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Allows 4 Computers to use a HDS Hard Drive,

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Model 3/4 RS232 Kit ..... \$69.

## Hard Drive Specialist

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orderline  
1-800-231-6671

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Use our WATS line to place your order via Visa, MasterCard, or Wire Transfer. Or, you can mail your payment directly to us. Any non-certified funds will be held until proper clearance is made. COD orders are accepted as well as purchase orders from government agencies. UPS ground is our standard means of shipping unless otherwise specified. Shipping cost are available upon request. Tandy and Radio Shack are Trademarks of Tandy Corporation, TanPak, and TanTel are Trademarks of Hard Drive Specialist, a division of CompuKit Corporation.

## Printer News

Xerox Corporation's Xerox/Diablo D80 is a letter-quality daisy-wheel printer that prints at speeds up to 80 characters per second with noise measured as low as 58 decibels.

The D80 features Diablo's all-purpose interface (API), which allows easy hook-up to RS-232, Centronics, or IEEE 488 interfaces. A semiautomatic paper feed lets you switch between different paper sizes and weights.

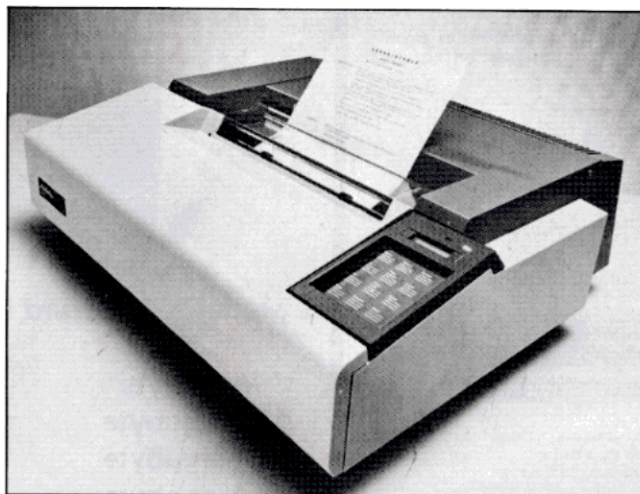
The D80 uses Diablo's extended character set with 200 characters per print wheel. Multilingual print wheels are also available that allow the D80 to print in 33 languages. The printer is \$2,195. An optional bidirectional tractor (\$300) and a dual-bin, cut-sheet paper feeder (\$903) are available. For more information, contact Xerox Corp., Xerox Square 006, Rochester, NY 14644, 716-423-5078.

Circle 566 on Reader Service card.

## Universal Basic

ZBasic 3.0 from Zedcor Inc. is faster than Turbo Pascal 3.0 and uses the same programming commands regardless of the computer you use. The IBM PC, PC XT, PC AT and compatibles; Apple IIc and IIe; Macintosh; TRS-80 Models I, III, 4; and CPM 80 2.2 and 3.0 computers all use the same commands with this language. ZBasic code works with all the leading microcomputers; if you write a program in ZBasic on an Apple, you can port it over to a Tandy computer and it will run the same way.

ZBasic includes device-independent graphics, 54-digit accuracy, a built-in interactive editor and compiler, a choice of alphanumeric labels or line numbers, and more at a base retail price of \$89.95. For more information, contact Zedcor Inc., 3438 N.



The Xerox/Diablo D80 daisy-wheel printer is quiet and fast.

Country Club, Tucson, AZ 85716, 602-795-6800.

Circle 560 on Reader Service card.

## Board Talk

Fast80 (\$59.95) from SOTA Computing Systems Ltd. is a bulletin board system for the Model 4/4P. It's written entirely in machine language so responses to user requests are almost instantaneous. The entire message/user/command base resides in memory. Fast80 needs 128K and works under TRSDOS 6.2 and DOSPLUS 4.

The bulletin board supports 445 different user IDs and handles up to 120 messages. Fast80 drives just about any direct-connect/auto-answer modem including Radio Shack's Modem II and Hayes and Microconnection units. For further information, contact SOTA Computing Systems Ltd., 213-1080 Broughton St., Vancouver, British Columbia, Canada, V6G 2A8, 604-688-5009.

Circle 554 on Reader Service card.

## A, B and C

Jack Purdum's *C Self-Study Guide* helps you discover the C programming language at your own pace. Part I of the book provides

questions of varying degrees of difficulty to guide beginners over the rough spots and to challenge more experienced C programmers. Part II has answers that include many complete programs for testing new functions and for illustrating tips, traps, techniques, and shortcuts.

The book is approximately 250 pages and costs \$16.95. For more information, contact Que Corporation, 7999 Knue Road, Suite 202, Indianapolis, IN 46250, 800-428-5331.

Circle 562 on Reader Service card.

## Remote Control

Dynatech's Turn-On, a compact, intelligent power controller, automatically activates unattended computer systems 24 hours a day, permitting file transfers, electronic mail delivery, and more.

Turn-On activates and powers up a computer system when it senses an incoming phone call, leaves the system on for the duration of the call, records the time of the call and all activity, and powers the system down when the call is completed. Turn-On comes with full communications software capability and built-in ac power

and phone line protection to guard against power surges and potentially damaging voltage spikes.

Turn-On sells for \$295. For more information, contact Dynatech Computer Power Inc., 4744 Scotts Valley Drive, Scotts Valley, CA 95066, 800-638-9098.

Circle 555 on Reader Service card.

## Language Tutor

Learn Spanish The Easy Way (\$69.95 plus \$3 shipping) is part of a new foreign-language software series from International Computer Products that runs on the Models III and 4, some CP/M-80 based systems, and MS-DOS computers.

You type in a simple sentence in English. The program uses artificial intelligence techniques to interpret the sentence and display or print a Spanish translation. A large vocabulary allows phrase compositions with over 80,000 possible word combinations. The program also includes conjugation of regular and irregular verbs, and exercises in noun declension. A German version is also available. You can also get an optional voice synthesizer for the Models III and 4.

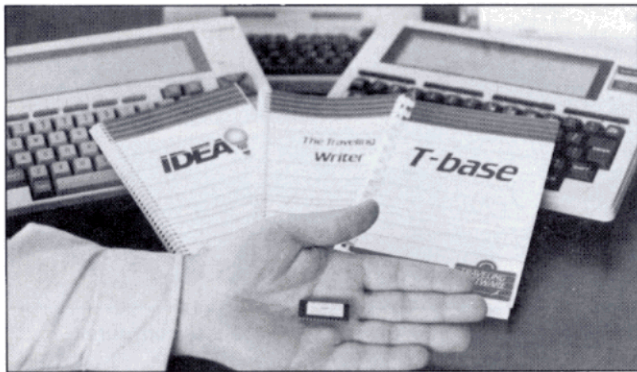
For more information, contact International Computer Products, 346 N. Western Ave., Los Angeles, CA 90004, 213-462-8381.

Circle 565 on Reader Service card.

## Stocking Stuffer

The *Floppy Disk Story* is a 32-page booklet from Fuji Photo Film that introduces computer users of all ages to the basic building block of the floppy disk. The booklet teaches you about a floppy disk's construction and operation, as well as its proper care. While appealing to children, *The Floppy Disk Story* is also perfect for the not-so-young who are new to computing.

## NEW PRODUCTS



Three programs for the Models 100 and 200 come on one ROM chip.

You can get the booklet free by writing to Fuji Film Promotion Dept., P.O. Box 9870, Wethersfield, CT 06109. Limit requests to one per household.

Circle 556 on Reader Service card.

### Three in One

Traveling Software has put three of its most popular Model 100/200 programs on a single ROM chip. The Ultimate ROM includes Ideal, an outline processor; T-Base, a data base management system; and T-Writer, a text formatter.

Because these three programs reside in ROM, they use almost no RAM, allowing larger data files than ever before. Ultimate ROM sells for \$229.85 and includes the Traveling Memory Manager and an audio cassette overview of the programs.

The Ultimate ROM is available from Radio Shack stores.

For more information, contact Traveling Software Inc., 11050 Fifth Ave. N.E., Seattle, WA 98125, 206-367-8090.

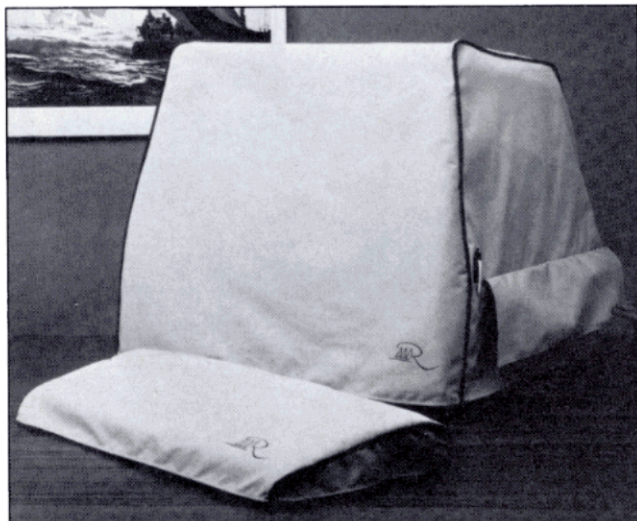
Circle 552 on Reader Service card.

### Executive Covers

Regatta computer covers from Cover Craft Corp. are made of cotton/polyester blend material specially treated to resist stains, moisture, and wrinkles. They are also machine washable and nonstatic.

The covers come with a built-in disk storage pocket and pencil holder, and a storage wallet for the cover when not in use. Sizes are available for all popular microcomputers and related equipment. Colors are sand with navy trim and navy with sand trim. Prices range from \$21.95 to \$34.95.

For further information, contact Cover Craft Corp.,



Dress your computer in Regatta wear.

Circle 186 on Reader Service card.

New for  
Profile users

## PROfix \* IV™ RESTRUCTURE & TRANSFER UTILITY

**NEW!** For PROFILE® 4 PLUS **NEW!**  
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PROfix allows you to reorganize your data base TO MEET TODAY'S NEEDS, and then moves ALL or SELECTED fields and/or records of existing data into your new file structure.

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- CHANGE NUMBER OF SEGMENTS
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### -TO ORDER-

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Plus \$2.50 for Handling and Postage

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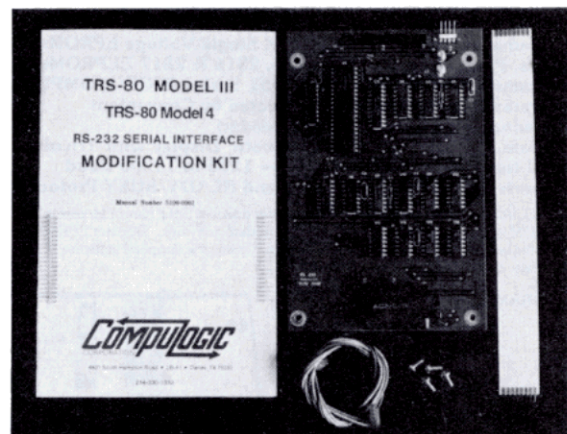
PLEASE SPECIFY VERSION

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LDOS is a registered trademark of Logical Systems, Inc.

Circle 86 on Reader Service card.

## THE RS-232 MODEL III MODEL 4



State of the art technology in board design, our direct replacement of Radio Shack's internal RS-232 board, mounts inside the Model III or 4 on the existing brackets. All cables, screws and complete mounting instructions are included. Non-technical people will find that installation is quick, straight forward and simple requiring less than 15 minutes to complete.

Total compatibility with Radio Shack® and all existing software is maintained. Software programmable baud rates from 50 to 19,200 baud are supported along with programmable word length, stop bits, and parity. May be utilized in either half of full duplex operation.

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DALLAS, TEXAS 75232  
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## EDIT

Full-screen Basic editor. On-line, 30+ commands/functions.  
Reg \$40 **\$20 + \$2 s/h**

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Sophisticated relational dbms. Changes structure anytime, no re-blocking. Interfaces with Basic, Scripsit, VisiCalc. Works with HD, Network3.  
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Easy-to-use Basic Compiler, huge speedups (2-200 times), accepts 25k+ programs, handles the whole Basic language.  
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Machine-code development system. Upwards compatible with PC version.  
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## SuperStep/EMU02

Fascinating Z80/6502 simulators. Terrific fun for learning, debugging.  
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Programs work on TRS-80 Model I/III, MAX-80 (specify which machine), any DOS. CA add 6%

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### UNIVERSAL PROGRAMMING CAPABILITIES AT AN AFFORDABLE PRICE

- Ultra Fast Programming - 2716's in 16 Seconds
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NO SPECIAL SOFTWARE REQUIRED. Transfer disk files (Intel Hex or Motorola's S\* Format) to EPROM with your system's line printer or modem software. Transfer EPROM contents to disk file with your system's modem software. Or use the supplied software \*\* to transfer any binary or ASCII file to/from EPROM.

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2516	2732	27128A	2816	8742*	8749*
2532	2732A	27256	2817	X2212*	8751*
2564	2764	68764	27C Series		8755*

\*Requires low cost personality adapter

#### SOFTWARE AVAILABLE FOR: \*\*

CP/M systems on 8" SSD - many 5 1/4 formats  
TRS-80 Model I & II TRSDOS - NEW! TRSDOS 6.X  
Heath H8/H89 HDOS & CP/M  
ZENITH Z90 & Z100 CP/M - Z100 ZDOS - Z150  
KAYPRO II/IV/10/16/286/2000  
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IntelliBurner Programmer with Software	\$299.00
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(expandable to 256K Bit)	89.00
RS-232 Interconnect Cable	12.00
IntelliBurner PC Boards, EPROM, Plans & Software	99.00

Low Cost "DumbBurner" serial programmers harness the power of your personal computer with the supplied software for full programming capabilities:

DumbBurner II Programmer for 28 Pin and 24 Pin EPROMs and EEPROMs (with Software)	\$199.00
DumbBurner II Bare PC Board, Plans & Software	59.00
16K/32K DumbBurner for 28 Pin EPROMs (with Software)	149.00
16K/32K DumbBurner PC Board, Plans & Software	39.00

Add \$3 Shipping & handling (\$2 Bare Boards). C.O.D.'s accepted. Foreign Orders add required postage. Specify Environment and Media Requirements.  
H8, H89, Z100 are \* Heath/Zenith; CP/M is \* Digital Research; TRS-80 is \* Tandy Corp.; IBM PC, PC/XT, AT are \* IBM; MS-DOS is \* Microsoft.



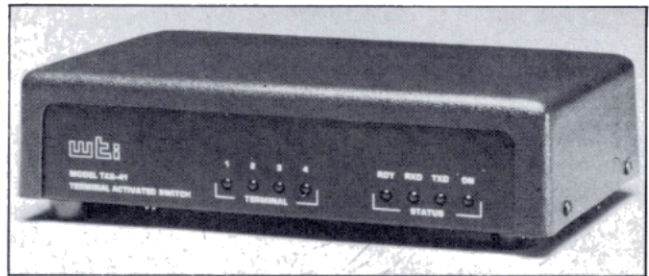
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## NEW PRODUCTS



With TAS-41, four users can share one computer.

540 N. Commercial St.,  
Manchester, NH 03101, 800-  
644-3555.

Circle 561 on Reader Service card.

## Hook Them Up

Western Telematic Inc. offers a terminal-activated switch that lets up to four users share one computer port. The TAS-41 (\$395) makes switching automatic. Each user connects and disconnects by entering simple commands from the terminal's keyboard. To prevent port tie-up in the event a user forgets to log-off, a timeout feature disconnects a port if no data activity takes place within a user-selectable time period.

For additional information,

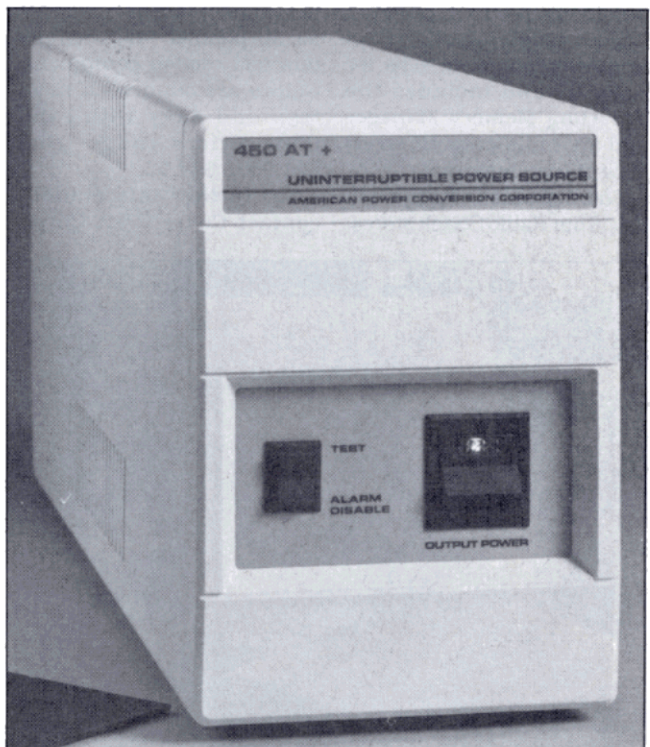
contact Western Telematic Inc., 2435 Anne St., Santa Ana, CA 92704, 800-854-7226.

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## Power Play

American Power Conversion Corp. introduces the 450AT uninterruptible power source. When protecting a typical enhanced personal computer with a hard disk and monitor, the 450AT provides 15 minutes of operating time during an extended outage. For added protection, an electronic overcurrent protection and a master power switch control come standard.

The 450AT incorporates an internal, sealed, maintenance-free battery and a precision



The 450AT is specifically designed to power your desktop computer.

battery charger to insure dependable power at a moment's notice. It also offers built-in surge protection and combined EMI/RFI filtering.

The price is \$799. For more details, contact American Power Conversion Corp., 89 Cambridge St., Burlington, MA 01803, 800-343-2507.

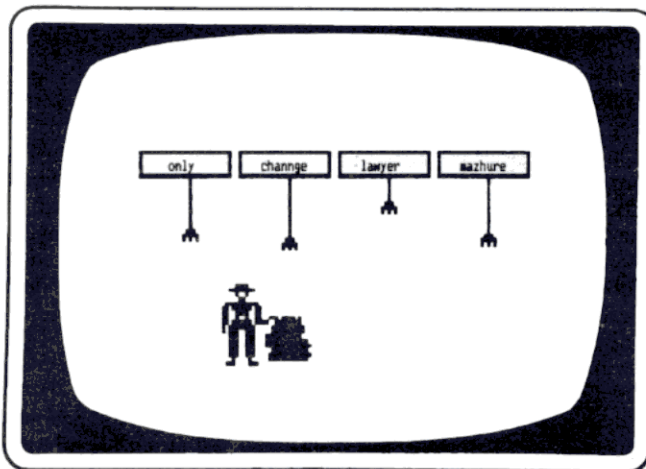
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### Spider Terror

Gamco Industries' Spider Hunt Spelling game (\$39.95) for the Models III and 4 teaches spelling and includes student and program management systems as well.

The student becomes a spider hunter whose goal is to catch as many spiders as possible in a set amount of time (one to 10 minutes). You can also set a level of difficulty (1-5).

Four words appear at the top of the screen, each with a spider descending from it. Some of the words are spelled correctly and some are misspelled. Students move the



*Spider Hunt Spelling teaches spelling the fun way.*

spider hunter from word to word and identify each word as correctly spelled or misspelled. If they answer correctly the spider falls into a sack.

A bank of 400 words (200 spelled correctly and 200 misspelled) permanently resides on the disk. Teachers may also enter up to five lists of 80 words each.

For more details, contact Gamco Industries Inc., Box 1911, Big Spring, TX 79721, 800-351-1404.

Circle 558 on Reader Service card.

### Facts and Logic

Logical Lynx from Krell Software Corp. teaches the art of scientific reasoning by showing you how scientists apply logic to actual bodies of

knowledge in the natural and social sciences and humanities. It also teaches you basic scientific facts and how you can understand, organize, and fit these facts into meaningful patterns.

Twenty data bases provide basic information in critical areas of knowledge, as well as techniques for linking that information in new ways. You create, research, and organize new data bases on subjects of your choice.

Logical Lynx comes in three levels of difficulty priced at \$49.95, \$69.95, and \$89.95. One free data base comes with each system's master.

Additional data bases cost \$19.95 each. Sample data bases include sports of the world, great writers, and chemical elements.

For more information, contact Krell Software Corp., 1320 Stony Brook Road, Stony Brook, NY 11790, 800-245-7355.

Circle 563 on Reader Service card.

Circle 464 on Reader Service card.

## Graphics Solutions

### High-Resolution Software and Hardware

**GBASIC 3.0** - Radio Shack Model 4/4P/III hi-res board owners take note of an enhanced graphics Basic; GBASIC 3.0 not only has an equivalent for each of the BASICG commands but adds a number of important new commands while using less memory. The hi-res screen can be printed on any of 20 popular printers or saved to or loaded from disk without leaving Basic. The software works with TRSDOS 1.3, 6.1.2, 6.2, LDOS, NEWDOS80, and DOSPLUS. The disk contains 40 graphics programs/files. Also included is a detailed manual which includes assembly language entry addresses. \$49.95. (Specify Model 4 or III mode or add \$10 for both.)

The following nine programs run on a Model 4/4P/III equipped with a Radio Shack graphics board and GBASIC 3.0 or a Micro-Labs Grafyx Solution board:

**DRAW** - A powerful full screen graphics drawing and editing program. \$39.95.

**BIZGRAPH** - Create business graphs from hand-entered or VisiCalc data. \$98.00.

**XT.CAD** - Professional drafting aid which outputs to a printer or plotter. \$449.95.

**CHESS** - A very powerful program with 10 skill levels, 40 play options. \$49.95.

**REVERSI** - Play Othello with 10 skill levels, 20 execution options. \$39.95.

**3D Tic-Tac-Toe** - Play the computer or a friend on a 4 x 4 x 4 matrix. \$29.95.

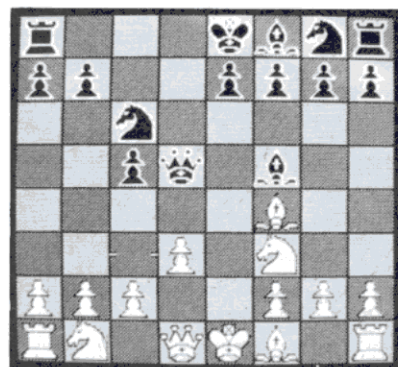
**3D-PLOT** - View three-dimensional data from any perspective or angle. \$39.95.

**MATHPLOT** - Plot equations of the form  $Y=F(x)$  with auto scaling. \$39.95.

**SURFACE PLOT** - Plot three-dimensional equations of the form  $Z=F(x,y)$ . \$39.95.

**GRAFYX SOLUTION.** Plug-in, clip-on board enhances any Model 4/4P/III to provide 640 x 240 / 512 x 192 dot graphics. Comes with over 40 programs and files including GBASIC 3.0 which adds over 20 new commands. \$199.95.

**JOY-MOUSE.** Allows a Radio Shack CoCo joystick, mouse, or touch pad to be connected to any Model 4/4P/III. Hardware provides X, Y position values from 0 to 255. A built-in speaker produces sound from the cassette port. \$129.95.

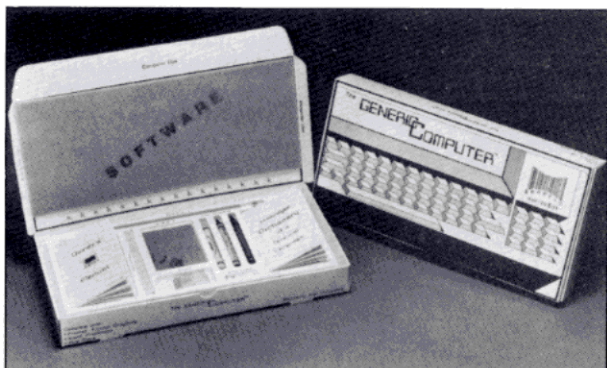


**G.I.N.A.** Software program for the Model 4/4P/III/I which uses the standard block graphics screen to display a window to a larger 65536 x 65536 dot tablet. The arrow keys are used to draw two or three-dimensional figures. The display can be scaled, shifted, or rotated in any dimension. The final picture is printed in hi-res on Radio Shack, Epson, Gemini, NEC 8023, or Prowriter printers. \$75.00.

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

**MICRO-LABS, INC.** 214-235-0915  
902 Pinecrest, Richardson, Texas 75080

# DIFFERENT TRACK



The Generic Computer comes with 16K and color graphics.

## New Generation Computer

The Generic Computer from Intec Inc. weighs less than 10 ounces and comes with color graphics, a letter-quality printer, its own special software, 16K, and the most dependable chip in the industry.

The computer is designed and written in good taste and sells for \$5.95. Add 50 cents for shipping and handling. Contact Intec Inc. (676 Polk St., Eugene, OR 97402, 503-343-1464) for more information.

Circle 564 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.

Circle 449 on Reader Service card.

# P R O F E S S I O N A L

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A "Full" featured thoroughbred analysis designed for the professional and the serious novice  
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# Little Treasures

Welcome to Fine Lines, *80 Micro's* new back-page contest. The purpose of this column is to give you a chance to flex your programming muscles, learn some techniques from other readers, and (most importantly) win a prize or two. Each month, we'll give you a problem that needs solving, along with the winning solutions to a previous month's problem. If we publish your solution, you'll receive (at the very least) an "I Break for *80 Micro*" bumper sticker. If we think you've demonstrated particular brilliance and creativity, we'll send you an *80 Micro* T-shirt (don't count on it, though; we're stingy with the T-shirts).

If you can't seem to solve the problems, don't despair; we'll hand out prizes for any contest ideas you submit that we use. Since this is the first installment of Fine Lines, here's a run-down of 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 21st of the issue month. Thus, this month's deadline is Dec. 21. We realize that this doesn't give everyone the same amount of time to come up with their 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 March 1986 issue.

4. Employees of CW Communications are not eligible.

5. We will not, unfortunately, be able to return entries.

6. Specify your T-shirt size. Bumper size not required.

## Contest No. 1

Okay, enough of that. Let's get down to the first contest. Your task is to write a word processor in two lines of Basic. Simple enough, eh?

We'll judge entries on the basis of creativity, number of features, and programming elegance.


Just to get you going, we whipped up the clunky little Model 4 program you see in the Program Listing. We're confident that you can come up with something better. Give it a try; you might win yourself a T-shirt. ■

### Program Listing. *80 Micro's* wimpy little two-line word processor.

```
110 WHILE X$<>CHR$(0):X=0:X$=INKEY$:IF X$="" THEN GOTO 110 ELSE IF X$=CHR$(9) THEN
EN X$=CHR$(25) ELSE IF X$=CHR$(10) THEN X$=CHR$(26) ELSE IF X$=CHR$(11) THEN X$=
CHR$(27)
200 PRINT X$;:WEND
```

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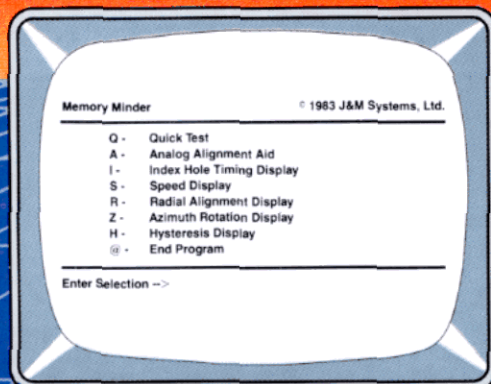
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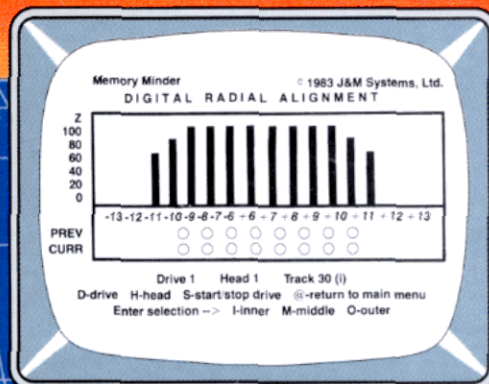
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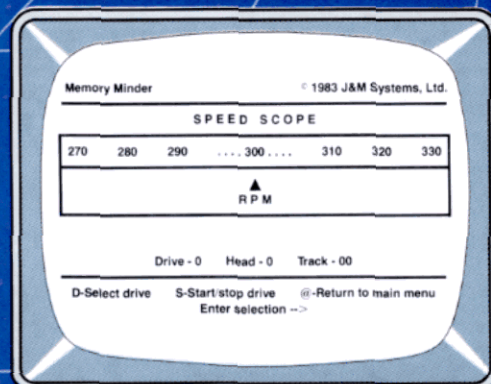
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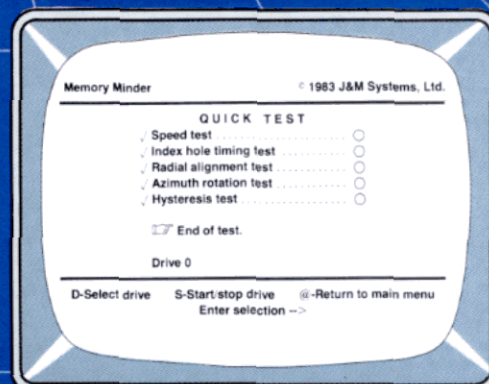
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