PRINTERS: HOW DO THEY STACK UP?

57 Compared in 80's First Buyers Guide to Printers.
Store Up to 350 Kbytes on a 5" Disk

The DOUBLER™. It packs almost twice the data on a disk track as your single-density system. Depending on the type of drive, you can store up to four times more data on one side of a minidiskette than you can store using a standard Model I mini-disk drive.

- The DOUBLER™ reads, writes and formats either single- or double-density minidiskettes.
- Proprietary design allows you to continue to run TRS-DOS®, NEWDOS®, Percom OS-80™ or other single-density software without making any changes to software or hardware. Switch to double-density operation at any convenient time.
- Includes DBLDOS™, a TRSDOS* compatible double-density disk operating system.
- CONVERT utility, on DBLDOS™ minidiskette, converts files and programs from single- to double-density or double- to single-density.
- The DOUBLER™ circuit card includes high performance data separator, write precompensation circuits for reliable disk read operations - even with 80-track drives.
- Plug-in Installation - The DOUBLER simply plugs into the disk controller socket of your Expansion Interface, requiring no stripping or trace cutting. Expansion Interface disk controller may be completely restored to original configuration by simply removing the DOUBLER™ and re-installing the original disk controller chip.
- Works with standard 35-, 40-, 77- and 80-track mini-disk drives rated for double-density operation.
- Introductory price, including DBLDOS™ and format conversion utility on minidiskette, only $219.95.

Mini-Disk Systems

More storage capacity, higher reliability - from Percom, the industry leader. One-, two- and three-drive configurations in either 40- or 77-track format. Fully burned-in. From only $399.

Double-Density Software

- OS-80D™ Double-Density Disk Operating System - This double-density upgrade version of Percom's acclaimed OS-80D™ resides entirely in RAM - requiring only 7.5-Kbytes! A BASIC programmer's "dream operating system," even utilities are in BASIC.
- DOUBLEZAP-II/80 This program modifies Apparat's NEWDOS/80 to run either double- or single-density programs — even to run a mix of the two formats on one system!
- DOUBLEZAP-II/V This program modifies Virtual Technology's VTOS 4.0f to provide the same capability as DOUBLEZAP-II/80 provides for NEWDOS/80.

Call toll-free, 1-800-527-1592, for the address of your nearest authorized Percom dealer, or to order directly from Percom.

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE. PRICES DO NOT INCLUDE SHIPPING AND HANDLING CHARGES.
Percom's DOUBLER II* tolerates wide variations in media, drives

GARLAND, TEXAS — May 22, 1981 — Harold Mauch, president of Percom Data Company, announced here today that an improved version of the Company's innovative DOUBLER™ adapter, a double-density plug-in module for TRS-80® Model I computers, is now available.

Reflecting design refinements based on both theoretical analyses and field testing, the DOUBLER II*, so named, permits even greater tolerance in variations among media and drives than the previous design. It allows the same drive to read 364-Kbyte diskettes of any manufacturer.

Like the original DOUBLER, the DOUBLER II plugs into the drive controller IC socket of a TRS-80 Model I Expansion Interface and permits a user to run either single- or double-density diskettes on a Model I drive. With a DOUBLER II installed, over four times more formatted data — as much as 364 Kbytes — can be stored on one side of a five-inch diskette than can be stored using a standard Tandy Model I drive system.

Moreover, a DOUBLER II equips a Model I with the hardware required to run Model III diskettes. An additional circuitry board for Model III diskettes is not needed. (See "OS-80*: Bridging the TRS-80* software compatibility gap" elsewhere on this page.)

The critical clock-data separation circuitry in the DOUBLER II is a proprietary design called a ROM-programmed digital phase-lock loop data separator. According to Mauch, this design is more tolerant of differences from diskette to diskette and drive to drive, and also provides immunity to performance degradation caused by circuit component aging.

Circuit misapplication causes diskette read, format problems.

GARLAND, TEXAS — The Percem SEPARATOR* does very well for the Radio Shack TRS-80® Model I computer what the Tandy disk controller does poorly at best; reliably separates clock and data signals during disk-read operations. Unreliable data-clock separation causes format verification failures and repeated read retries.

**The SEPARATOR**

The problem is most severe on high-number (high-density) inner file tracks. As reported earlier, the clock-data separation problem was traced by Percem to misapplication of the internal separator of the 1771 drive controller IC used in the Model I.

The Percem Separator substitutes a high-resolution digital data separator circuit, one which operates at 16 megahertz, for the low-resolution one-megahertz circuit of the Tandy design.

Separator circuits that operate at lower frequencies — for example, two- or four-megahertz — were found by Percem to provide only marginally improved performance over the original Tandy circuit.

The Percem Separator is a simple adapter that plugs into the drive controller of the Expansion Interface (EI).

Not a kit — some vendors supply an untested separator kit of resistors, ICs and other paraphernalia that may be installed by modifying the computer — the Percem Separator is a fully assembled, fully tested plug-in module.

Installation involves merely plugging the SEPARATOR into the Model I EI disk controller chip socket, and plugging the controller chip into a socket on the SEPARATOR.

The SEPARATOR, which sells for only $29.95, may be purchased from authorized Percem retailers or ordered directly from the factory. The factory toll-free order number is 1-800-527-1592.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty.

Owners of original DOUBLERS may purchase a DOUBLER II upgrade kit, without the drive controller IC, for $30.00. Proof of purchase of an original DOUBLER is required, and each DOUBLER owner may purchase only one DOUBLER II at the $30.00 price.

The Percem DOUBLER II is available from authorized Percem retailers, or may be ordered direct from the factory. The factory toll-free order number is 1-800-527-1592.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty.

All that glitters is not gold

OS-80* Bridging the TRS-80* software compatibility gap

Compatibility between TRS-80® Model I diskettes and the new Model III is about as genuine as a gold-plated lead nugget. The Model III TRSDOS* diskettes can be read on a Model III. But first they must be converted and re-recorded for Model III operation. And you cannot write to a Model I TRSDOS* diskette. Not with a Model I. You cannot add a file. Delete a file. Or in any way modify a Model I TRSDOS* diskette with a Model III III computer.

Furthermore, your converted TRSDOS* diskettes cannot be converted back for Model I operation. TRSDOS* is a one-way street. And there's no retreading. A point to consider before switching your computer's filesystem to your new Model III.

Real software compatibility should allow the direct, immediate interchangeability of Model I and Model III diskettes. No read-only limitations; no conversion-to-recording steps and no chance to be left high and dry with Model III diskettes that can't be run on a Model I.

What's the answer? The answer is Percem's OS-80* family of TRS-80 disk operating systems. OS-80 programs allow direct, intermediate interchangeability of Model I and Model III diskettes. You can run Model I single-density diskettes on a Model III; install Percem's plug-in DOUBLER adapter in your Model I, and you can run double-density Model III diskettes on your Model I.

There's no conversion, no re-recording.

Slip an OS-80 diskette out of your Model I and insert it directly in a Model III. And vice-versa.

Just have the correct OS-80 disk operating system — OS-80, OS-80D or OS-80III — in each computer.

Moreover, with OS-80 systems, you can add, delete, and update files. You can read and write diskettes regardless of the filesystem.

OS-80 is the original Percem TRS-80 DO* for BASIC programmers.

**Even OS-80 utilities are written in BASIC**

OS-80 is the system around which a user writes, in Creative Computing magazine. *... the best $3.00 you will ever spend*.

**Requiring only seven Kbytes of memory, OS-80 disk operating systems reside completely in RAM. There's no need to dedicate a drive exclusively for a diskette system.**

**And, unlike TRSDOS, you can work at the track sector level, defining and controlling data formats — in BASIC — to create simple or complex data structures that execute more quickly than TRSDOS files.**

The Percem OS-80 DOS supports single-density operation of the Model I computer — price is $25.00. The OS-80D supports double-density operation of Model I computers equipped with a DOUBLER or DOUBLE II adapter. OS-80III — for the Model III of course — supports both single- and double-density operation. OS-80D and OS-80III each sell for $49.95.
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Part III  68
Advanced Graphics Techniques
by Bob Boothe
In this final part of a graphics series, Boothe uses machine language routines with disk commands. He also teaches his printer how to do high density graphics. More patterns are presented, and Boothe provides the spells a computer wizard needs to rotate a pattern on its axis.

80 Microcomputing's Buyers Guide to Printers  84
The editors have been busy during the long winter months compiling this very detailed list of printers. What they are, what they do, how much they cost, and where to get them are a few of the questions covered in this guide.

A Tiger With Dots  96
by George Somers
Somers bought a Paper Tiger, and immediately began tiger training. Turns out he's very good at this! He's trained his tiger so well it won't put out a dot without his say-so. And when he does say so, it jumps. No whips and chair for this trainer, though; he uses software, and shares some of his training routines in this article.

The Color Computer—An Inside Look  202
by Phillip Martel and Robert Nicholas
The authors describe the Color Computer, its features, functions and commands. Some handy charts are presented, as well as programs that make this newest '80 strut its stuff.

The Software Broker  268
by John Harper
Ever want to try to make a killing in the stock market but not quite dare? Harper arms you with all the software and information you need to use your 80 to help you make predictions and a few calculated decisions.
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COVER PHOTO

Cover photo by Martin J. Paul

*TRS-80 is a trademark of Tandy Corp.
FEATURES:
1) Radio Shack compatibility
2) Error free variable length records
3) Full lower case detection and support
4) Repeating keyboard with NO keybounce EVER
5) Shift [O] typewriter keyboard option
6) Execute only protection feature for BASIC programs
7) Automatic track support for 35 through 80 track drives (mixed)
8) Device I/O handing with FORCE command
9) Supports high speed clock modification (up to 4.096mhz)
10) Supports mixed mode (single & double density) automatically
11) Allows disable-enable of break key
12) Allows user to define step rate per drive and re-configure system disk
13) Allows for efficient use of double-headed drives
14) Built in screen printer (shift [CLEAR]) with [BREAK] key abort
15) Multiple command chaining with "DO"
16) Built in memory test with CLEAR command
17) New printer driver which allows complete forms control and paging
18) Automatic serial printer driver with optional auto linedfed
19) Execute any DOS command from BASIC and return to BASIC
20) Free space map of diskette with optional output to printer
21) Copy with variable length files
22) Complete RS232 control from keyboard with status check
23) Create and pre-allocate files from DOS
24) Display current date and time from DOS
25) More information from Directory with optional printer output
26) Enter DEBUG with shift [BREAK] to allow use of [BREAK] from BASIC
27) New DISK2DUMP/CMD sector display/modify program (works with filespecs)
28) New DISK2DUMP/CMD single/double density disk editor
29) New BACKUP (more reliable, no more 'back' disk check)
30) New FORMAT (more reliable, no need to bulk erase disk first)
31) New MAP utility (maps out disk, showing where files are located)

New DOSPLUS Z80 Extended Disk BASIC

1) Faster loads and saves
2) BASIC Reference utility (lines, variables, keywords, printer option)
3) BASIC Renumber utility (renumber section of text, block text move)
4) Shorthand for almost any direct command (LOAD, SAVE, etc.)
5) Shorthand for cutting (listing and editing with single keystroke)
6) CMO 'M' instantly displays currently set variables
7) Global search and replace in BASIC text
8) Line printer TAB to 255
9) OPEN"E" to end of sequential file (for output)
10) DI (delete and insert text line)
11) DU (duplicate text line)
12) "R" & "V" options after LOAD and RUN (files open & save variables)
13) OPEN"D" allowed (Model II compatible) equal to OPEN"R"
14) DOS commands from BASIC
15) Automatic, error-free variable length records
16) Single step execution with TRON (fabulous for debugging)
17) CRUNCH (BASIC program compressor)
18) New TBASIC (tiny BASIC) offers full BASIC commands
19) TBASIC and DOSPLUS together only use 8K of RAM (40K left in 48K TRS-80)

***** 7 MORE UTILITIES *****
1) Single drive copy
2) Restore (dead files)
3) Purge (unwanted files)
4) Clearfile (destroys data by writing zeros to file)
5) Transfer (moves all user files from one disk to another)
6) Spooler (allows printing of text while freeing up the CPU)
7) Crunch (Basic program compressor)

***** ALSO *****
* New I/O package 30% faster
* No BREAK key death from DOS
* No closing killed files and ruining diskettes

DOSPLUS gives you more of what you buy an operating system for. Speed and reliability without sacrificing simplicity and power. If you need extra power without extra wait, then you need DOSPLUS!

Single or double density systems available for Model I, Model III DOSPLUS ready for immediate delivery.

Perhaps the best investment you can make for your TRS-80! Listen to what others have had to say about DOSPLUS.

"Overall, DOSPLUS is the fastest operating system I have seen..."


"DOSPLUS... the better mousetrap."

Stewart Fason in 80-Microcomputing

"On a scale of 1 to 10, I give DOSPLUS a solid 9."

Reese Fowler in 80-Microcomputing

(Model III DOSPLUS review)

For the BASIC programmer, our features are unmatched. For the average businessman, our speed and simplicity cannot be beat.

So, join the satisfied users who have joined DOSPLUS. Experience excellence! Experience DOSPLUS!

DOSPLUS comes complete with full utilities, PLUS a FREE patch to enable Model I Scriptsit/Superc Script to run on Model III, UNLIMITED Backups!

Model I DOSPLUS — $99.95
Model III DOSPLUS — $99.95
Model I double density upgrade — $175.00
Master Directory 1.2 (double density) — $29.95

STEP ON THOSE DOS BUGS!!
ORDER TODAY!!
The Pocket Computer

Despite the lack of consumer enthusiasm for the Pocket Computer, Radio Shack has not lost faith. We are promised memory expansion, a printer and other goodies as support.

The noticeable absence of user interest in the PC has kept us from doing much for the system in this magazine. Perhaps many PC owners reacted as did I—becoming a bit disillusioned at the poverty of even remotely useful programs in the thick book that accompanies the computer. I was further put off by the miniscule internal memory and the difficulty involved in expanding that memory. I hoped that

"Since the main benefit of the PC is its very small size, ways of adding memory without significantly increasing the size will be welcome."

The Color Computer

Another Radio Shack computer which has gotten little play so far is the color system. With the total lack of available software, there is no reason for any businessman to even take a look at it. But since it seems likely that this system is going to be around for a while, I'd like to see some articles on it. We want to know what changes have to be made in BASIC programs to get them to run on the color system. We want to know more about color graphics and how to get into the machine to make these graphics more useful and flexible. We want to see programs for it, as well as successful conversions.

Then there is the Model III, which is fairly compatible with Model I programs. We all want to know more about its differences and what to do about them. If you've had to change any of the published programs in 80 to get them to run on the Model III, let us know about it.

The New Magazine

To provide businessmen with a magazine which will tell them what computers are doing now and what will happen in the future, we're planning a magazine for fall debut which will be written in plain English.

The new magazine (Desktop Computing) will have articles on the successful business uses of small computers. Since you are in touch with many of the businesses where desktop computers are being used, this is another publishing opportunity for you. Readers of the new magazine will want to know what system a business chose, some of the reasons why, what hardware, software and accessories were used, what problems were encountered and how they were solved, and, most importantly, the benefits of the new system. Did the installation save money, eliminate a job?

The tricky part of writing for Desktop Computing will be avoiding terms with which businessmen are not familiar. You may know just what is meant by a global search and replace, but the average businessman will be bewildered.

Royal Shafting?

Some wag apparently sent my name to Royal as a prospect to buy a word processing system from them. The literature package arrived, and I do want to thank whoever did me that good turn. Not that I became interested in the Royal system, but rather that I was surprised at how little computer you get for $11,500.

Royal no doubt has a very nice word processor. But it is dedicated and, from the literature, can be used for nothing else. Compare that to the TRS-80 word processor, where, with the flick of a disk, you can use the same system for bookkeeping, inventory, invoicing and making sales charts. And it costs about one third the price of the Royal. How can they stay in business?

Do you realize how much computing equipment you can buy for $11,500? I think I could outfit a small office for the same price as one dedicated Royal word processor. Buyers beware!

"We want to know more about color graphics and how to get into the machine to make these graphics more useful and flexible."

Notice: Because of a late mailing William Barden's column, The Assembly Line, will not be appearing this month. Our apologies. He'll be back next month.
Last week, Bill Waiters (our Consumer Information Manager) and I visited 80 Microcomputing's nice folks in beautiful Peterborough, N.H. Know what? Those employment ads Wayne runs every so often don't lie—it's a lovely place! It's also true that it's a non-smoker's place to work. Since Bill and I are both successfully reformed smokers, we were allowed in for a look around and a very enjoyable day. We found the staff hardworking, enthusiastic, bright and very friendly. If you don't smoke and think you're either young enough or crazy enough for this sort of work, I'm sure they'd like to hear from you.

If you do smoke (or even if you don't...we're open-minded) keep Radio Shack in mind too! Our R&D group keeps an eye open for talented engineers, systems and applications software analysts and programmers. Our documentation group is always on the lookout for people to develop manuals for our software and hardware products. There are also two software testing groups, one in the software area, and one in our Merchandising Department.

There are long hours, great people to work with, and some outstanding fringes. If you're interested, drop a letter and resume to Mr. George Berger, our Personnel Director at 500 One Tandy Center, Ft. Worth, TX 76102.

Model II Scriptsi Owners

While I'm enjoying Scriscript on my Model II right now, I'll pass on some information. We have received comments from a number of people about funny things happening during printout: pages printed with only one or two lines on them, or even completely blank pages printed between correctly formatted ones. As far as I know, there is one thing you can do which will cure all these problems—before you print a document, issue a repaginate command. This is especially important if you've added text after a previous repagination.

Repagination adjusts your pages to the maximum allowed number of lines. If you then add a couple of lines, that page is too long. The extra lines are stored in the proper place, but can only print as an additional (and usually unwanted) page. To make room for the addition, all following pages must be readjusted. We left that for you to do manually, saving time when you're editing a multi-page document.

Wanted... A Variety of Experts

There are lots of vertical markets (uses which are specific to a particular kind of business) for computers. Unfortunately, we haven't found a way to become experts in all business and professional fields... yet there is a great demand for software for specific vertical markets. We'd like to provide for as many as we can. Maybe there are a lot of you who could help us and yourselves.

If you're really knowledgeable, or a recognized expert (whatever that means) in a viable field, and you believe you could define a really outstanding use for a TRS-80 in that field, write to us.

We work with outside people on about 60 percent of our software, so it's not a new idea, just not too well known. Now that our basic accounting and word processing packages exist, the vertical markets are most interesting to us.

Complaints, Again

Complaints and misunderstandings (in plain language, our hate mail) have recurred significantly in recent months. I still would like to touch on some complaints or misconceptions from time to time, just for those who might not have heard the answer to their specific questions.

Our computers are designed for the needs of the target market: cost effectiveness, ease of repair, etc. We don't trade off these items just so they'll easily interface with existing peripherals. Neither do we make an effort to make interfacing difficult. Come on, guys, we have to interface them to the outside world too, when we produce our own peripherals.

Want information? Phone calls won't often get the technical information you want. However, I am assured that our engineering group (which includes systems software) will answer almost any technical question (we won't do custom engineering or software for you) which is submitted by mail. They will answer specific questions about, but will not furnish source code listings to, our systems software. You should be able to get any answer for which you know how to ask the question. If you find my information to be untrue, I'd like to hear about it, and who you corresponded with.

Warranty, Warranty... Who's got the Warranty?

We've received many questions recently about who to buy your TRS-80 from, and whether or not you get a warranty. We hear that a few of our salespeople may be leaving the wrong impression with customers as to company policies, warranties and dealers, so I'd like to clear some of the fog.

Radio Shack has company owned stores, as well as authorized dealers and franchises. There is absolutely no difference in the Radio Shack merchandise you get from these outlets, or the warranty you're entitled to on it. We control our stores, while authorized dealers are independent businessmen who buy our products and resell them to you. Their operating policies and how they run their business is up to them. If you buy any Radio Shack product from any of our authorized outlets, you can return it to any Radio Shack store anywhere, for warranty service. You will need your original sales ticket to secure in-warranty service.

Although I'm often asked, I'm not going to tell you where to buy, because it shouldn't matter. I will make one common sense suggestion. Anything electronic can go wrong; when you need help or advice, you're almost always going to fare better with the guy who made the profit on the sale.

Radio Shack requires its company owned store personnel to handle any customer's problem in a timely fashion. Human nature simply says that a company store employee or dealer is much less likely to give up his lunch hour to help
WHEN YOUR NUMBER IS UP, CALL OURS.

FREE.

1-800-321-META

IN OHIO, (216) 289-META

When you are weary of the "NEVER UNDERSOLD" dealers, when you are tired of corresponding with a post office box number, when you are fed up with paying for long distance phone calls because you haven't received your merchandise, when your number is up, call ours.

We don't think any company can be everything to everybody, so we don't try to be. While each of our companies is an independent legal and financial entity, we share a common bond. The one thing we will never undersell you on is service.

With almost 20,000 square feet of facilities, knowledgeable, professional staffs, and solid experience in the industry, we intend to be around for a long time. Our level of automation within our companies (centered around our $200,000 data processing/communications network) may be unsurpassed in the business. Bigger can mean better... and we're out to prove it.

Whether you need a $20 box of diskettes or a $250,000 timesharing system, help may be a phone call away. So, when your number is up, call ours.

The META Companies
26111 Brush Avenue, Euclid, Ohio 44132

META TECHNOLOGIES CORPORATION
Software/Supplies

META RESOURCES CORPORATION
Management/Services

META LOGIX CORPORATION
Wholesale/Dealer's Supply

META VIDEO CORPORATION
Video Tapes & Supplies

METATRONICS CORPORATION
Hardware/Supplies

MMP
Meta Media Productions, Inc.
Advertising

© 1981 by Meta Resources Corporation
"...accusing fingers have been pointed toward the poor TRS-80 and its apparent inability to handle tabs in excess of 64."

HOWZAT?

While I appreciate your publishing my article ("WHERZIT") in the April issue, your choice of a title is a cruel joke, given the article's premise. Please assure your readers that I had no part in its selection.

There is a typo on page 254 of the article that we all missed. CLEAR 44000 is correct for a 48K machine, not a 64K machine.

James H. Fox
Atton, MN 55001

You're no fun!—Eds.

DOS vs DOS

Mr. Fason's review of Percom's doubler was very interesting to me, and I certainly agree that the product is a boon to disk storage space. The DBLDOS sale literature and the review, however, are very misleading; it does support TRS DOS commands, but only those of version 2.1. If one is fortunate enough to have version 2.3, you learn that you not only lose DEVICE, which is not loss in most cases, but you also lose BASIC and COMMAND "!". Now, that is very disappointing, especially when one has hopes of doing some long postponed MERGING.

I would appreciate any assistance you can give in the way of an article or source of a technique to get TRS DOS version 2.3 into DBLDOS.

Joe Restle
Langhorne, PA 19047

Double Density DOSPLUS from Micro Systems Software is a better alternative to DBLDOS and is a more powerful DOS than even TRS DOS 2.3.—Eds.

80 Tabs

For many months now, accusing fingers have been pointed toward the poor TRS-80 and its apparent inability to handle tabs in excess of 64. I suggest that the accusers look to the real culprit, their

printers.

I use a NEC Spinwriter 5330 which accepts tabs from 0 to 132 without a murmur; tabs in excess of 132 executes a CR/LF. I do not know what the upper limit is, but would hazard a guess at 65535.

Big tabs work equally well with the new two-chip ROM and the older three-chip ROM when used with an intelligent printer. So stop blaming the 80, there are very few shortcomings with it, and most of these can be attributed to software and peripherals.

C. J. Casselden
Sutton, Surrey, England
SM2 5DL

Easy Machine Language

My eternal gratitude for Lt. John Harrell's article (January 1981) on the Super Bug Monitor. As the proud new owner of a TRS-80 Model III, I was eager to begin writing machine language. To my chagrin, Radio Shack had no EDMASM for the Model III. I had written a BASIC program to permit me to input hex into RAM, and was blindly POKENg in machine code.

Upon reading Lt. Harrell's article and perusing the listing for his program, I figured the monitor would work in the Model III as long as the ROM calls would work. The ROM routines listed in the Model III Manual were the same as Lt. Harrell's, so I hoped the others would be, also.

Lo and behold! All ROM calls worked. The program works exactly as described.

After loading and testing the program in high RAM (6330H), I relocated it to where Lt. Harrell had located it (4330H). However, some of the code kept getting overwritten; apparently the Model III uses 4420H-4430H as some kind of stack.

I now eagerly await an assembler-disassembler for the Model III. Lt. Harrell's monitor has eased the pains of machine language programs, but I am still manually assembling them. Perhaps a vendor has an assembler for the III? (If so, none indicate such in any ads in your great mag.)

Bruce C. Hampton
320 A. N. Kenwood
Glendale, CA 91206

Thanks Readers

Thank you very much for sending our Folsom Prison Computer Group the complimentary subscription to 80 Microcomputing, and for publishing my letter in your February issue. As a result of the letter, many of your readers sent our group a fine selection of software tapes, textbooks, and various computer related materials.

In January, our Education Department initiated a course in Introduction to Microcomputers, which will be followed by a course in BASIC language for micros. So, our program is starting to move at a faster pace and we will be able to make good use of all the materials sent to us by readers of 80 Microcomputing.

On behalf of our computer group, I would like to take this opportunity to thank all of the many readers who sent materials to us, and to again thank you and your staff for your interest and assistance. All of us who will be making use of the materials sincerely appreciate the efforts extended on our behalf.

Gottfried R. von Kronenberger
P.O. Box B-49542
c/o Mr. R. E. Miller,
Supervisor of Education
Folsom State Prison
Represa, CA 95671

Pennington Pal

The following letter was addressed to H. C. Pennington.

Congratulations on a very fine article in the March issue of 80 Microcomputing. I wish more people realized what we have gone through with the TRS-80. I read John Grass's letter and it became obvious to me that he was naive as to what makes a disk operating system work. I'm glad you wrote the reply.

I am very skeptical of anything that Radio Shack sells. They just don't quality control their products very well before they are released to the public.

As a design engineer, I don't think much of their hardware design. The tape interface circuitry in particular amazes me that it works as well as it does.
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I have your book and am very, very pleased with it. That kind of information is not commonly known. I, like John Grass, am also looking for a good book disassembling Level 2 and Disk BASIC. If you have a specific recommendation, I'd appreciate hearing about it.

John Zdenek
Riverside, IL 60546

Letter vs Book

If I were Pennington and English were my fourth language, I would still be embarrassed by the semiliterate style, or lack thereof, of TRS-80 Disk and Other Mysteries. Had he written his book as well as the rebuttal of Mr. Grass' letter, it would have been a masterpiece.

Louis Zeppa
Sacramento, CA 95819

European Orders

I have unfortunately had a bad experience with some American firms who regularly advertise in your magazine, but who pursue a most dubious business policy vis-à-vis European customers.

For example: In October 1979 I ordered a one year subscription from H & E Computronics. As demanded, I paid in advance by bank transfer. In spite of several letters and reminders, this firm seems not to be willing to carry out my order. Meanwhile I have asked the German Consulate in New York for help. But, despite telephone calls and reminders, even the Consulate had no success. In their letter of November 12, 1980 they write: "Leider hinterleB die Firma auch beim Generalkonsulat keinen guten Eindruck," which means, "This firm did not leave a good impression vis-a-vis the General Consulate."

In order to avoid such losses to other readers of your magazine, I would be glad if you published this letter.

I had the same experience with Cost Effective Computer Service, who received my money order of September 19, 1980 for a TRS-80 program, which they have not delivered.

Claus Behnke
Dasnoeckel 59
D-5600 Wuppertal 11
W. Germany

Unfortunately, Mr. Behnke does what many other foreign buyers do. Mr. Behnke had his bank (or post office) forward a check to a United States company. When these checks arrive, they come without any explanation and usually contain an incomplete address. In the case of Mr. Behnke, we received a check without any explanation. The address that appeared on the check was: Dasnoeckel 59, 5600 Wuppertal 11.

We didn't even know what country the check came from and had no way to contact the customer.

Our policy is to deposit these checks after making a photocopy of the check. We always have a file of about 20 outstanding checks of this kind. We have to wait for the customer to contact us (usually stating that they had sent us a check and didn't receive their order). At that time, we check the customers complaint against our outstanding check file and try to find a check that matches the customer's order.

We suggest that you advise all 80 Microcomputing readers that they should always send their orders with their check.

Marlin, Customer Service
H & E Computronics

Ed's Note: A copy of Mr. Behnke's complaint was also sent to Cost Effective Computer Service with an offer to print any reply they might care to make. As of this date, no reply has been received.

Character Generator Works

I would like to clarify and update a few points brought up in Eric Keener's letter on page 16 of the March issue.

The character generator IC, part number AXX-3027, whose catalog number is 26-1104, cannot be ordered from a Radio Shack store. It can only be obtained through the Service Department. The address has been changed to: Radio Shack Customer Service #0048, 900 E. Northside Dr., Fort Worth, TX 76102. It can also be ordered by calling 817-870-5662. I used the latter method and received the part in seven days.

I installed the lowercase modification that was published on page 72 of the March 1980 issue. I was hesitant about ordering the IC because a friend of mine had the Radio Shack version installed, which was wired slightly differently than the one I had installed. I decided to go ahead and buy it even though I could not be certain it would work. It arrived after seven days.

I opened the case of my computer and examined both chips carefully to see if there was much difference in the part number. The one in my computer had the number 8046670 and the new chip had the number 8046673. Figuring that there wasn't much difference, I replaced the old with the new and put my computer back together. I reconected everything and powered it up. A-O.K., DOS booted up and everything seemed normal. I turned on the lowercase switch and ran SCRIPSET/IC. Voila, I had normal uppercase and lowercase with descenders. It works fine for me.

Jeffery A. LeBlanc
548 Marion Ave.
Lima, OH 45801

Airborne Computer Programs

I am producing a weekly communications magazine program in English for the Dutch External Service, which is broadcast on short-wave to a world-wide audience each Thursday. At the suggestion of some of our listeners in the USA, Europe and the Pacific, we intend to try an experiment fairly shortly, which might be of interest to you readers.

On Thursday September 10th, 1981, we will be devoting our Media Network program to the subject of home computers and how they can be of use to the active short-wave listener. As well as an introduction to microcomputing, we will also be including a short computer program in three different formats, broadcast in machine readable form over the air. Providing the signal strength is sufficient in the listener's area, we hope it will be possible to record the computer program (off the air) onto cassette tape and play it back into a home computer. Preliminary experiments indicate that the system should work, but the purpose of the experiment on September 10 is to gauge whether atmospheric noise is low enough in most of our target areas to enable the scheme to work. If successful, the idea might be repeated on a more regular basis.

Three computer programs will be transmitted, of use to the short-wave listener, to be compatible with Tandy Radio Shack, Apple, and Commodore PET microcomputers.

The time chosen is the beginning of the program Media Network, which runs for 30 minutes. All times are quoted in Greenwich Mean Time, which is five hours ahead of Eastern Standard Time.

Listeners who hear the broadcast, and try out the computer program, are encouraged to write in and report their results to the following address:

Computer Experiment
Media Network
Radio Netherlands

Continued to p.14
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Tel: 16151  
Tix: 43336

Eds. Note: See box below for broadcast times and frequencies.

Mod III List

I am attempting to compile a list of TRS-80 Model I programs that will (or will not) run on the Model III. I would appreciate any input from your readers.

To those who kindly respond, please mention if the program was on disk or tape—BASIC, System or disk CMD file—whether run under Level II or DOS, and, if DOS, which one. If any changes needed to be made to the program, what were they? All those who send me information will be sent the compiled list (after a reasonable length of time to get all input) if a SASE is included with your information.

Ken Knecht  
1340 W. 3rd St. #130  
Yuma, AZ 85364

Rummy Master Notes

Here are some comments on a game I purchased. The name of the program is Rummy Master, by Dave Gubser, and is published by Quality Software. The program is supposed to accept light pen input. However, if a light pen is used, an OM error occurs during most games.

There are also two occasions when an SN error will be generated: in line 254, when an ace is melded to an existing 2-3-4 meld, and when a flush meld is attempted with card suits that don’t match.

The first bug can be fixed by changing MF(99)=INT—130 to MF(99)=CA—130. The second bug can be fixed by changing 3: to :GOSUB 3: and retyping the rest of the line using the back and insert edit command.

One other problem is that the computer will not allow you to call Rummy. This problem I have not been able to fix... yet. If you call Rummy while using the light pen option, the program crashes back to the beginning of the game.

If Rummy is called while using the keyboard, the computer just ignores you. If anyone has a debug for this problem I would like to hear from you.

There are two cures for the OM error problem: Add more memory to your computer, or make two programs out of the one, separating the light pen and the keyboard options.

I hope this helps others who have this program.

John F. Costello  
Philadelphia, PA 19127

Likes Hayden

A public thankyou and “attaway” to the Hayden Book Company.

Several months ago I purchased Sargon II and enjoyed many hours with this fine chess program. My only complaint was that the volume setting of my cassette player was very critical.

After a period of disuse, the tape would not load at any volume level. With fingers crossed, I sent the tape to Hayden. I promptly received a letter of apology from Stephen Rados, Games and Entertainment Software Editor, along with a new tape that loads correctly.

At $30, Sargon II is a bargain, and Hayden is to be commended for standing behind their product.

James L. Price  
Modesto, CA

Business and Model I

I quite agree with Dr. Goldstone in his letter “Radio Shack and Model II” in the April issue, p. 21.

The very reason I chose and purchased the TRS-80 Model I was due to its modular design. I certainly didn’t purchase it for its good looks. Had I been interested in a good-looking computer I’d have gone elsewhere. Instead, I wanted one that was both functional and convenient. It will not be at both convenient for Model II and Model III owners to interrupt their computing because they have to haul the whole thing in for repairs. I’m not saying that those Models don’t have a market (obviously they do). The same ought to be true for Model I. I compare it to the purchase of fine stereo equipment—modular systems are much more preferable to the music enthusiast.

Perhaps Radio Shack is looking over the continued marketplace for the “ugly duckling” Model I.

Question: Why has the Model I been withdrawn from production? Let’s hear Tandy’s side of the picture.

Patrick T. McArron, President  
Advance Weekends, Inc.  
Santee, CA 92071

Patches from Holland

After reading the article “#26-2202 Review” by G. F. Stevens in the February 1981 issue of 80 Microcomputing, I decided to purchase the package. Much to my surprise, the complete package cost me less than the cassette EDTASM that I purchased two years ago.

The first thing I had to do was fix the crash that occurred when exiting EDIT and M80. I would like to share my fix with your readers.

TRSDOS 2.1/2.2/2.3 does not initialize the Debug jump vector at 4315 (hex) to the correct value at Boot. Both EDIT and M80 prevent a jump to Debug by filling location 4315 (hex) with 00 upon entry. But both programs store the value C3 (hex) at this location upon exit to DOS. Since the jump vector has not been initialized to the correct value, and since the user is probably
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OPINION = OOPS!

The following Debug is submitted concerning the article in the March 1981 issue titled “OPINION = PEEK (MAIL)” (page 248):
I fully expect that in 1981 we will see a full network type data base management system released ‘for’ (not ‘by’) the Shack to revolutionize information management.

My apologies to any Shack Dealers who might have been bug by inquiries about the data base manager. And a special apology to Micro Data Base Systems, Inc., of Lafayette, Indiana, which did release this remarkable piece of programming.

Jim Glosser
1425 Eden Rd.
York, PA 17402

KKEEPFIX FIX

I have found the following error in my article, “KKEEPFIX Revisited,” in the March 1981 issue. In the third column on page 271, the two lines of machine and assembly language code should be:

<table>
<thead>
<tr>
<th>Location</th>
<th>Hex Code</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>7FBA</td>
<td>3E 89</td>
<td>LD A,39H</td>
</tr>
<tr>
<td>7FBC</td>
<td>32 49 40</td>
<td>LD (4649H),A</td>
</tr>
</tbody>
</table>

Darrell R. Whitehead
11 Patterson Road
Bedford, MA 01730

Lost POKE

Re: “Where Have all the GOTO’s Gone?,” March, 1981: One command is missing in the printed version of my article.

Under “APPENDING,” page 237, top left, following POKE 16548,233, add this command: POKE 16549.66.

Hubert C. Borrmann
2840 S. Circle Dr. #209
Colorado Springs, CO 80906

still pressing the Break key upon entering DOS, a crash may occur.

TRSDOS users should always type DEBUG (OFF) and DIR after a Boot to initialize 4315 (hex) to the correct value. But M60 and EDIT may also be patched to prevent a crash. This is done by filling 4315 (hex) with 00 instead of C3 (hex) upon exit.

Also included is a patch to have EDIT echo a graphic character for the Break key, instead of a dollar sign.
The relative sector of the disk file may be used when patching the programs with Superzap 2.0.

Tom de Man
P.O. Box 169
2250 AD Voorschoten
Holland

BASIC Business

How many times have you heard people say that BASIC is too simple and too slow a language to use for business purposes? I think the problem is that too many have not had the chance to really learn BASIC and the methods that can be used to speed things up in order to use it effectively. The following simple program demonstrates that BASIC is not so bad. The starter program for assembly language seems to be a program to white out the screen since BASIC takes so long. Try this one for speed: It’s slower than machine language but...
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### DEC Interface, Anyone?

We have a TRS-80 Model 1 Level II with an expansion interface and 64K. We also have a DEC (Digital Equipment Corp.) VT78 with two dual RX01 disk drives.

Wouldn't it be nice if the TRS-80 could utilize some of this disk space!

We would be very interested to hear from anyone who has a bright idea and/or experience at interfacing such equipment either directly or via the processor, which is basically a PDP8.

**Stephen and Margrit Walsh**  
Birkenweg 8  
6024 Hildisrieden (LU)  
Switzerland

---

### cassette woes

I seem to have developed a random problem with my CTR-41 cassette recorder in use with a Model 1, Level II, 32K system.

Occasionally during a LOAD verification of a CSAVE tape dump, the check will come up bad. At this point the tape transport stops and a check of the tape shows what appears to be a perpendicular line across the tape. In most cases the tape can be cleaned (erased) using an RS-44-210 bulk eraser, and then CSAVEd and CLOADed all right.

I have experienced this problem several times on various quality tapes and am wondering if this could be unique to my system. I have heard of the CTR-80 recorder having some problem along this line, but do not know whether it is a hardware or ROM routine problem.

Apparently I have the earlier Level II ROM which also has the infamous POKE 16563,255 problem to solve with the data read routine from restoring each read.

Any help you might furnish in this regard would be appreciated.

**William J. Weaver**  
714 St. George Dr.  
Washington, IN 47501

---

### Pocket Computer Interface

Mr Richmond, February 1981

"Input," is looking for a device that transfers data between the Tandy Pocket Computer and the TRS-80. This interface is available from:

- Reinhard Wiesemann  
  Winchenbachstr. 3a  
  D-5600 Wuppertal 2  
  W. Germany  
  Tel: 0202/514044  
  TELEX: 8 591 617

The device is accompanied by a machine code program (MTERM32 MTERM48) on disk for disk systems with 32K and 48K. Also included are demo programs and an extensive description.

I have tested both the hardware and software and I am amazed with it. Data and BASIC programs may be transferred to the TRS-80. Programs that will allow downloading the Pocket Computer will be announced in the future.

**Gunter Hochstatter**  
43 Essen 1  
Tommesweg 57  
Ruf 71 39 36

---

### TRSDOS POKE

Under Level II BASIC I know that I can POKE 16396,23 to turn off the break button, and POKE 16396,201 to turn it back on. And under NEWDOS, I can POKE &H5BA5,0 to turn off the break, and POKE &H5BA5,1 to turn it back on. But what about under TRSDOS 2.3? What can I POKE to turn on and off the break button?

**Alan Dardik**  
270 Highwood Ave.  
Tenaflky, NJ 07670

---

### Connections

I would like to obtain information on connecting a FSK/AFSK unit to use with a Macrotronics M-80 (M-800) Ham Interface (TRS-80) in conjunction with a KENWOOD TS-520. Any type of information is appreciated.

**James Gonsalves, Sr.**  
2257 Manhattan Place  
Santa Clara, Calif. 95051

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### Softball Software

Is anyone aware of any programs for compiling baseball statistics that would run on a TRS-80 Model II (64K, one disk)? As both an avid software player and microcomputer owner, I can attest that such a program would find a ready market. For example, in San Francisco alone, there are over 400 softball teams involving over 7,000 players.

I would be more than happy to work with a skilled programmer (which I am not) in developing and marketing a multi-level program that could provide a range of statistical data to subscribing teams. More specifically, I have developed a conceptual design for this type of program and identified over 60 output measure that describe hitting, fielding, and pitching performance.

**Edmund F. Fennessy**  
1841 24th Avenue  
San Francisco, CA 94122

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18 • 80 Microcomputing, June 1981
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See List of Advertisers on page 306
80 Microcomputing, June 1981 • 19
Word processing is a major advancement in the science of communication—a science that has become crucial in the post-industrial world. Sophisticated use of our language is important in every field.

Word processing gives the writer, editor or proofreader the freedom to be creative without being bogged down with the details of producing error-free copy. Anyone who has ever written for an audience has experienced the exhilaration that comes from changing a single word to give a sentence just the right meaning—and most of us have also experienced the frustration of having our well-chosen words misunderstood, sometimes because of our own cleverness. Word processing could make us all better writers by simply making rewrites easier, freeing us to evaluate our written efforts more thoroughly and critically.

Word processing for microcomputers is a recent phenomenon, but great strides are being made in this area. We'll take a look at three of the latest TRS-80 software packages in this overview of word processing, circa 1981.

What is Word Processing?

How does one process words? The two major functions of word processing software are: text editing and text formatting. Text editing provides the ability to enter text, and then go back over it to correct mistakes and add or delete words and single characters. A sophisticated text editor will also permit search operations and search/replace operations.

Text formatting provides the ability to set parameters for the printed copy of your text. It allows you to set up your printed page format for line length, lines per page, margins and other standard parameters. The more sophisticated formatters also support text centering, headers and footers, underlining, superscripting, subscripting, bold type and other functions (i.e., specialized symbols).

The most obvious ability that a good editor provides is the ability to correct the most common mistakes we make when writing—spelling errors, omissions, errors of punctuation and the like. This is most often accomplished by moving a cursor to the area of a mistake, and overtyping or inserting (or deleting) incorrect characters. A sophisticated text editor provides much more. If you had to go back and correct the spelling of a word that appeared many times in the text, you could go blind or crazy, or both. With a global search and replace word command, the computer would do all the drudgery.

Good word processors provide a block move feature that allows the transfer of entire paragraphs, or any size block of text, from one location to another. A block delete permits the deletion of any size chunk of text. The insert mode of a good word processor allows the addition of unlimited amounts of new text, wherever it is needed.

Text formatting is the icing on the cake. Now you've written a top-notch report using the word processor's editor, with sophisticated text formatting you can make that report look like it was produced by a professional printer. The components of good formatting go far beyond mere margin assignment, double spacing or page numbering. They include headers and footers that appear on the top and bottom of every page; proportional spacing to achieve justified left and right margins for the typeset look; tab settings; single keystroke paragraph signals; support for underlining, boldface type, subscripts, superscripts; and support for special characters or type fonts.

Most word processing systems allow command characters to be embedded in the text to produce the format functions desired. This is how the most elaborate features are called by the system.

Since there is a wide variety of printers available for use with micro and minicomputer systems, the major weakness of most word processing systems is an inability to support more than one printer. If, after all, you have set up the print format to look as attractive and professional as possible, then give the print command and the system just sits there doing nothing...you know you have a problem, particularly if you forgot to save the text before the system hung up. It is important that the user determine which printers his software will support before using that package.
Scriptlet and Electric Pencil have been around for some time now; there have also been some inexpensive entrants, such as The Wordslinger and PensaWrite1, into the word processing derby. The three most recent word processors on the market are: LazyWriter by ABC Sales for $125, PensaWrite2 by Pensadyne Computer Services for $79.95, and Subedit/Subscript by ProSoft Software for $39.95 (with enhancements: $59.90). Let's take a look at some of the major features of these new offerings.

Fig. 1 will provide a quick overview of the major features of each package. Both LazyWriter and Pensa-Write2 are written in machine language and offer sophisticated text entry and editing features. The Subedit/Subscript package is written in BASIC. All three are configured for a TRS-80 Model I with at least 32K of memory and a disk drive. More memory usually allows you to process larger files.

The producers of this software plan enhancements to their individual packages, and all three offer some kind of plan to allow purchasers to acquire updates at nominal cost. This usually involves registration of the purchase of the software with the manufacturer, and will require the return of the original disk in order to obtain an upgrade. All three provide thorough documentation (usually produced with their own software!) and a place to write or call if you have trouble.

Each software package offers something unique. LazyWriter has a Model III version on the drawing board. It also features a unique cancel edit feature which allows you to cancel an editing change should you decide you really don't want to make it. LazyWriter also allows loading of Electric Pencil files as well as BASIC saved files and ASCII saved BASIC programs. There is a Help command which explains the features most often used, and there are ten user-definable command keys that can be programmed for special functions.

Pensa-Write2 has an intriguing module support feature. It allows you to append program modules (available from Pensadyne) such as mailing list, financial report generator or special printer support modules to the main program. Or, you can write your own machine language modules and use any one of up to ten commands that you create to call them up. The program also keeps track of free disk space and allows inspection of the files in the directory without an exit to DOS.

The Subedit/Subscript program is modeled after the CMS Editor used on the IBM System/370 mainframe computer. The user's manual claims that familiarity with this Editor makes use of the manual unnecessary! Even though Subedit/Subscript is written in BASIC, it runs very fast. Its run time has been increased by a Pro-Soft utility called Faster. Of all word processors for the TRS-80, this program's text formatter has the most features. Of course, any formatter is limited by what its printer can produce.

Compare and Contrast

Nothing in this world is perfect and these three packages have some minor problems. All perform the task at hand admirably but all also have their little annoyances.

LazyWriter is the easiest of the three packages to use. Its text editing commands are called with single keystrokes (I for insert, O for overwrite, etc.) and its screen displays are simple and uncluttered. When you are in a text editing mode, that mode's name is displayed at the bottom of the screen so that you won't forget where you are. To exit that mode, you merely press (enter). Its major drawback is in the print formatting area. As Fig. 1 shows, it cannot support headers, footers, underlining, page numbering and the like. There is a character counter at the bottom of the screen during text entry that lets you know where you are in relation to the end of the current file. It has a built-in lowercase driver and is fast enough to stay ahead of the nimble fingered typist.

The Pensa-Write2 package has substantially more complicated screen displays and system commands. It has excellent text formatting capabilities which are easy to modify. The system does not provide a lowercase driver but will support the Radio Shack driver at the expense of the on-board clock. There are no flaws in this package and the documentation provides excellent flowcharts to help you decipher the intricacies of its command structure.

\[
\begin{array}{ccc}
X = \text{Yes} & \text{LazyWriter} & \text{PensaWrite2} & \text{Subedit/Subscript} \\
- = \text{No} & \text{LazyWriter} & \text{PensaWrite2} & \text{Subedit/Subscript} \\
\text{Insert Text} & X & X & X \\
\text{Page Scrolling} & X & X & X \\
\text{Block Move} & X & X & X \\
\text{Lowercase} & X & - & - \\
\text{Cancel Edit} & X & - & - \\
\text{Merge Files} & X & X & X \\
\text{Wraparound} & X & X & X \\
\text{Justify Text} & X & X & X \\
\text{Margin Formatting} & X & X & X \\
\text{Subscripts} & - & - & - \\
\text{Underlining} & - & - & - \\
\text{Overstrike Bold} & X & - & - \\
\text{Page Numbering} & - & X & X \\
\text{Headers/Footer} & - & X & X \\
\text{Price} & 125 & 50 & 40
\end{array}
\]

The Bottom Line

There is no question that these new word processors and the others already on the market are a big investment. If you don't mind sacrificing a few features, the ProSoft entry is the best at $79.95. LazyWriter is by far the easiest of the three to use and, with enhancements to its text formatter, will someday be worth its price. The classiest package in this group is the Pensa-Write2 package — the price is moderate, the features are solid and professional and it will be worth the extra time you pay for learning its complexities.

Of course, there are other word processor software packages on the market and there are probably more being written. Each new generation of these packages will refine and enhance what has gone before. The result can only be a boon to writers everywhere.

Ed. Note: Pensadyne has just completed a revised version of Pensa-Write 2 which they are calling Pensa-Write 2.1. Present owners of Pensa-Write 2 are eligible to receive the updated version. Contact Pensadyne for specific information.
The Micromatic-80 Printer
Micromatic Corp.
Indianapolis, IN
$795

by David E. Clapp

The Micromatic-80 is an excellent output device for the TRS-80. It consists of a used, heavy duty IBM 1980 terminal system and an interface device. The interface is enclosed in a small cabinet about the size of a dictionary.

The typewriters are not new, but they are reconditioned and tested by the Micromatic Corporation before shipment. The typewriter and the interface are interconnected by a short cable. The interface, in turn, is connected by ribbon cable to the TRS-80 output port, either directly or through the expansion interface.

The typewriter arrives equipped with a BCD ball which can be supplemented by purchasing other IBM selective typing balls (10 pitch only). This interchangeability is a valuable feature, permitting an interesting variety of output formats (script, letter Gothic, prestige elite, etc.). The interface has a code switch so the user can select BCD or correspondence code.

Whenever using a standard IBM typewriter ball, the switch must be in the correspondence position.

The Micromatic-80 system can be used off-line as an ordinary office typewriter. In this mode, the typewriter must be operated with the BCD ball only. Standard line printers are typically only usable when connected to the computer.

The major advantage of this system is letter quality output. This feature is important for generating output equivalent in appearance to common business correspondence. It is impossible to distinguish the output of the Micromatic-80 from original typewritten copy. For applications demanding originally typed, letter quality copy—the Micromatic-80 is especially effective.

Disadvantages

The system has certain disadvantages. Rate of output is especially slow; eight to nine characters per second. While this rate could be increased, the manufacturer feels the present rate is most appropriate for used equipment. Knowing that the copy will require five to ten minutes for output allows the user to step away from the computer and engage in other activities while the output is completed. Typically, most text is composed, edited, and stored on some peripheral device, then left alone while copy is generated.

Another potential disadvantage is possible service or repair requirements. An IBM selective is a complex device which will require periodic maintenance and adjustment. Certain maintenance can be performed by the user, but other tasks may require a trained technician. Most typewriter shops will service IBM selectrics; however, since these typewriters are terminals some shops may refuse to work on them or charge more. A final alternative is to obtain service directly from IBM, which is probably the most expensive option.

The Micromatic-80 works beautifully with Radio Shack's Scripsit. A lowercase modification is required to properly prepare correspondence. The least expensive modifications will work for the Micromatic-80 system (typically $19.95); these modifications do not display descendents on the screen. Most lowercase modifications require a short driver routine to reverse the keyboard (shift for uppercase like an ordinary typewriter). Fortunately, this driver is not required with Scripsit and the Micromatic-80 system.

When operating Scripsit and the Micromatic-80, the operating procedure is quite simple. The first step is to power up the system, load Scripsit, and begin typing! No other software is required. The lowercase option, keyboard debounce and keyboard reverse are all operational.

The Micromatic-80 requires a specific power-up sequence: turn on typewriter, turn on interface, turn on TRS-80. This protects the TRS-80 from incoming spikes from the Micromatic-80 system. If the sequence is ignored, the spikes will frequently bomb the resident program as well as threaten the electronics of the TRS-80.

The selective typewriter is noisy both at idle and in operation. Typically, the user may wish to leave the Micromatic-80 system off while preparing copy. After the copy is edited, formatted, and ready for output, the Micromatic-80 can be activated. However, this sequence requires computer shut-down which, in turn, requires reloading of the program and text copy. Reloading is no problem with high speed peripherals, but if cassette tape is used, considerable time is required to reload Scripsit and the text copy. One could avoid this delay by simply allowing the Micromatic-80 system to idle while preparing copy and enduring the low background rumble of the typewriter motor. Enclosures are available (or can readily be built) which will reduce this noise to an acceptable level.

The Micromatic-80 system will accept either fanfold or ordinary single sheets of paper. A tractor feed option is available, but the friction feed option will feed fanfold paper satisfactorily. When feeding individual sheets, the user can use the "print, pause" feature of Scripsit which delays printing until the next sheet is input.

The Micromatic-80 system does not have a tabulation function. The user will find that extensive tabulation will be time-consuming since the typewriter must individually count the spaces to a tab location.

The Micromatic-80 system represents a quality investment for quality output for the TRS-80. The selling price is competitive with any printer on the market. It is an excellent means to economically produce letter quality output. Many features do not compare to the daisy wheel printers on the market, but the appearance of the output is equivalent. The use of the system off line is valuable feature which is unavailable with a dot matrix or a daisy wheel printer.

The Micromatic Corporation stands behind their product. They spared no cost ensuring that I had a working, satisfactory system.

If you've been looking for a line printer, you know what a jungle the business can be. Prices range from a couple hundred to a few thousand dollars, and features and functions of the printers are just as varied. Expensive printers are usually far beyond the resources of the hobbyist. On the other hand, low cost printers are slow, limited in function, and likely to give your computer system a case of heartburn that will reduce it to a smoldering heap of electronics on your desk top. Unless you want to pay a good price you are not going to get a good printer.

What are the alternatives? You can do without, or you can risk buying a cheap printer and pray it works without vaporizing your computer. You can go all out and buy a $3000 word processing printer. Finally, you could get Radio Shack's new Line Printer VI. For the money, I believe it is the best choice. I had a Radio Shack Quick Printer II, which was fine for numerical data runs and was cheap and reliable, but it wasn't a line printer. I finally decided to spend the money and get a good line printer. I wanted a lot of features: tractor and friction feed, graphics, a print font that would be acceptable for word processing, a paper out warning, bi-directionality, adjustable width that would handle everything from labels to 15 inch computer paper, and a good print rate. I didn't want to pay more than a thousand dollars.

I took my request for a printer with my list of requirements to a friend of mine who happens to be a Radio Shack manager. All he had was an advertisement for a new line of printers, including the Line Printer VI. It sounded good, but delivery time had not even been set. I put in an order just so I could see what the printer looked like, and left without much hope.

A few days later I received a call from my friend. He had managed to get one of the first printers released, and I could have it if I wanted it. I was desperate so I decided to take the printer and hope it was what I wanted. It turned out to be much more than I expected. Well designed and fast, it had all the features I wanted and more.

**Special Features**

I wanted a tractor feed that was adjustable from 2 1/2 to 15 inches. I also wanted single sheet friction feed. The Line Printer VI had that and the added feature of a removable tractor. The tractor, which is almost flush with the top of the printer, snaps in and out.

The Line Printer VI has a paper out alert that stops the printer without losing data when the paper runs out. This means I can leave the printer unattended while it prints long data runs without worrying about returning to find my carriage receiving a nice coat of ink. The paper out warning works whether the paper is fed from the bottom or from the rear of the printer. After refilling the paper and resetting the printer, it takes up where it left off with no data lost.

**Dimensions, Type and More**

The Line Printer VI is not small: at 24.2 inches wide by 8.3 inches high by 13.3 inches deep, it does require some room. A separate, sturdy desk is recommended. Since the tractor is not a large superstructure, the weight and height are not prohibitive. Remember that a 15 inch wide carriage requires a fairly large printer.

The printer fonts available (four) are shown in Fig. 1. Power up mode is 132 characters per line (at 15 inch paper size). This will print at 100 characters per second and 33 lines per minute. The normal characters may be elongated to double width, or compressed to 120 characters per second, 37 lines per minute. The compressed mode can also be elongated into the compressed—elongated mode. In either elongated font, the bi-directionality of the printer doesn't work. It does func-

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**POWER UP MODE - 132 CHAR.**

**ELONGATED MODE**

**COMPRESSED MODE**

**COMPRESSED - ELONGATED MODE**

*Fig. 3*

<table>
<thead>
<tr>
<th>Text</th>
<th>Lines/Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>THIS IS 6 LINES/INCH</td>
<td></td>
</tr>
<tr>
<td>THIS IS 6 LINES/INCH</td>
<td></td>
</tr>
<tr>
<td>THIS IS 8 LINES/INCH</td>
<td></td>
</tr>
<tr>
<td>AND 12 LINES/INCH</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 2**

---

```
!"#$%&'()*)**+,-./0123456789;:<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_abcdefghijklmnopqrstuvwxyz{|}\abcdefghijklmnopqrstuvwxyz{|}

Fig. 1
```
I was especially impressed that once a particular font is selected it will remain active, unlike many printers on which you must call special fonts after each carriage return. Also, when a print font is cancelled, the printer returns to the font that was active previously, not necessarily the power up mode. Line spacing, called pitch, is another important consideration. The Line Printer VI powers up at six lines per inch. There is also an eight lines per inch mode that is software selectable. Finally, the 12 lines per inch pitch is available for graphics. The pitches remain active until cancelled. See Fig. 2 for an example of the three available line pitches.

Fig. 3 shows the complete character set, including graphics and special symbols. The characters in Fig. 3 were printed in the normal mode for clarity. In the elongated modes some of the special symbols are not clear. The printer has a full upper/lowercase. Like most printers, it prints a bracket for an up arrow.

The print is satisfactory for word processing; it is not as fancy as an impact printer, but the letters are neat and clean.

Most printers available to hobbyists are slow. Forty characters per second is not uncommon. In the normal mode, the Line Printer VI will print 100 characters per second.

If you watch a unidirectional printer, you will notice that the character per second rate is clocked only while the print head is active. The time of the carriage return and the time of inactive print head travel is not added in. Also, most printers make a full left to right travel regardless of where they print on the page. Eighty characters per second is rather slow when all this unused time is added in.

The Line Printer VI is not plagued by any of this slowness. Since it is bidirectional, it prints on the carriage return as well as left to right travel. Also, when printing tabbed data, the print head moves to the tabbed position the first time and then returns to the tabbed start position only as long as more tabbed data is available. This means that no time is wasted returning full left and then to the tabbed position with each line. The same is true at the other end of travel; the printer will print only until the line end and then returns. The only exception to this is when LLISTING a BASIC program. If the line is 200 characters long and you have nine inch paper, the printer will continue off the paper and onto the roller.

Everything considered, the Line Printer VI is faster than other printers that claim the same or higher character per second rates. Speed may not be a requirement for you but you have to admit that it would be a welcome extra. For speed and economy, the Line Printer VI can't be beat.

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MT-32 Printer/Interface Module
Microtek Inc.
San Diego, CA
$119.50-$199.50

by Fritz Milhaupt

Expansion of the TRS-80 beyond the Level II, 16K limits of the keyboard/CPU unit has always presented the question of which expansion system is best suited for your needs. With expansion interfaces available from Radio Shack, Lobo, Exatron, Microtek and an expansion board from LNW Research, it is difficult to choose the most economically designed and priced unit.

Until Microtek introduced their MT-32 Printer/Memory Module, there was no way of adding just additional memory and a parallel printer interface to your system short of building one yourself. The MT-32 provides both of these features for less than $125 in its most basic form.

This peripheral is considerably cheaper than Radio Shack's expansion interface. It only costs $119.50 for a unit with no additional RAM. 32K (MT-32B) and 48K (MT-32C) models are also available for $159.50 and $199.50 respectively. The MT-32, like Radio Shack's Interface, sits under the video monitor so it takes up no additional desk space.

Documentation

The documentation and instructions are clear and straightforward; however, there is a difference in the memory installation instructions. The instructions included with the interface stated that the first additional set of 16K chips should be installed in sockets U13-U20 of the unit. The instructions in the advertising brochure stated that the chips were to be installed in sockets U5-U12. After some trial and error testing, I found that the correct sockets were U5-U12, as stated in the brochure.

Memory installation couldn't have been made any easier. All that is required is to remove two screws on the back of the module, slide the cover off, insert the chips, slide the cover back on and replace the screws.

The only disadvantage that I could find was that the MT-32 has no extension of the CPU's bus for connection to other peripherals. Fortunately this problem is easily solved by the installation of any of the commercially available "2 for 1" bus splitting cables between the MT-32 and the keyboard/CPU unit.

Although I am presently unable to test the printer interface portion of the expansion module (until I can scrape enough together for a good printer), I have been assured through calls to Microtek and Radio Shack's computer services department that any cable used for interfacing a printer to the Radio Shack expansion interface will work with the MT-32 as well.

One of the major advantages of this interface is that since it has no disk controller, pressing the reset button to stop the cassette recorder or the printer will not result in a hang-up or return to Memory Size? but will return to Ready as it would without the interface. Another great advantage is that the interface draws its power from the keyboard's power supply so that another cord needn't be added to the already impossible tangle of cords behind the computer.

The power supply is simply plugged into the back of the interface. A cord from the MT-32 to the keyboard is connected to the keyboard power jack to feed the CPU. All power-ups are now handled by pressing the button on the front of the module.

In summary, the MT-32 is a great, low cost alternative to the $300 plus price of the Radio Shack expansion interface. I have experienced no problems with it in the three months that I have been using it.

Even if you don't want a printer but need the extra memory, the MT-32 is the lowest cost product for memory expansion. The money saved by using this interface can be used for other worthy causes such as the purchase of a printer or other peripheral.

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"I have experienced no problems with it (the MT-32) in the three months that I have been using it."
Before the TRS-80 Model II, I had an Imelai with CP/M as an operating system. I purchased a Model II as an upgrade and because it could better serve our business. I basically wanted to use it to computerize the company accounts. Because I liked using a CP/M operating system, I considered getting it for my new Model II. I was also shopping around for an accounting package, and was pleasantly surprised when I received a product announcement from a company in California called Microed, offering both the CP/M system and an accounting package for the Model II. It appeared to be what I needed.

I received the software package, which contained manuals and two disks. The first disk contained all the CP/M programs and 11 general ledger programs. The 11 ledger programs alone occupied 218K bytes of space, in executable code, not BASIC. (It probably wouldn't fit on the disk if it were written in BASIC.)

**Documentation**

The first Microed manual was a summary of CP/M programs and a description of Microed's written programs for CP/M. This manual provided a background adequate for understanding the use of the programs.

The accounting manual is written in a self-teaching style. It is intended to be used as a step-by-step guide in setting up the accounting system on the computer. It uses a sample list of accounts to explain all the functions of the software. After spending about a half an hour reading through the manual, with not much luck absorbing the material, I decided to do as the manual suggested. I created a data disk and used it to exercise the programs.

I made back-up copies of the disks I received, using Microed's CP/M program to format the disk. I also formatted two extra disks (a data disk and a standby) as suggested in the accounting manual. The data disk is used in the second disk drive and contains all the accounting program results. This disk also receives all the newly created files. It is similar to the data base concept where the data disk becomes the data base. Following the manual, I used one of the general ledger programs to enter a chart of accounts listed in the manual as good learning examples. The manual slowly guided me through the use of the program.

**Step by Step**

I spent most of the day going through the accounting manual following the step by step procedures. I printed out reports along the way, when indicated by the manual. Samples are included for comparison. The amount of software was overwhelming. When finished, I felt knowledgeable, yet confused. It was almost too much, too fast. The next day, after reviewing what I had done and re-reading the manual, I felt better about the project I had undertaken. I finally entered some January transactions with ease.

**Numbered and Named**

I found several suggestions in the manual quite useful. The first was to post a sheet nearby containing a list of the program names and numbers. (The sheet was furnished with the manual.) The programs are "named" with a number which is acceptable under CP/M. Until I am familiar with each program, the list is handy and saves me from referring back to the manual. All the general ledger programs are numbered (named in the 100s, accounts receivable in the 200s and accounts payable in the 300s. A second suggestion was to post the chart of accounts nearby. When transactions are made, it is handy to be able to quickly scan your chart of accounts for the account number.

When I first found out that the program was written in FORTRAN and I would not have access to the source code, I was somewhat disappointed—I would have no way to modify it for my own situation. I see now that the capability of this accounting package far exceeds my needs, and it may be quite some time before I need to modify it, if ever.

Transactions are entered using program 103, Add General Journal Transactions. The screen printout guides you through the input, and the manual explains the process. Another program, 104, posts transactions and gives you a report containing those transactions. Two additional programs give you a general ledger detail report and a general ledger summary. Program 109 finalizes the month. Program 107, Print a Balance Sheet, and Program 108, Print a Profit and Loss Statement, are for annual summaries or for any update on the financial status of the business.

Program 110 defines parameters (account numbers, dates) so that you can search out specific information from the data disk. The output is a report under any title you give it, containing the information.

The accounts receivable and accounts payable programs are on the second supplied diskette. Accounts receivable has 10 programs and accounts payable has 11. The basic function of both sets is keeping track of invoices and statements. Accounts payable has the capability to print checks onto a pre-formatted check blank which goes into the printer. The data disk used in the general ledger is also used by both programs, and there are no problems sharing the data base among the different programs.

The CP/M from Digital Research is the 1.4 version. However, it is more than adequate. Microed has written the portion for the Model II, so that either single or double density disks may be used. The densities may be mixed and the system is able to detect the difference. For the average business person, the supplied CP/M programs would not be used. Only the disk formatting and disk copying programs are really necessary for the accounting programs.

I received a bonus in my package. My package came with what Microed called security programs. These programs allow me to use a password for entry into the system, and hence the accounting information. I created my own password and was not allowed to get to the CP/M system until I entered the correct password. It will accept uppercase or lowercase, or any numbers or symbols in any combination, up to eight characters. When I was done, I was able to kill the password feature by simply entering a carriage return when running the program Newpass.

After using this package for several weeks, I have become more and more convinced that it is one of the best bargains available in off-the-shelf software.

In summary, I am quite satisfied with the package. It is successful, in my eyes, because it is a complete package; system software and application software combined to run together.
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Midway Campaign
Avalon Hill Game Co.
Baltimore, MD.
$15

by David Tinis

Midway Campaign is one of those games that on the surface seems laughably simple but proves, through playing, to be anything but. The creators of Midway Campaign, The Avalon Hill Game Co., are well-known for their excellent board games. Having already produced a board Midway game, a computer version seemed natural.

With all the graphics in use today, the lack of them in Midway Campaign is striking. Play is text oriented with the only graphics being a 12 x 12 grid of dots. These portray a map of the Pacific Ocean around the island of Midway. The two American task forces and Midway are under the player’s control. The computer controls the three Japanese naval groups.

At the beginning of the game, the American units are placed in their historic positions; the date is June 3, 1942. Japanese forces are on the map but not shown. Their position and composition is not known until they are spotted by search planes from Midway. Even though the American forces are visible to the player, the computer does not know where they are. It, too, must perform searches to locate the enemy.

At the beginning of the game, the player issues a Fleet command. There are four Fleet commands that display the map, the status of American aircraft carriers, change the heading of the task forces, and conduct aircraft operations. The computer remains in an interactive mode until an integer number is entered. This represents the length of time (in hours) the player wishes to play.

Next, the computer takes over. It moves American forces in accordance to Fleet commands, decides upon and executes Japanese actions, conducts searches and combat (if any) and checks for the end of game. Unfortunately, this can be rather lengthy and with no graphics involved the player has no recourse except to sit and wait.

Should the requested time pass or a significant event such as an attack or spotting occur, the computer returns to the interactive mode. If an attack must be resolved the computer does it prior to permitting the issuance of new Fleet commands.

As in the actual battle, the events are aircraft oriented. Search, we are told, is conducted by American PBY’s from Midway and float planes from Japanese cruisers. However, we never see the search being conducted. We just sit and wait until told if there were any results. Likewise, when airstrikes are launched, we wait until the results are relayed. This waiting, in my opinion, is the game’s major flaw.

Tactical Decisions

There is, however, enough in the way of realistic decision-making to keep the game interesting. Should the task forces be kept together or split up? How many fighters should be kept for defense of the carriers and how many sent out with the strike group? How many attack aircraft of each type in the strike group? Should all available aircraft be sent in hopes of getting in a crushing blow or should several waves be sent in? These tactical decisions will have a great bearing on the outcome of the game. A minor oversight can result in a sunk carrier.

The computer plays a very good game as the Japanese commander and is not easy to beat.

Midway Campaign is written in BASIC for the 16K Model I Level II TRS-80 and is available only on cassette. Along with the cassette are four pages of rules, historical background, examples of play and instructions for loading and running the program.

I would recommend Midway Campaign to those new to conflict simulation. Advanced game strategists will probably tire of it quickly.

ZBASIC Compiler
Simutek
Tucson, AZ
16K/32K Level II
Cassette and manual $79.95

by Bruce Douglass

Simutek has recently been advertising a new compiler called ZBASIC. ZBASIC comes in two packages; the first contains 16K and 32K versions for tape storage based systems and the second has 32K and 48K versions for disk based systems.

Pros and Cons

On the positive side is the small size of the compiler, the awesome speed with which it compiles, the run time speed of the programs it compiles, the interactive nature of the compiler, the fact that you can compile a 4K BASIC program in 16K, and that the compiler is yours when you buy it (no royalties to pay!).

ZBASIC sits in a fixed block of RAM, and its ORG depends on the version you use. The 32K version resides from 8680H to 9590H. Section 9200-9590 contains the subroutine package that gets tacked onto your program and speeds compiling as well as increasing run time speed. You could conceivably move the compiler anywhere you like by using an editor/assemble. I attempted to do this, using Radio Shack’s EDITASM, and quickly ran out of text buffer. With a better, disk-based assembler, this should not be a problem.

Faster Than a . . .

The program compiles faster than a speeding daisywheel. Short programs compile instantaneously. I compiled a 2.5K BASIC program, and compile time was less than five seconds. I’m impressed with the speed of this program!

The ZBASIC manual lists run times for various commands in BASIC and ZBASIC. The increases in speed are from six times faster for AS = INKEY$ to 12 times faster for SET and RESET and up to 286 times faster for jump commands such as GOTO and GOSUB. Using the SET command in a tight double loop, Level II BASIC requires 50 seconds to white out the screen. In its compiled form, it takes three seconds!

ZBASIC syntax is slightly different than Level II. A very nice feature of the compiler is its ability to jump back and forth between the BASIC program, ZBASIC, and DOS, enabling you to check for syntax problems as you tidy up your debugged BASIC program.

The compiler checks for errors during compile time and if it finds one, will return the type of error and the line number where it occurs. If you attempt to jump to a non-existent line, you get a peculiar error message, like line error in line 67757, which may cause some consternation if
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the highest line number in your program is 200. This is the only case in which you get this kind of error message (as far as I know).

The manual lists some potential causes and corrections of errors. If you get an error message giving a line number that doesn’t exist, try renumbering your program in BASICR or with a renumber program in high memory, and you will be able to locate the problem.

Another advantage of this program is that you can compile a 4K program in 16K. Note, however, that you can only compile for a 16K machine using the 16K version, as the compiler program resides in a fixed block of RAM and the larger versions won’t run in 16K.

Mine and Mine Alone

Finally, I like the fact that when I buy this program, it is mine and mine alone. I don’t have to pay anyone any money (except Uncle Sam) when I sell programs I write with ZBASE, unlike Microsoft’s compiler.

This is not the ideal compiler for all applications. It only handles integers, does not work with arrays, limits your variables considerably, does not support all Level II commands and starts and compiles into fixed RAM locations. Also, there is an error in the disk-saving version (although when I called Simutek they quickly advised that they would send me a new tape since mine was apparently defective).

Part of the reason the compiler works so fast is that it only handles integers. This is also why the compiled programs run so quickly. Multiple precision takes time and memory space; the compiler would have to be larger and slower to handle non-integers. The fact still remains that you need greater than integer accuracy for lots of applications. I was hoping to compile a 10K sophisticated multiple linear regression program that I wrote, but it cannot be done with ZBASE.

So assess your needs before you purchase this compiler.

The compiler also doesn’t handle arrays. They can be simulated by fixing a block of RAM somewhere and using PEEK and POKE to store data. This requires some thinking on the user’s part and rewriting most programs (all my programs use arrays!), but the method works. I compiled a program that required an array of 2000 elements, so I set aside 2000 bytes of memory. This is considerably more dense storage than using array variables anyway, and can often be used to save space in BASIC programs. Writing complex matrix calculations using this kind of data structure is not my idea of a good time, however.

Normally in Level II you have many variables: AA to ZZ, where the second letter can be anything from any letter to a single digit number. ZBASE uses fixed RAM locations for its variables and limits your variables to save space. You may use 26 string variables, A$ to Z$, each of 31 characters. If the string is longer, you will overwrite the string above it. Thus, if LEN (A$) = 80, you will have wiped out BS. Numerical values run from A-Z, A1-Z1, and A2-ZZ. This is a fairly large number of variables, but it is inconvenient to rewrite programs changing all instances of several variables. In fact, it can be a real pain.

Some Level II commands are not supported, and the manual contains a long alphabetical list of these commands. They include VARPTR, SIN, COS, LOG, LEFT$, STRING$, CLEAR, and RESUME. The manual does give short routines to simulate SIN and COS (they return the value time 1000) and various string functions, including MID$, INST$, and RIGHT$. The meaning of some other BASIC commands are changed slightly as well. For example, you cannot use the logical operators and or or in conditional if. then statements, and if you use logical math operators, syntax must be closely watched.

One major fault of this program is that it fixes the RAM locations of its compiled programs. It would be so nice to be able to use the 32K version to write programs for a 16K machine. In the 32K version, the program begins at 9200H (the subroutine package); 846 bytes later, the compiled program of your program is packed on. Variable memory for the 32K version begins at 9600H. To move the program to another memory location is a lot of work, using a disassembler and an editor/assembly.

I spent 15 hours in an unsuccessful attempt to move a program (3.3K compiled down to 4300H) that is tedious work and error-prone. If you have a very good disk-based assembler (not Radio Shack’s), much of this misery can be avoided, but it is still not fun! A programmer at Simutek advised me that they do have a patch, but presently, it’s unpublished. It will move the ZBASE compiler down into low RAM, put the BASIC program up in high RAM, and will compile a 16K program that will run in a 16K machine, but the cost will be about $230 (and you must have ZBASE also). He advised that it may sell for less once on the market; since it was new, the price had not really been decided upon.

On the version I received, the compiler made errors when it tried to save the programs onto disk. DOS would return with an Illegal Access Attempted To Protected File error. The file name would be put into the directory, but the program would not. After some work, I discovered that the second attempt, with the same file name, would save the program, but somehow the transfer address was messed up. The programmer at Simutek advised me that I must have a defective tape, and that they would replace it.

The manual is okay, but not up to the standard I would like in a program costing $130. It does give valuable information, but I don’t feel it goes far enough. An alphabetical listing of commands supported by ZBASE (they are listed in an apparently random fashion), an index, a more complete explanation of syntax differences and error codes, are all things I feel the manual should include. It does show how to link compiled programs (NEWDOS only), and gives some routines to get around or simulate normal BASIC functions in ZBASE, and gives a memory map for the different versions, including the various fixed RAM locations for the variables. A complete map for the subroutine package would really be nice, so that you could easily link different machine language programs together with your ZBASE program. As it is, you are stuck using USR. You must use the Level II USR format even with the disk versions. It is relatively simple to link your programs. However, with the subroutine map, you could write simplified programs to append to the compiled program, and call on the present subroutines.

I am impressed with several aspects of ZBASE. Its most unfortunate aspect is the fixed memory ORGs for compiled programs. Lack of higher precision arithmetic can be a major problem.

Note: The price of the compiler was recently reduced from $130 to $89 for the 32K-48K disk version and from $99 to $79 for the 16K-32K tape version. The author considers this price to be more reasonable, and regards it as an extra plus in his recommendation of the product.
THE ALPHA I/O SYSTEM
A COMPLETE FAILURE?

It happened 3 years ago, when our President made a decision. At the time we specialized in custom analog and digital circuit design. The decision was to attempt to develop a line of standard interface hardware for the emerging microcomputers. At the time (1977) we had to decide which of the new machines could become the “industry standard” of the low cost micros.

Despite a few aggravating but minor deficiencies, the TRS-80 seemed to have the most chance of success and it had the best price/performance ratio. Also, with some imagination, their large sales organization could become the largest service network in the world, a reassuring thought for the many novices in this new field.

It became clear that the TRS-80 could be used (with our then hypothetical system) to solve problems in many fields where computers were not yet used, mostly because of their high cost. The idea was simple: ALPHA PRODUCT would supply the missing link between the TRS-80 and the “outside world” (more about this “outside world” later).

BAD NEWS! If Radio-Shack couldn’t get the same service in 3 years, we would not have survived, but the expectation was that they would be too busy developing their basic line (drives, printers, modem etc.). Thanks to our more specialized products, we would not be competing with them. BAD START! We began with a failure. Our first product was supposed to be a simple, low cost, general purpose device. It would allow the TRS-80 to accept inputs other than the keyboard. Many kinds of external devices (the “outside world” mentioned before) like photocells, sensors, thermostats, switches, contacts, etc. could be connected easily. In addition there were two relays to control (on or off) external loads such as motors, lamps, appliances, heaters, etc. etc. In other words, it would allow the computer to interact or interface with external devices. We called it the INTERFAKER 2. What a mistake! It sounded too much like “expansion interface”. Many enthusiastic TRS-80 users called thinking that our “INTERFAKER 2” was a low cost Expansion interface (all $85 that would have been a real bargain!).

We wanted to change the confusing name. That meant reprinting the manual, changing the ad, scraping the flyers, discarding the silk screened cases. Well, “INTERFAKER 2” it would stay.

TROUBLE! We also found that the majority of TRS-80 users were AFRAID of the hardware. They could be very comfortable with fancy programming but thought you had to be a computer specialist or technically inclined to put the INTERFAKER 2 to work. In truth, some IMAGINA

TION and a SCREWDRIVER is all you really need. Anyone able to wire a switch could use this device.

WORSE! There was also the fear of plugging a “foreign device” into the precious computer. This notion has all but disappeared as there are now so many quality products designed for the TRS-80 that plugging in a Non-Radio-Shack device has become common.

Our ad in Creative Computing (80-Microcomputing) did not yet exist hardly paid for itself. We had a decision to make. Were we wrong or just too early? Our first INTERFAKER 2 was sold to someone who wanted to, and succeeded in, controlling his fancy model railroad with his TRS-80. Interesting, but what made us stick with the concept was that some of our INTER- FACERS began finding use in applications with fascinating possibilities. Space is lacking to describe them, but the most exciting was the successful use of the system in assisting a handicapped young boy. We were pleased to hear of such a meaningful application.

Three years later, as you can see in our ads. The INTERFAKER 2 is alive and well. The price went up a bit, and despite the introduction of the more powerful INTERFAKER 80, the sales have been steady.

Then came the least understood product: the ANALOG-80. This $139, nicely designed module is an Analog Input EXPander with 8 input channels. Used with your TRS-80 it provides a powerful “data acquisition system”. This jargon simply means that you can monitor, measure and record 8 independent varying voltages. Very few people realized its real power. Such a system would have been needed just a few years ago.

The possibilities in scientific and engineering environments are endless. This system could replace chart recorders, digital data recorders, programmable calculators, data analyzers and many other specialized and expensive pieces of equipment. Furthermore, up to 8 ANALOG-80’s could be used simultaneously for a total of 64 channels of analog input! They simply plug into the TRS-80 using our “X” series of bus extenders (EXPANDBUS).

Our next product was to be a second generation, input/output interface, with more flexibility than the INTERFAKER 2. Careful design and refinement yielded the INTERFAKER 80, the most powerful real world interface on the market today. It has 8 inputs, each optically- isolated and 8 outputs, each with a relay contact. The INTERFAKER 80 is fully compatible with our ANALOG-80, allowing these to be used together in order to create systems that control external devices based on “sensed” input under control of the TRS-80. A FAILURE! In spite of our extensive advertising, very few are aware of the existence of the powerful ALPHA I/O SYSTEM.

THE FACTS ARE:
• The ALPHA SYSTEM/TRS-80 combination forms an incredibly versatile and powerful tool for acquisition/procesing/control.
• In spite of its moderate cost, the system is sophisticated and reliable.
• The entire system can be easily programmed in BASIC using MP(IX) and OUT X Y commands.
• The modular approach and our EXPANDBUS allow for flexible expansion as requirements demand.

The following pages contain more information about the devices mentioned here. We invite you to call or write to discuss your particular application.

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Why lose precious time restored, only TIMEDATE 80 will update the system with current TIME and DATE information, in impossibility with the computer’s internal clock.

TIMEDATE 80 is quartz crystal based with INTELLIGENT CALENDAR, including provisions for leap year! TIME display may be by 12 hour AM/PM or by 24 hour military and European format.

TIMEDATE 80 plugs directly into the rear of the TRS-80 keyboard and gives the "TIMES" function even without an Expansion Interface. For those with a disk system, it plugs into the left side panel of the Expansion Interface. An optional "Y" connector can provide further expansion.

TIMEDATE 80’s small size keeps the computer table uncluttered. If you have an Expansion Interface, TIMEDATE 80 literally “DISAPPEARS” by slipping into the empty space in the bottom of the interface.

Two sets of software, on cassette, come with TIMEDATE 80—"TIMESTAMP" and "TIMES"—"TIMESTAMP" is a step by step set of instructions for setting TIMEDATE 80. "TIMES" is a set of over 1000 routines which patch DOS and Level II TRS-80 and is easily incorporated into any user software. "TIMES" will always print the time and date when LISTING a program—great for keeping track of revisions!

Other valuable uses for TIMEDATE 80 are: time information for business reports like payroll records, financial reports, etc., or to various T/0 devices requiring 24 hour clock input, such as laboratory instrumentation, and to communication systems needing "Log In/Log Out" data (bulletin boards).

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402
Owning Your Home Computer: The Complete Illustrated Guide
Robert L. Perry
Everest House
New York, NY
Softcover, 224 pp.
$10.95

by Mary Shooshan

Oh, no, another "complete" guide. It's truly amazing how the total knowledge on a subject can be reduced to 224 pages (counting 24 pages of appendix, glossary, bibliography, and index).

Have you ever noticed how these "complete" books always start with chapter(s) on history, miscellaneous stories and trivia? This one has an incredibly technical and involved chapter on microcomputer networks. (Specifically, computers connected by telephone to other computers.) It would have made a good appendix—at the end of the book—after you know something about computers, not before.

An Eggbeater for the Brain

Non-technicians, do not fret. Just skip over to chapter two, which is written just for you: "What is a Home Computer? " Did you know that the computer is a "mind appliance?"—an eggbeater for the brain. Don't worry that the computer will be smarter than you, since "any computer, no matter how large or small, is an idiot. It's dumb, stupid, inert until you tell it what to do." But, of course, you want one in your home.

Seriously, after this initial fooling around, Perry does settle down on page 27 to talk about the parts of a microcomputer and the common terms: input, data, CTR, etc. He also devotes many pages to the various systems on the market, emphasizing those with exciting sounds, colors, music, and graphics—things that whirr, beep and go bump in the night.

However, his information is vague and incomplete. He doesn't mention Radio Shack's Model III, which is replacing the Model I, or their Color Computer. He confuses hardware and software advantages, implying that some systems are user-oriented (easy for non-programmers to use) when that often depends on the software.

One chapter is entitled, "99 Things to Do with a Home Computer." Unfortunately, it is not much more than a description of ninety-nine programs (out of the millions) on the market.

Perry talks about computer uses in education, especially home education, in aiding the handicapped, and in business. He gives some useful suggestions for finding a good microcomputer for your business and even gives a lesson in BASIC computer programming (remember, this is the Complete Guide), but even here there are errors in his information.

Perry states that the command, PRINT HELLO, will cause the computer to print Hello on the screen. However, this is not true. The computer will attempt to analyze Hello as a number (the number zero). If you want it to print a word, you must use quotes: PRINT "HELLO". If you want to learn programming, get a book written just for programming.

One of the main thrusts is the future applications of the computer. Specifically they are the computers that can tie in through modems and telephone to larger computers and networks of computers for communications and sharing information and programs; and computers that will run the house—doing everything from controlling the thermostat and locking the doors to watching the kids and feeding the dog. Tying in to a network will provide a lot of information at low cost once there are enough microcomputers around to make a network practical. This might be something to keep in mind for the future. As for computers running the house, microprocessors (the brain of the computer) are finding their way into many appliances, such as microwave ovens.

Attempts Too Much

To sum up, some of Perry's information is useful and helpful for laymen, some is interesting for technical people, and some is inaccurate and confusing. The book attempts too much; it tries to speak to all audiences on all aspects of microcomputer development and use, and it reaches none. It is poorly organized and difficult to read. As a "complete" book, it has something for everyone, but, unfortunately, it does not have much for anyone.
Have two printers on line at all times and select printer 1 or 2 by software or built-in push-button. End the hassle of plugging and unplugging printer cables with our new PRINTSELECT 80. $95.00

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Use existing software or write your own. With this low cost 8 bit digital to analog converter you can synchronize up to 8 music voices. Built-in volume control handy when stereo not near TRS-80. Simply plug the "MUSIC-80" into the keyboard or the E/I speaker port and connect the output (RCA jack) to any amplifier. The Radio Shack $12 speaker/ampifier works fine. Fully assembled and tested. 90 day warranty 39.95

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CONNECT ALL YOUR TRS-80 DEVICES SIMULTANEOUSLY on the 40 pin TRS-80 bus. Any device that normally plugs into the keyboard edge connector will also plug into the "EXPANDABLE". The TRS-80 is shown with protective covers (included). The TRS-80 keyboard connects the bus drivers (74LS125) for up to 20 devices, more than you will ever need. Using the E/I, plug either between K8 and E/I or in the Screen Printer port. Professional quality, gold plated contacts. Computer grade 40 conductor ribbon cable X2 $29. X3 $44. X4 $50. X5 $74

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Measures Temperature, Voltage, Current, Light, Pressure etc. Very easy to use, for example: let's read input channel #4: 10 OUT 0.4 Select input #4 and also start the conversion 20 A = 0.4V (X10) plus the result is variable. A Volt Specification: Input range: 0-5V, 0-50V. Each channel can be set to a different scale. Resolution 20mV or 50mV. Accuracy: 8 bits (1%). Port Address: jumper selectable. Plugs into keyboard bus or E/I (screen printer port). Assembled and tested. 90 day warranty. Complete with power supply, connector, manual $139

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Still the best value in sense/control devices. Use it for energy control: burglar alarm, darkroom, sequencer, drive, model trains, robots, Skinner box...

- 8 latched TTL outputs. 2 relays SPDT 1A. 12VDC contacts
- 8 TTL/CMOS inputs. Input 0 and 1 are normally isolated
- Heat and compact design, very easy to use.
- 10 A (500W) Reads the 8 inputs (0 A + C) of all inputs are low 20 OUT 0.3 Controls the outputs and the relays Assembled & tested. 90 day warranty. Price includes power supply. Cable to KB or E/I requires user's manual, free phone dealer program. $95. Manual only $5.

**GREEN SCREEN WARNING**

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But WARNING: All Green Screens are not created equal. Here is what we found:

- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Others are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claims: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both front and Lucite type) ADD their own reflections to the screen.
- A few laugh: One ad claims: "to reduce screen contrast". Since green is a color it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to replace. For necessary periodic cleaning. All except ours are flat. Light pens will not work reliably because of the big gap between the screen and the tube.
- Many companies have been manufacturing video filters for years. We are not the first (some think we are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- It fits right onto the picture tube like a skin because it is the only CURVED screen Molded exactly to the picture tube curvature. It is cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place. We also include some invisible reusable tape for a more secure fastening.
- The filter material is used so it is just right, not too dark nor too light. The result is a really eye pleasing display.
- We are so sure that you will never take your Green screen off that we offer an unconditional guarantee. Try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.
- A last word: We think that companies like ours, who are selling mainly by mail should wise their street address when a phone number for questions and orders accept C.O.D. not every one likes to send checks to a PO box without the convenience of charges to major credit cards. How come we are the only green screen people doing it? Order your ALPHA GREEN SCREEN today $12.50

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LET THE "CHAIN BREAKER" FREE YOUR MINI DRIVES.

End the daily chain mess once and for all. Fits all mini-drives: Percom, Aerocomp, Stuart Micropolis, MIT, Vasa, Perles, Siemens, BASIE. Easy to install: just remove the drive cover, plug in the "CHAIN BREAKER" and replace the cover. WaLa!!

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Basic FORTRAN
James S. Coan
Haydon Book Company, Inc.
Rochelle Park, NJ
Softcover, 248 pp.
$8.95
by Dave Smith

While it may seem strange to see a text on FORTRAN reviewed in a magazine catering to users of BASIC, James Coan has packed a wealth of information into his text which can be of value to programmers in any of the high level languages. The text is designed for an elementary FORTRAN course, but lends itself equally well to the individual who wishes to learn FORTRAN on his own and as a supplemental text for a precalculus mathematics course. All you'll need is a knowledge of first-year algebra. Coan develops all additional algorithms required in the text.

There are two premises upon which Basic FORTRAN has been written. The first is that the reader is essentially a newcomer to computer programming; the second, that for a rewarding learning experience, the student should begin meaningful programming immediately.

Responding to premise one, the author clearly defines (on page one) his method for familiarizing the student with FORTRAN while simultaneously inculcating good programming habits. Not without humor, he draws the analogy between learning to program and learning to drive a car. He notes that, although each process can be accomplished from a book, both are facilitated by the availability of a machine on which to exercise the knowledge.

Having explained the method, Coan proceeds to implement it. The author presents the student with his first program on page two. Logically enough, this three-liner is a program to generate output from the computer printer, thereby giving immediate reinforcement to the novice programmer. Each line of the program is analyzed, and Coan gives the student only enough information to foster understanding without inundating him with related but non-essential detail. By increments of one and two lines, this initial program is expanded throughout chapter one until the three-liner has been developed into an 18-line program to compute and write paycheck amounts.

Chapter one closes with problems and a summary. Each type of statement introduced in the chapter is reviewed, as is each structural or programmatic concept. The problems exercise the material presented in the chapter, and an appendix provides answers and sample solutions to every other problem.

Language and Applications

While the chapter one format is basically that of the entire book, the author departs from this format by introducing problems and exercises more frequently chapter by chapter. He is careful to divide the material into readily digested elements and encourages the reader to become fully familiar with each new concept before continuing. The self-instructed programmer can easily establish his/her own pace for absorbing the chapters of the book and the features of FORTRAN.

Of the eleven chapters in the book, the first five are devoted primarily to the language of FORTRAN, while the remainder emphasize applications. There are more than 80 programs developed throughout the text. Applications range from simple business and finance to more complex data processing, graphing, quadratics, trigonometrics, polynomials, probability and random simulations.

One of the many attractive features of this book is that all sample programs are listed in an index, which facilitates review and permits the book to serve as a handy reference. Other appendices provide a table of FORTRAN-supplied functions and a Z80 random number function (since most FORTRANs do not incorporate random number generation).

As with Basic BASIC and Advanced BASIC, Mr. Coan has filled a small number of pages with a sizeable quantity of information, and has presented it so as to capture the interest of the broadest spectrum of students of FORTRAN. ■

Getting Started with TRS-80 BASIC
Going Ahead with Extended Color BASIC
Tandy/Radio Shack
Fl. Worth, TX
Softcover
$8.95 each
by Lynda Streton

Hot off the presses from Radio Shack are two books designed for the new computer enthusiast.

Because I am a beginner myself, initially I was leary. I had visions of complex figures and hard-to-understand diagrams. However, being familiar with Radio Shack's flawless User's Manual for Level I, I thought perhaps I might be in for another treat. I wasn't disappointed.

Getting Started with TRS-80 BASIC and Going Ahead with Extended Color BASIC are not only complete and easy to understand introductions to your microcomputer, but are also the kind of books that make learning fun.

Some of you are so dedicated to your computer that it might be called an addiction. Well, it would be very easy to become addicted with help from either of these books. Most importantly, they are tools to help you use your computer effectively (instead of floundering around in the dark the way most beginners do the first few months).

If your computer isn't ready to go, you'll want to get it ready first. As it says at the beginning of Getting Started with TRS-80 BASIC, both are do-it-now books.

Going Ahead with Extended Color BASIC

This book is for those of you who have some knowledge of TRS-80 BASIC, and have itchy fingers to try out new and colorful things. Going Ahead with Extended Color starts off more or less where Getting Started left off; reminding you of important concepts and procedures along the way.

Going Ahead is split into three sections, making it easy to skip those parts you are already familiar with. If you're in an artsy mood, start with the first section. If you're ready for more complicated problems and want to play around with a few figures, the middle section is for you. The back section is for everyone—it has answers to the exercises, which appear throughout the book, along with worksheets and useful tables.

The central exercise, which runs through the book, is a house building project. I must admit, I got hooked on this program and couldn't wait until it was finished and ready to move into. Friends came by and were horrified to see the color of the smoke from the chimney. "What the hell are you burning, you've got pink smoke." They all wanted to pitch in and add their ideas. "Draw a garage! Open the door! Put drapes on the window! One friend even wanted me to have an airplane circling overhead!"

As this is a first printing, there are a few things that need to be ironed out. For example, on page 42, they tell you to change the PMODE in line 20 to 4. This isn't too serious as it is very obvious that the PMODE is set in line 5, so go ahead and change line 5. Another error is on page 156. In the answers to exercises four and five, line 135 tells the program to GOTO line 145. There is no line 145, so I deleted line 135, and it didn't seem to interfere with the rest of the program.

Another plus to this book are the note
THE STICK 80

- Features the famous Atari Joystick.
- Works with any Level 2 and Disk systems.
- Plugs directly into KB, OR E/I (Expansion port).
- Includes simple, detailed instructions to make Joystick versions of most action games.
- Compatible with any other TRS-80 accessories.
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- If you and your TRS-80 have looked for a fast-paced arcade-type game that is truly a challenge, then SUPER NOVA is what you've been waiting for! In this two player machine-language game, large asteroids float ominously around the screen. Suddenly your ship appears and you must destroy the asteroids before they destroy you! (But watch out because big asteroids break apart into little ones.) The controls that your ship respond to are thrust, rotate, hyperspace, and fire. All right! You've done it! You've cleared away all the asteroids! But what is that sound from the laser? Quick! You must destroy him fast because the guy's accurate! SUPER NOVA!

- The sound of the klaxon is calling you! Cruel and crafty invaders have been spotted in battle formation moving toward Earth at an incredible speed. Suddenly, your ship materials just beneath the huge flock of invaders. Quickly and skillfully you shift right and left as you carefully fire your lasers at them. But watch out! A few are breaking out of the convoy and flying straight at you! As the white of their engines gets louder, you place your fingers on the fire button knowing all too well that this shot must connect—or your mission will be permanently over! With sound effects! GALAXY INVASION!

- Your TRS-80 screen has been transformed into a maze-like playground for this game. As you explore the screen, eight alien ramships appear on top. All of them are traveling at flank speed directly at you! Quickly and boldly you move toward them and fire missiles to destroy them. But the more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the wrath of the keepers of the maze—flying ramships. You must destroy him fast because, as you will find out, that guy's accurate! With sound effects! ATTACK FORCE!

- With thousands of stars whizzing by you, your SPACE DESTROYER ship comes out of hyperspace directly under a convoy of aliens. Almost effortlessly, you skillfully destroy every last one. But before you can congratulate yourself, another set appears. These seem to be slightly more intelligent than the first set. Quickly you eliminate all of them, too. But your fuel supply is rapidly diminishing. You must still destroy two more sets before you can dock with your space station. All right! The space station is now on your scanner! Oh no! Intruders have overtaken the station! You must skillfully fire your neutron lasers to eliminate the attackers from the station before your engines run out of fuel and explode! With sound! COSMIC FIGHTER!

- The second Big Bang has occurred and the galaxy is full of stray asteroids and meteors. As you look through your space craft you see a belt of asteroids drifting across the screen blocking your path. To the safety of the space station above. Be careful because, many shockers, exploding suns and invading aliens may strike your ship and send it hurtling back to ground level. How many times can you and your opponent maneuver through these obstacles before time runs out? With sound effects! METEOR MISSION II

SPECIAL INTRODUCTORY OFFER:

Order the STICK-80 with one or more games and choose one:
- FREE ALPHA GREEN SCREEN
- FREE MAGIC ARTIST PROGRAM

IN ADDITION YOU MAY:
- ORDER 2 GAMES AND TAKE 10% OFF the games
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All games are written in machine language and supplied on cassette.

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- ALL THESE NEW JOYSTICK GAMES WILL ALSO WORK USING THE KEYBOARD WITHOUT ANY MODIFICATIONS.

GOOD NEWS: If you already have a non-joystick version of these Big Five Software games, send the original tape(s) with your STICK-80 order + $3 per game. We will send you a new Joystick version of your game(s).

ALSO AVAILABLE DOUBLE-STICK 80: 2 ATARI JOYSTICKS + ALPHA DUAL INTERFACE + INSTRUCTIONS + DEMO PROGRAM: $59.95

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Phone: (212) 296 5916
Introduction to TRS-80 Level II BASIC and Computer Programming

Michael P. Zabinski
Prentice-Hall
Englewood, NJ
Softcover, 162 pp.
$10.95

by G. Michael Vose

Computer operation and programming is an intimidating subject to someone with no experience with computers. Those of us who have been around computers for awhile think of them as sophisticated tools, nothing more. We are no longer afraid of them. But the novice programmer is often simultaneously awed and frightened by the thought of programming the mighty computer.

The teaching of computer programming, therefore, becomes tricky. This is because there is a fine line between catching a student's attention and overwhelming him with jargon and detail. Some authors of computer instruction books have tried to overcome this problem by taking a lighthearted, humorous approach to their subject matter. Others have presented the material factually in a straightforward manner, letting the student learn if he/she can.

Michael Zabinski adopts yet another approach, although not a novel one. He takes a scholarly, textbook approach in his new book. This book would be suitable for use in a junior high or high school course in computer programming and would also be appropriate for college students or adult education students.

What makes Zabinski's book so acceptable is its liberal use of examples and a set of extremely challenging problems to solve using a computer. Even experienced programmers enjoy the pure challenge of solving good problems and this book has dozens. It has challenges for the quick learner but also is accessible by students at all levels.

Naturally and Easily

This book, while only 150 pages or so not counting the appendices, covers all the Level II BASIC commands and functions. Starting with the elementary stuff like turning on the system and getting it to print 'Hello', the text moves naturally and easily into a well-written introduction on how the TRS-80 uses numbers. Most people I know are afraid of computers because they think their math skills are weak (that's why we invented the darn things!) and they imagine that computer programming requires top-notch algebraic ability. Zabinski has sensed this and introduces the subject of using numbers early but gently. Once introduced, the subject of math no longer seems so important and the text moves on to define numeric and string variables and the TRS-80 arithmetic functions.

At this point, the student has learned very little actual programming. So the book takes advantage of the student's still uncluttered memory and discusses program logic and the use of line numbers. From there the discussion proceeds through input statements, program line editing, debugging, flowcharts, IF...THEN, FOR...NEXT, READ...DATA, subscripted variables and all the rest of the TRS-80 commands and functions.

The Key

Of course, the only way to learn most anything is to do it. This author knows the student will be sitting at his/her computer while absorbing its lessons and makes liberal use of examples. The examples are set off from the text and are annotated, line by line. They are well chosen and illustrative without being too simple.

This is a well-organized book, put together by a knowledgeable programmer/educator. The writing style is a little stiff, typical of a textbook, and some graphics would have brightened up its appearance. (There is not even a picture or a line drawing of a TRS-80, except on the cover.) The publisher chose to use the standard gimmick of a dot-matrix printer to simulate TRS-80 screen displays on the printed page (which I personally find annoying). However, the text is complete and informative.

80 Reviews
you if you bring him your problems and take your money elsewhere. The bottom line is, if you have a local authorized outlet from whom you can buy, do it!

There are some non-authorized folks selling TRS-80s. Some even advertise that you can take your purchase to any Radio Shack for repair. The non-authorized "dealer" was the original purchaser, and his warranty does not "pass through" to the person he sells to. Often these folks install their own RAM or disk drives or who knows what. My best suggestion to you is that you be prepared to return it to him for repair. We're not equipped to service non-Radio Shack drives; so be prepared for a possible service problem!

Line Printer VII Owners

We've found that the paper involved in mailing labels won't pull through the Line Printer VII's mechanism reliably. Any of you who were considering handling a mailing list on the VII (doubtful at 30 CPS), had better think about another printer.

Printing Multi-part Forms

Not too many of you will want to do this, either, but we did find one person, and we think he really ended up with a problem.

We've all seen (or used) multi-part forms which are bound together at the top with carbon sheets. Some of them get pretty thick. If they're too thick, they'll push the ribbon out of place on some dot matrix printers. If the ribbon moves, and the paper is thick enough, it could hook the print wires as they strike the paper. If the wires are bent or broken, you've bought an expensive new print head! Be careful what you try to put through your line printer.

Color Computer Memory

A couple of months ago, I wrote that the Extended BASIC Color Computer had about 14.5K of user memory. Well, in point of fact, the number is 13,095 bytes, plus 200 bytes reserved for string space. So, was I wrong telling you 14.5K? Well... almost. It seems that the guy from whom I got the number for my column was one of those creative programmers; and it seems there is another reserved area of memory for graphics, of 1,500 bytes. And it seems further that if you're creative enough (and desperate enough), you could store variable values there and retrieve them with PEEKs and POKEs, saving user memory.

If you're really going to die without another few bytes, read the thorough discussion of Color Computer memory in the June issue of our owner's newsletter, on the CC Product Line Manager's page.

Last week I received a call from one of my clients. In the process of completing a month's work on one of their new subsidiaries they were attempting to print an income statement when the program stopped with an FC error. Since the ledger program (Radio Shack's) had been running without a hitch in their other companies, I requested a backup so I could duplicate the error on my computer.

After reviewing the listing and the supplied data files, I found a coding error in the ledger account classifications. As a result, a counter was not initialized in the report generating program. The illegal function call was the result of an invalid FOR...NEXT loop which depended on the counter.

Who was at fault, the client who did not properly code the account classification, or the system designer who did not anticipate the problem? To the client the answer was simple; it was the computer's fault. He was right, the computer should have displayed a more informative error message. An FC error in line 4040 is meaningless. Yet how could a system designer anticipate every possible combination of input error?

The point of this lesson is that it's impossible to account for all errors. For this reason, Radio Shack and all other reputable software suppliers provide bug fixes for their customers. These fixes are published monthly in a newsletter which is sent to computer owners free for the first year after purchase.

Catching the Bugs

In addition, Radio Shack has offered to supply free bug fixes to registered owners of their software. (To register simply fill out the card in back of the software package.) It can save you lots of time and effort when that unanticipated bug hops out of the grey box.

Until recently, knowledgeable customers have been able to debug their own software. Each Radio Shack program has included a printed listing. Not only were these listings useful for tracking down software problems, but they were also full of good programming ideas.

Radio Shack's latest accounting software, however, is being supplied as compiled COBOL programs. While this permits Radio Shack to retain control over the code, it makes it very difficult to correct bugs or interface them with other programs. Fortunately, I have been told that source listings will be made available for a license fee.

Radio Shack is trying to catch as many bugs as possible before this software is released. New software is being tested by a user who is given extensive assistance by the vendor.

This method of pre-release testing is an accepted practice for larger software systems. Despite this, most commercial software firms recommend software maintenance contracts which cost approximately 10 percent of the system price.

Advantages of COBOL

The release of COBOL programs for the Model II is a surprising and interesting development. The advantage of COBOL (Common Business Oriented Language) lies in its wide application for most major computer systems. With the source listing, it is possible that a Model II accounting program could be compiled and run on a Hewlett Packard Minicomputer (the HP 3000 or the IBM 4331). The obvious result is to increase the market for the software which should mean better programs.

Conversely, some COBOL programs that are already in commercial use might be compiled on the Model II. This could be quite interesting; the amount of COBOL software available is enormous. This language has been used for over 20 years and COBOL programs are transportable between computers.

Because the software needs of science and industry are different, FORTRAN (FORmula TRANslator) was developed for scientists and COBOL was developed for business users. BASIC, which is familiar to many of us, is a subset of FORTRAN and was originally designed as a FORTRAN teaching aid.

Both FORTRAN and COBOL differ from BASIC in a fundamental way. They require compilation before execution. The compiler is the program that is customized for each computer. Thus, theoretically, a COBOL or FORTRAN program can be executed on any computer that has a COBOL or FORTRAN compiler.

Yet, in practice this is rarely possible. There are enough differences between
Because the options selected at set up time automatically affect finance charge calculation, check your local statutes before using the system.

**Accounts Receivable**

The accounts receivable system integrates with the BASIC general ledger system. At the end of the month a program that extracts the accounts receivable totals creates a file that is accepted by the general ledger. When this file is created, the general ledger master file must be present. The GL master file validates the codes assigned to the receivables. For this reason integration is only feasible in a two drive system.

If an invalid account is encountered during the account transfer operation, the transfer is aborted and an error indicated. This ensures that only properly coded data is accepted in the general ledger. In an integrated system, therefore, your accounts receivable codes must be identical with those already established in the general ledger.

The accounts receivable system uses alphabetic codes to indicate accounts to be charged or credited. Then accounts are predefined and used as default codes. The first eight default codes—A through H—are permanently defined to ensure that processing will not be interrupted at an inconvenient time. The eight permanent codes are: accounts receivable; sales; cash in bank; sales tax; freight; finance charge; discounts; and non-taxable sales.

The coding features available in the accounts receivable system are quite flexible. With 26 codes available, a complex sales analysis can be accommodated. With the proper coding you might be able to eliminate the need for separate sales and sales return journals. Because of the potential time saved you should discuss this coding with an accountant at setup time.

This system allows open item and balance forward accounts to exist in the same file. Open item systems retain the detail of unpaid invoices until they are paid or written off. A balance forward system retains invoice detail until a statement is prepared (then all detail is purged).

A balance forward system works best if the number of outstanding invoices can be kept to a minimum. However, if many questions of cash application are likely when a payment is made then an open item system should be used.

One plus to the COBOL accounts receivable system is that it accommodates both types of receivable recordkeeping. This recordkeeping is usually part of the order entry invoicing cycle of a firm. Fig. 1 indicates, in a simplified way, processing steps and major systems affected. Invoicing, inventory maintenance and accounts receivable updating are performed at the same time.

At billing time, invoice detail information is usually obtained from an inventory file. Because of this it is not unusual to integrate billing and inventory maintenance. Often the billing is also tied into order entry and warehouse control. Since the receivable file is only updated with the invoice total, a much lower volume of transactions is encountered. As a result, receivable systems usually do not include an invoicing module.

The COBOL receivable system is an exception. It allows you to generate an invoice or enter post billing information. If you are billing as well, invoice information must be entered line by line. Up to 99 lines are allowed. You can enter a general ledger account code, part number, quantity order, quantity shipped, description and unit cost.

"Price extensions, sales taxes and invoice totals are automatically calculated."

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![Diagram of the Generalized Order—Invoice Cycle](image)
Price extensions, sales taxes and invoice totals are automatically calculated. The system even distinguishes between taxable and non-taxable sales.

A customer's address is extracted from the accounts receivable file. If the shipping address differs from the billing address, the new address is entered. You can also enter an order date, ship-via-description, discount terms and a customer purchase order number.

All data entered is buffered on the disk. Data in the buffer can be printed for analysis or altered. When invoicing, the forms can be placed in the printer and printed all at once. Once data are printed, the program automatically transfers the invoice total to the sales entry file. Thereafter, you can alter these only by using the sales entry file maintenance routines.

Invoicing Module

The invoicing module is well done and unless it is used, the distribution of sales data to various general ledger sales accounts will be limited. The post invoicing module appears to accommodate only one general ledger sales account. Thus, if multiple sales accounts are affected by billing, multiple invoices will be required.

Other receivable transactions are accumulated in buffers before updating customer accounts. If unposted transactions are in the system, an account inquiry may not provide the most up-to-date information. For this reason Radio Shack recommends that you post transactions daily. As is their practice, a posting report is printed when accounts are updated.

On request, an account can be queried to determine status and open item information. The status report can also be printed.

The label printing program allows the accounts receivable file to be used as the source of names when mailing for promotional purposes.

Another available report is the system definitions that can assist you in coding new information.

It is often desirable to screen the accounts receivable file during a month. The account listing program allows you to have either a complete account list, accounts overdue or current accounts. Accounts can be printed in alphabetic or numeric sequence.

At the end of an accounting period an "end of period" menu is presented. The menu allows you to print the trial balance with or without updating. An update prints a detailed report showing each account, the new balance, all of the transactions for the period, and the finance charges that have been applied. This detail should be retained as a permanent record.

The next step in the end of the period processing is to prepare customer statements. These are numbered so that if for any reason it becomes necessary to re-run some of the statements, the entire process need not be redone.

At the end of the statement printing routine, the account summary for a GL journal posting is prepared. After this is compiled, a GL distribution report is run. This terminates the monthly closing procedures for unintegrated systems. If you are using an integrated system, the GL transfer program can be run to transfer the data to the general ledger file.

Although this accounts receivable system represents a good approach to dealing with billing and posting, Radio Shack has recently released a new version to handle even more functions. With this version, the three disk accounts receivable system is the first module of new COBOL Business Accounting Package. We will be looking at this new system in more detail in the future.

Word Processing? You need a SPELLING CHECKER

This is an example of a text being checked by HEXSPELL. The text scrolls up the screen as it is checked. When an error is detected, you have three choices:

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“Summer is around the corner, and the end of the school year is upon us.”

Summer is around the corner, and the end of the school year is upon us. That means you will have more time for all those tasks you had to set aside during the academic year.

Well, summer is here and summer is later; it’s time to get started. If you go about it more efficiently, you can get a lot done before fall and new classes are upon you. Here are a few suggestions to that end.

First, take a look at those document writing tasks. Study guides, grant proposals, etc. require writing and re-writing through several drafts. This is certainly an area in which your computer can be of great service. You can write the first draft and make as many changes as necessary without having to re-type the whole document. You can then make as many hard copies as are needed.

To realize this efficiency you will need a word processor program of some kind. Many word processors are available commercially for a variety of prices.

The May, 1980, issue of 80 Microcomputing published a comprehensive word processor page 50. I used this program for some time and found it to be quite good. With a few minor changes to suit my equipment and needs, it turned out several hundred pages of manuscript with a minimum of effort.

What about increasing your program writing efficiency? There are myriad techniques and procedures for reducing your time and effort, including using a standardized subroutine package, merging program parts secured from various sources, and the use of "authoring" programs.

The most useful assistant you can have is a well chosen utility. I rarely sit down at my computer without first loading a utility which includes the functions I use most frequently. I’ll give you a brief description of what mine does for me.

My utility includes debounce, reversible upper/lower case driver, and auto-repeat on all keys. It has completely programmable single stroke keywords and macrokey with special repeat capability and pauses for fill-ins. Most importantly, there is screen oriented editing with such capabilities as duplicating, renumbering, moving lines and quickly creating multiple statement lines.

The total program is self-relocating and self-protecting, and can be enabled and disabled in whole or in part at any time from the keyboard. Does all that sound good? It is Omni-Key from Discovery Bay Software.

A good multiple function utility program can do wonders for you. It takes care of the mechanics of writing so that you can concentrate on developing your program.

Please add one more item to your to-do list—share your work with other readers. Let me know what you are doing and how you are doing it. Send a sample if that helps to explain things. As space permits, I will tell others about your accomplishments, which will encourage the rest of us to get busy and give us ideas for our own lists.

“The most useful assistant you can have is a well chosen utility.”

Send your letters, notes, samples and whatever in hard copy, standard cassette, Exatron ES/F wafer, or TC-8 cassette with any of the three at normal speed or at the plus 50 percent speed option. Recorded material can be based on the Hindrichs’ Word Processor or on Scripsit. On all tapes, be sure to label the system used, the speed and the word processor if any.

CAl Planning Mechanics

Last month we discussed aspects of making a plan for a CAI (Computer Assisted Instruction) lesson and turning it into a CAI program. Now I would like to pass along to you a handy approach to the mechanics of planning.

You can waste a lot of time when planning. I’ve seen folk re-write entire sections of a plan just to insert something that had been overlooked or to change a point or two. You need a writing system which provides maximum flexibility for the inevitable changes which take place.

A plan is not the end product of CAI: It is nothing more than a plan for the instructional program—a guide. Once the program is completed, the plan is useless. For that reason, the plan should not be prepared in a polished, finished form.

Maximum flexibility can be achieved with a stack of unruled file cards. A single line across the narrow dimension will give you two areas on each card.

Holding the card vertically, think of the top half as the face of the computer display screen. Write in this area what you want the student to see on the screen at a given point in your program. Use the lower half of each card for notes about the program statements to be written later.

Changes in the instructional sequence are simple to handle: Just change the order of the cards. Add and delete by inserting or pulling out cards.

Seeing facsimiles of what the student will see on the display gives you a very good “feel” for the program. You can thus more easily spot weaknesses in the plan before the first program statement is written. Fewer changes will be required in the program writing stage.

Sometimes we become so involved in an undertaking that we cannot see it objectively. Have a knowledgeable friend look over your plan for things you may have missed. A pack of cards will provide a better idea of the finished product than a series of written descriptions.

Late Flash

I just received an interesting letter from Don Willard in Illinois. Don has arranged with the powers that be to have access to the school computer lab during off hours this summer. Several of his more accomplished students have volunteered to give a hand with some of the programs on Don’s summer list.

Students who have TRS-80’s at home will do the bulk of the writing there. They will meet with Don at the school lab from time to time for critiques of their work and to get new assignments.

Don sounds like a guy who knows how to spread the work around. He should get a lot accomplished this summer.
You have the chance to pick up some terrific programs written for an 8080 based computer. The prices are so low it's worth checking them out. When they arrive you find... a dozen rolls of paper tape!

Paper tape may no longer be the popular program storage medium it once was, but for archival storage or communicating among different styles and types of computers, it still has its place. This article will describe a hardware and software interface between the Raeco TPR-1 paper tape reader and the Model I TRS-80.

The TPR-1 reader is sold by Raeco (Box 185, Washington, ME 04574). The unit consists of a honed aluminum track for the paper tape, and a circuit board attached to the track. On the board are two integrated circuits, nine light sensors, and a 14-pin DIP socket. It is sold with a comprehensive technical manual for $32.50.

**Tape Date Storage**

Eight-level paper tape is capable of storing parallel bytes of data by means of holes punched in the tape. A smaller, ninth hole is used to provide a timing signal for the reading program. The ninth hole can also be used as a data-ready signal because, by the time the light triggers along the edge of the smaller hole, the larger holes are letting in enough light to be stable.

The TPR-1 reader is already set up for a computer bus, and hence is ideal for interfacing with the TRS-80. Its output is in parallel, and all signals are three-state. Because it uses only 12 mA, the reader can be run from the TRS power supply.

Fig. 1 is the diagram of the TPR-1. CMOS integrated circuits U1 and U2 evaluate the state of the light sensitive transistors and provide a parallel output. Part of U2 is used to drive the LED, which lights up whenever data is stable at the output of the reader.

Fig. 2 is the TRS-80 interface. Z1 and Z2 decode the port address 3F hex (63 decimal) in order to activate three-state buffer Z3. Ideally, the TPR-1 would have been designed with the Ready line separately activated from the data lines. That way, Ready

---

**Program Listing**

```
0100 ; TAPE READER AND 256-BYTE LOADER ROUTINE
0110 ; DENNIS RATHBUN KITZ
0120 ; ROXBURY, VERMONT 05659
0130 ;
0140 VECTOR EQU 4813H
86C EQU 0158 BASIC EQU 86CH
198 EQU 0168 VIDEO EQU 198H
170 EQU 0170

0181 ; INTERRUPT VECTOR AT 4012H
0190 ORG 4012H
01A0 DFBF 0C3H
01B0

01C0 CLEAR SCREEN SUBROUTINE
01D0 21003C CLEAR LD HL,VIDEO
01D1 21003C CLEAR LD DE,VIDEO+1
01E0 01FF03 CLEAR LD BC,03FFH
01F0 3620 LD (HL),20H
0200 ED88 \DIR
0210 DC9 \RET
0220 DC9 \RET
0230 DC9 \RET
0240 DC9 \RET
0250 DC9 \RET
0260 DC9 \RET
0270 DC9 \RET
0280 DC9 \RET
0290 DC9 \RET
02A0 DC9 \RET
02B0 DC9 \RET
02C0 DC9 \RET
02D0 DC9 \RET
02E0 DC9 \RET
02F0 DC9 \RET
0300 DC9 \RET
0310 DC9 \RET
0320 DC9 \RET
0330 DC9 \RET
0340 DC9 \RET
0350 DC9 \RET
0360 DC9 \RET
0370 DC9 \RET
0380 DC9 \RET
0390 DC9 \RET
03A0 DC9 \RET
03B0 DC9 \RET
03C0 DC9 \RET
03D0 DC9 \RET
03E0 DC9 \RET
03F0 DC9 \RET
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04B0 DC9 \RET
04C0 DC9 \RET
04D0 DC9 \RET
04E0 DC9 \RET
04F0 DC9 \RET
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0670 DC9 \RET
0680 DC9 \RET
0690 DC9 \RET
06A0 DC9 \RET
06B0 DC9 \RET
06C0 DC9 \RET
06D0 DC9 \RET
06E0 DC9 \RET
06F0 DC9 \RET
0700 DC9 \RET
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07A0 DC9 \RET
07B0 DC9 \RET
07C0 DC9 \RET
07D0 DC9 \RET
07E0 DC9 \RET
07F0 DC9 \RET
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0A00 DC9 \RET
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0A50 DC9 \RET
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0A70 DC9 \RET
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0A90 DC9 \RET
0AAF DC9 \RET
0B00 DC9 \RET
0B10 DC9 \RET
0B20 DC9 \RET
0B30 DC9 \RET
0B40 DC9 \RET
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0BD0 DC9 \RET
0BE0 DC9 \RET
0BF0 DC9 \RET
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0CA0 DC9 \RET
0CB0 DC9 \RET
0CC0 DC9 \RET
0CD0 DC9 \RET
0CE0 DC9 \RET
0CF0 DC9 \RET
0D00 DC9 \RET
0D10 DC9 \RET
0D20 DC9 \RET
0D30 DC9 \RET
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0D70 DC9 \RET
0D80 DC9 \RET
0D90 DC9 \RET
0DA0 DC9 \RET
0DB0 DC9 \RET
0DC0 DC9 \RET
0DD0 DC9 \RET
0DE0 DC9 \RET
0DF0 DC9 \RET
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0F90 DC9 \RET
0FA0 DC9 \RET
0FB0 DC9 \RET
0FC0 DC9 \RET
0FD0 DC9 \RET
0FE0 DC9 \RET
0FF0 DC9
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could be tested at all times, whereas data would only be input whenever Ready indicated stable data. In its present configuration, a separate buffer must be used for the TPR-1 data lines.

Z4 is a flip-flop which sends an interrupt signal to the TRS-80 INT line, INTAK (interrupt acknowledge) is used to clear the interface flip-flop once the data have been read.

The entire circuit can be wire-wrapped on a small piece of perfboard, and mounted inside the case with the TPR-1. A detachable 40-pin cable is used in the prototype.

Page Read Software

Listing 1 presents the software to read a page (256 bytes) of data into the TRS-80 and store it in memory. At power-up, the interrupt patch point at 4012 hex is initialized with C9, a RETurn instruction. In its place, a patch is made to one of three interrupt service routines which will read

```
7057 47 00070  LD  B,A
7058 AF 00660  XOR  A
7059 C9 00990  RET
705A 00 00000  ; MESSAGES FOLLOW
705A 54 00910  MSGNO1  DFM  'THREAD TAPE AND PRESS CLEAR.'
705D 00 00920  DEFB  00
7057 4C 00930  MSGNO2  DFM  'LOADING PAGE ADDRESS:'
7058 00 00940  DEFB  00
705F 42 00950  MSGNO3  DFM  'BYTE LOADING AS FOLLOWS:'
705A 00 00960  DEFB  00
705B 43 00970  MSGNO4  DFM  'CALCULATED CHECKSUM IS:'
7062 00 00980  DEFB  00
705C 43 00990  MSGNO5  DFM  'CHECKSUM AS READ IS:'
705D 00 01000  DEFB  00
705A 43 01010  MSGNO6  DFM  'CHECKSUM ERROR IN THIS BLOCK.'
7057 00 01020  DEFB  00
705F 42 01030  MSGNO7  DFM  'BLOCK LOADED CORRECTLY.'
705A 00 01040  DEFB  00
705B 41 01050  MSGNO8  DFM  'ANOTHER BLOCK? REP 1 FOR YES, 2 FOR NO'
7059 00 01060  DEFB  00
705A 50 01070  MSGNO9  DFM  'PRESS CLEAR TO RETURN TO BASIC.'
7059 00 01080  DEFB  00
705A 00 01090  ; REMEMBER THIS IS ENTRY POINT AND NOT!
705A 00 01100  ; BEGINNING OF PROGRAM......
705A 00 01110  ; CLEAR SCREEN, DISPLAY "THREAD" MESSAGE
705A 100D 01120  START  CALL  CLEAR
705C 215A7D 01130  LD  HL,MSGNO1
705D 11003C 01140  LD  DE,VIDEO
705E 0D067D 01150  CALL  DISPLAY
705F 0D0E7D 01160  CALL  DESER
7060 01170  ; DISPLAY "ADDRESS" MESSAGE & FIND IT
7062 21777D 01180  LD  HL,MSGNO2
7066 11483C 01190  LD  DE,VIDEO+48H
7067 2D167D 01200  CALL  DISPLAY
706D 21407D 01210  LD  HL,SERVER2
706E 221340 01220  LD  (VECTOR),HL
7067 37 01230  SCF
7068 0D56 01240  IM  1
7069 FF 01250  EI
706C 38F5 01260  JR  C,5
706E 21437D 01270  LD  HL,SERVER1
7072 221340 01280  LD  (VECTOR),HL
706B 21573C 01290  LD  HL,VIDEO+57H
7067 37 01300  SCF
7068 FF 01310  EI
7069 38F5 01320  JR  C,5
706E 21437D 01330  LD  HL,SERVER
7072 221340 01340  LD  (VECTOR),HL
706B 21573C 01350  LD  HL,VIDEO+57H
7067 37 01360  SCF
7068 FF 01370  EI
7069 38F5 01380  JR  C,5
706E 18FA 01390  DJNZ  LOOP2
706F 21547D 013A0  LD  HL,SERVER3
7072 221340 013B0  LD  (VECTOR),HL
706B 21407D 013C0  LD  HL,MSGNO4
706E 11483E 013D0  LD  DE,VIDEO+240H
7067 2D167D 013E0  CALL  DISPLAY
706E 79 01400  LD  A,C
706F 05 01410  PUSH  DE
7070 81 01420  POP  HL
706B 1D167D 01430  CALL  CONVRT
706F 1550 01440  LD  A,H
7070 05 01450  PUSH  DE
7070 81 01460  POP  HL
706B 1E167D 01470  CALL  CONVRT
706F 1710 01480  LD  B,C
706E 59 01490  CP  C
706D 09 014A0  JR  NZ,CHKM0
706D 11037D 014B0  LD  HL,MSGNO5
706E 1710 014C0  JR  C,CHKM0
706D 1710 014D0  JR  NZ,CHKM0
706D 11037D 014E0  LD  HL,MSGNO6
706E 1710 014F0  JR  C,CHKM0
706D 1710 01500  JR  NZ,CHKM0
706D 11037D 01510  LD  HL,MSGNO7
706E 1710 01520  JR  C,CHKM0
706D 1710 01530  JR  NZ,CHKM0
706D 11037D 01540  LD  HL,MSGNO8
706E 1710 01550  JR  C,CHKM0
706D 1710 01560  JR  NZ,CHKM0
706D 11037D 01570  LD  HL,MSGNO9
706E 1710 01580  JR  C,CHKM0
706D 1710 01590  JR  NZ,CHKM0
706D 11037D 015A0  LD  HL,MSGNO0
706E 1710 015B0  JR  C,CHKM0
706D 1710 015C0  JR  NZ,CHKM0
706D 11037D 015D0  LD  HL,MSGNO0
706E 1710 015E0  JR  C,CHKM0
706D 1710 015F0  JR  NZ,CHKM0
706D 11037D 01600  LD  HL,MSGNO0
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706D 1710 01680  JR  NZ,CHKM0
706D 11037D 01690  LD  HL,MSGNO0
706E 1710 016A0  JR  C,CHKM0
706D 1710 016B0  JR  NZ,CHKM0
706D 11037D 016C0  LD  HL,MSGNO0
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The program is entered at line 1160. The screen is cleared, and the user is prompted to enter a base address in hex. This is an address starting at which the tape data is to be loaded into memory. The keyboard is scanned for characters 0 to 9 and A to F; these are displayed, and when Enter is pressed, they are converted to a starting address.

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80 CALENDAR

June

The National Forum on Computers and Health, Alexandria, VA is offering a workshop called Mini-computers and Microprocessors in Medical Practice Management. It will be held June 4-5 in Philadelphia. To register call (703) 549-8820 collect. The toll free number for Virginia residents is (800) 536-4776.

June 30 is the deadline for submissions for The Johns Hopkins First National Search for personal computing devices, programs and designs to aid the handicapped. The search is designed to "discover existing applications and to inspire new ideas for the application of personal computing to meet the needs of the handicapped," according to a press release from Johns Hopkins University.

A $10,000 grand prize is offered along with 100 other awards. The three submission categories are defined as 1) Computer Based Devices which includes "hardware invented or modified for the purpose, or working hardware and software which can demonstrate a new application;" 2) Computer Programs which means "specialized software and concepts for existing computers;" and 3) System Concept/Design, which is "written descriptions of ideas not yet implemented."

The competition is being sponsored by grants from The National Science Foundation and by Radio Shack.

For more information, write Personal Computing to Aid the Handicapped, The Johns Hopkins University, P.O. Box 670, Laurel, MD 20810.

July

July 5-31 The Hill School, Pottstown, PA, will conduct four one-week computer workshops using the school’s PDP 11/34 system and will offer students maximum hands-on experience. The first three workshops will be open to students of Grades 7-12. The last will be for teachers and other professionals.

Contact John E. Parnell, The Hill School, Pottstown, PA 19464, for information.

July 13-14 will see a seminar on using the OASIS operation systems on Z-80 microcomputers at Phase One Systems, Oakland, CA.

Classes will be limited to 20-30 students with plenty of "hands-on" activities. Price is $195. Information is available from Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA, 415-562-8085.
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Before Someone Else Does!
What may be the world's first electronic newsroom is being created for the TRS-80 and videotex user as part of the Interactive News Division of Dow Jones Co., Inc., Princeton, NJ, publisher of The Wall Street Journal.

The seven-man newsroom's aim, according to its editorial director, Richard J. Levine, is to "create a new product by seeing and showing relationships" among businesses and whole industries. They will reorganize information from existing Dow news publications, including The Journal, Barron's National Business and Financial Weekly, and Dow's financial news wire. They will supplement this with statistics and information from other published private and government records.

Their aim is to take advantage of the unique interactive nature of computerized news to give each user a large amount of information on the subject he asks about, Levine said.

Levine, The Journal's former chief economic writer, called the newsroom a major upgrading of a service previously concerned solely with encoding Dow wire stories for computer retrieval by professional financial people and Apple and TRS-80 microcomputer users.

The electronic service works by providing each user with information on subjects he defines by specifying the database he wants (news, stock quotes or financial statistics, for instance) and the specific subject area (individual company or group of industries.)

Levine's assignment is to remake the news database, which currently contains stories off the Dow Jones financial news wire from the last 90 days. He sees the interactive nature of the computer news service as freeing the newsman from the confines of space which limit his stories severely on a daily newspaper. And, since electronic news is user specific, it does not burden each reader with material on subjects he is not interested in.

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Two Major Moves

The newsroom evolved as the result of two major moves by Dow in the last two years.

In May 1979 Dow bought full control of its interactive information service from its partner in the venture, Bunker Ramo Corp., Oak Ridge, IL, a producer of information systems for brokerage houses and banks. A year later Dow reorganized into seven operating groups, one of them the Interactive News Division.

The moves signaled an overall expansion of Dow's electronic publishing.

Besides creating the newsroom, Dow recently arranged to make stock quotation and statistical information databases available on TRS-80 microcomputers and Videotex terminals.

Levine is also considering adding to the databases by using material from Dow's many other publications. They include a foreign news wire that reaches 40 countries, an Asian edition of The Journal, the Ottaway Newspaper Chain with daily papers in 20 cities, a textbook publisher and Book Digest magazine.

For instance, Levine said, little of the statistical information from Barron's is being put into the computer. He may have a new database created to contain the rest of Barron's.

Dow, which has been in electronic publishing since 1971, sees it as a "powerful new medium," according to Levine, who said the recent Dow moves are part of a decade-long evolution.

When Dow and Bunker Ramo went into electronic publishing, Levine said, they aimed at major computerized financial institutions and Fortune 500 companies. As smaller firms computerized, the service was marketed to them.

When microcomputers became widespread, Dow solidified an agreement with Apple Computer Inc. Cupertino, CA, in 1978 that made some databases available to users on a timesharing basis. A similar agreement this year with Tandy/Radio Shack, Fort Worth, TX, is a major expansion into that same market, said Levine.

The newsroom, he said, is a natural outgrowth of that outlook.

"When we get serious about something, we tend to involve journalists," Levine said.

Selecting Writers

To meet the challenge of creating an editorial product for this medium, Levine is choosing writers with a strong background in hard news. Like Levine, himself, they may not have great technical knowledge.

Levine was a Journal reporter for 14 years, serving as military correspondent, labor reporter and editor and White House and Congressional reporter. He became chief economic writer in 1976 and has written a front-page weekly column, "The Outlook," since 1977.

His deputy editor is Peter J. Schuyten,

“Our feeling is this is a powerful new medium. If we are serious about electronic publishing, there has to be a way to design editorial products for that medium.”
FCC Liberalizes Ruling

In a decision that will lighten the hearts of peripheral manufacturers everywhere, the Federal Communications Commission (FCC) has made some major concessions regarding certification of computer peripherals.

The commission has re-evaluated certain sections of the rules (15.843(a)(3), 15.4(9)) covering peripheral equipment compatible with Class B computers—those used in residential settings where radio frequency interference is most likely to be a problem.

Up to now, any peripheral that was capable of being connected to a Class B computer had to meet the same stringent certification requirements that the computer, itself, faced. In the future, peripheral manufacturers need not be constrained by the strict Class B limits if they can show the commission that the likelihood of their peripheral being used with a Class B computer in a residential/hobbyist application is small. One example is a manufacturer who might produce an extremely expensive printer costing many times the price of a popular microcomputer with which it could be used.

This change in attitude toward peripheral manufacturers marks a new realization by the FCC that the stringent RFI requirements which it has placed on a hitherto unregulated industry are causing economic hardship for many. To ease these “growing pains,” as the commission terms them, the FCC has established a computing device panel to answer industry inquiries and to continually review regulations.

This panel, headed by the commission’s chief scientist, provides peripheral manufacturers with an opportunity to plead their case. A unique aspect of the panel is the power provided the chief scientist to make immediate decisions, thus speeding up the usually sluggish bureaucratic decision-making process. The commission cites the Administrative Services Act in defense of its right to dispense with normal rule-making procedures. Under this act, rule changes which are merely “interpretive,” rather than substantive, may be made without the normal 30 day waiting period.

The net result of the FCC’s change in rule interpretation is simply this: The manufacturer’s marketing of a peripheral is the prime, but not the only, consideration in establishing the device’s certification requirements as far as the FCC is concerned. A manufacturer may now petition the commission to reclassify his peripheral if it appears unlikely that the device will be used in residential or hobbyist applications.

by Chris Brown
80 Staff

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See List of Advertisers on page 306
Sharp Selling RC Pocket Computer in US

The Japanese firm that makes the Pocket Computer for Tandy Radio Shack has started marketing it in this country under its own name.

A spokesman for Tandy denied any link between Tandy's recent price cut of the Pocket Computer and the move by Sharp Electronics Corp., saying the sale was planned last fall and extra computers were ordered for it.

In fact, the spokesman, Ed Juge, director of computer merchandising for Tandy, Fort Worth, TX, said that his company and Sharp were discussing the design of a second generation of the pocket computer.

Meanwhile, Don Lawrence, national sales manager of Sharp's Systems Division in Paramus, NJ, said they will market the Pocket Computer nationally through every outlet available.

He said they would be sold in department stores, computer specialty stores, discount stores and even college bookstores.

He said it would be sold as a scientific and business machine usable, for instance, in photographs darkroom work, computing airplane flight plans, and working with stocks and bonds.

The Sharp Pocket Computer was unveiled at the National Computer Convention in Chicago, IL, in early May, where Sharp also introduced its first microcomputer.

Lawrence said Sharp organized its Systems Division at its Paramus, NJ, headquarters to handle sales of all its programmable products. He confirmed that Tandy would continue selling the Pocket Computer and said from Sharp's standpoint Tandy is simply another major outlet for the product.

Juge declined to give any details of Tandy's "wish list" for the second generation Pocket Computer, saying, "We don't know what's feasible yet."

In an earlier statement, however, he said when Tandy decided to buy the Sharp product they had planned to have a completely redesigned version made as soon as possible.

Tandy, Tokyo Firm Join In Japanese Market Rush

Tandy/Radio Shack and the Tokyo Electric Co. (TEC) are making a joint assault on the Japanese microcomputer market with an agreement that allows TEC to sell the TRS-80 Models I, II and III microcomputers in its new computer centers.

TEC will also manufacture TRS-80 Model IIs for the Japanese market.

The agreement effectively combines the new TEC stores and the existing Japanese Radio Shack outlets into what Tandy President John V. Roach and TEC President Toshiro Akita said would be the largest sales and service set-up in the Japanese microcomputer market.

It is a major bid by Tandy for a larger share of that market. Tandy has been successfully selling its TRS-80s through its own stores in Japan for three years according to Gerald P. Asher, director of financial planning for Tandy.

TEC is a Tokyo-based electronics manufacturer, a member of the Toshiba group of companies, and has recently set up a Small Business Computer Division to market microcomputers. The firm has opened a computer center in Tokyo and has centers in Osaka and Magoya, Japan, in the works. As part of the agreement the two firms will work together to extend their sales and service network throughout Japan.

Tandy and TEC have worked together in the past. The Tokyo firm has custom made several items for Radio Shack, including some of their best line printers, Asher said. TEC is the leading manufacturer of electronic cash registers and point of sale terminals in Japan.

A Good Value

Asher said the TRS-80 microcomputers are a success in Japan because they are a good value for their price. Stacked up against the major Japanese competitors, he said, they tend to be less fancy but also less expensive.

"I don't think there's any question the Japanese are making good equipment," Asher said. Some of the Japanese equipment he has seen is better than the American equipment.

However, he said, "Most of the 'for real' equipment I've seen is in the $4,000 class. They're not low end products."

Asher said the Japanese machines do not represent any significant technological breakthroughs. There is nothing they do that the TRS-80s can't do. According to Asher, the Japanese products are simply refined further. But not everyone is interested in paying for this further refinement.

In fact, Asher said, the TRS-80 Model I, the most basic of the Radio Shack desktops, is still popular in Japan and Europe both. It is no longer sold in the US because of Radio Frequency Interference standards set by the Federal Communications Commission (FCC) for microcomputers.

Asher said adequate software packages are available for the TRS-80s in Japan. These products, he said, are all developed in Japan for that market.
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By the way, our replacement print-head costs less than $30 too! Call or write today for more information.
Shack’s Hopes High for Hard Disk

A hard disk system will be available for Tandy’s Model II microcomputer by the end of 1981 according to Ed Juge, director of computer marketing at Tandy/Radio Shack, Fort Worth, TX.

Juge said both the hardware and software phases of the project are on schedule, and he foresees no delays. He said, however, that no announcements will be made by Tandy until enough hard disk drives are warehoused around the country to satisfy the expected heavy demand.

The Model II hard disk will be approximately a 10 megabyte stand-alone device requiring no special interface or cabling. The disk operation system (DOS) is expected to be extremely advanced and business oriented.

Several Sources

Juge offered “no comment” when asked who the OEM (original equipment manufacturer) of the drives would be, but 80 Microcomputing has learned that Tandy is considering several sources.

When queried about operating software, Juge said, “As far as I know, the DOS is being developed in-house, although portions may be contracted out to specialty software houses if necessary.”

One source of hard disk drives that Radio Shack is considering is Micro Peripherals Inc., Oklahoma City, OK, a division of Control Data, Inc. Ken Nichols, manager of public relations for Control Data, said his organization has sent several Finch Drives (hard disk units) to Tandy for evaluation. The Finch Drive, manufactured by Micro Peripherals, is an eight-inch unit that has 24 Mbytes of storage and a data transfer rate of 6.4 bits. This Winchester-type unit is a sealed module and operates at 3600 rpm with a head clearance of 25 micro inches. It employs a voice coil linear motor, hard sectored disks and has built-in data recovery circuitry.

As supplied by MPI, it has no interface circuitry. Radio Shack must design the interface logic required by the Z-80 chip.

Nichols told 80 Microcomputing that MPI will be shipping the Finch Drive to customers in quantity by June and added, “At this point it is up to Tandy as to when any hard disk system using our drives is available.”

While Juge said that, for the most part, the DOS would be developed in-house, 80 has learned Tandy has been looking to outside consultants for help with the hard disk system. Pick and Associates of Irvine, CA, a small but experienced software-development firm, is one of the organizations to which Tandy has turned.

Tim Holland, the senior VP of Pick, told 80 Microcomputing that his organization has been involved in negotiations with Tandy, but not in an occasional software patch within TRSDOS. Instead, they have been looking at adapting the entire Pick operating system to the Model II. He added, “Tandy is looking for an extremely sophisticated, business-oriented system for the Model II. We feel that the Pick system fits the bill nicely.”

The Pick system is already running in Z-8000 applications and on hardware manufactured by Honeywell, Hewlett-Packard, Evolution Systems, Micronet and Applied Digital Data Systems. Over 1,000 Pick operating systems have been sold at $1,000 a copy.

According to Holland, the Pick system has many benefits. These include extremely detailed documentation, optimal Z-80/Z-8000 operations, excellent data base management, a reportorial language called Access and full networking capability using DMA (direct memory access) techniques.

An added plus for the Pick system in Holland’s view is the fact that it is already running with hard disk drives that Tandy is considering, those of ADDS (Applied Digital Data Systems). Holland optimistically told 80, “At this point we feel that we’ve got the inside track.”

A senior contract negotiator for Pick, who preferred to remain anonymous, was more reserved in his outlook. He said that his client had gambled heavily on Radio Shack choosing the Pick system and, consequently, much time and energy has been committed to preparing the DOS by January 1982. He did predict, “We will soon see a working relationship between Pick and Tandy.”

Juge Visits Wayne Green

Tandy/Radio Shack recently sent Director of Computer Merchandising Ed Juge and Consumer Information Officer Bill Walters, north from their Fort Worth, TX, headquarters to tour Wayne Green, Inc., Peterborough, NH, publishers of 80 Microcomputing.

While there they held a two-hour news conference with the magazine’s staff during which Juge revealed some of his personal thoughts and Tandy’s official ones on topics ranging from the importance of microcomputing software to Radio Shack’s continuing support for the Model I.

“Software is the future of the industry,” Juge said.

The emphasis on hardware and “doing your own thing” will die down, he said, as more people in both business and the home buy microcomputers to serve as appliances.

These people, he said, will not be interested in learning to program. They will want to buy their software ready to use, directly applicable to their needs.

This market will grow so large, he said, it will support specialty stores which will sell only software, just as bookstores only sell books.

Specialized Software

It will also support highly specialized software houses, he said, which will produce programs for one small area, such as inventory control.

Such a house, he said, might base its work on two or three programs. They would constantly research their area and bring out many versions of their programs, each designed to fit the needs of a particular industry.

While increasing numbers of small businesses ranging from pharmaceutical houses to engineering firms are developing specialized programs to suit their uses, Juge threw cold water on the idea that these firms will turn to selling their software.

Often, he said, such a company will be better off keeping a program to themselves, especially one that solves a problem and gives them a competitive edge. If they do decide to market it, he said, they may find they have taken on more than they bargained for.

“We get all kinds of people who say they’ve developed a program that does a good job for them,” Juge said. Unfortu-
How in heavens name, can SUPER UTILITY provide answers?

Super Utility is a powerful and sophisticated zapping program that allows you to go to the heart of the disk and read or modify data with ease, engaging simple one-key commands that threads through all of your logical decision choices. Super Utility, written by Kim Watt of Breeze Computing, Inc., is a stand alone program containing seven main menus, which are the answers to frustrated questions you have while struggling through your TRS-80 programs.

Q: How can I format my disk without erasing what I have?
A: Format your disk and add tracks. Make a 35 track disk a 40 track. You also have the option of formatting with or without erase, or custom formatting your disk.

Q: This disk is protected. Isn’t there some way I can copy it?
A: Disk Copy enables you to back up most TRS-80 readable disks, regardless of efforts to protect it. So, back up your original and back up your modified version, too, or . . .

A: Tape Copy if you wish to back up your tape.

Q: How can I get more access to my memory?
A: Memory allows you to move, test, compare, zero, exchange, edit, or jump to, memory. Load memory to/from disk and input or output a byte to any port.

You will love the simplicity and freedom of modifying programs to suit your needs. Now, the only question left is . . .

Q: How do I order?
A: Send check or money order for only $49.95 plus $2.90 shipping and handling to:

Breeze Computing, Inc. 4018 Bacon Berkeley, MI

Foreign orders, please add $5.00 additional postage. Michigan residents add 4% sales tax.

Breeze Computing, Inc. will send every owner, upon registration of Super Utility, a back up copy.

Price-Performance Breakthrough at OMIKRON

OMIKRON has set new Price-Performance standards in the micro-computer industry with the formation of COUGAR - the official Omikron Users Group.

All purchasers of our MAPPER I CP/M Adaptor for the TRS-80 Model I are now eligible to receive Omikron’s newsletter, the OMIGRAM offering the very best in CP/M Software at unprecedented group purchase rates.

MAPPER III for the Model III available soon.

Write or call now for free brochure

Initial offerings include:
- Word Processors
- Languages
- Data Base Managers

Dealer and Quantity Discounts now Available.

See List of Advertisers on page 306

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nately, those programs are often designed so specifically that they cannot be used by anyone else.

For instance, he said, a small print company may write a program to estimate the cost of jobs. It may work well for them, but only handle jobs involving less than 100,000 copies because that shop only does work under that size.

If a print shop that does larger jobs buys the program, they will find it useless.

Juge said Tandy has between 80 and 100 programmers developing software for the TRS-80 computers. This spring they doubled the size of their systems software department in eight weeks and, “If we could find the people, we would double it again.”

Tandy has the same problem in at least one other area, Juge said. He is constantly looking for business program reviewers. This small group must evaluate a program’s worth to the small businessman. Though he has essentially an unlimited budget for the group, he cannot find enough people with both the technical knowledge and business experience necessary.

**BASIC as Standard**

Juge said BASIC will probably remain the standard microcomputer language for the foreseeable future. It combines utility with ease of use for the non-professional, he said.

He sees a need for new intermediate languages for complex programming applications, however. At present programmers often have to develop their own.

For instance, he said, Tandy recently had a programmer develop a COBOL for the TRS-80 for Tandy’s private use. Juge said it definitely would not be marketed.

What is needed for general consumption in a market leaning more and more to the non-technical user, is not a more powerful language, but a simpler one.

“’As far as a simpler interface for the user is concerned,’” he said, “’a lot of people are working on that. If somebody comes up with it, I hope they will come to us first. We have four or five people working on it.’”

One important consideration of any new programming language is compatibility with what is already in the field.

Tandy finds making changes in hardware, for example, increasingly complex because of the compatibility problem.

When the Model III was designed, Juge said, “We gave up things like an 80 by 24 screen... to maintain compatibility with the Model I.” As a result however, 80 percent of the programs for the Model I will run on the Model III without any changes, and most of the rest need only a minor adjustment, he said.

“Yet we’ve gotten just gobs of mail from people who are upset,” Juge said.

**New Model I DOS**

While he would give no details on it, Juge said, “A new Model I DOS is a distinct possibility.”

However, he said, “If we come out with one we want to be sure it is compatible with what everyone is using.”

According to Juge, if it isn’t literally compatible with every single program, Radio Shack will junk it, even if they have invested a great deal of money in it.

Once a program like a new DOS is written, the problem becomes protecting that investment from copying.

Juge said Tandy is considering copy protection devices and legal action to protect what they regard as their property.

Tandy put a simple device on its Model III programs to prevent copying, but they can be easily circumvented. Tandy promises a more effective system soon.

The new changes in the copyright laws which make it possible to copyright programs have not been tested in court, and, Juge said, until they are no one knows how effective they will be.

However, he said, at least in the case of TRS-80 Tandy is ready to go as far as necessary to protect its property.

TRS-80 is of particular concern because Tandy apparently suspects some independent software houses are putting it on disks with non-Radio Shack programs and without permission.

“We have objected to others using TRS-DOS,” he said. “We will take whatever legal means we have to protect it.”

He did not comment, however, on whether Tandy is actively preparing to sue over TRS-80. Juge labeled all of the TRS-80s basically business machines. Their penetration into the home market has been a sideline.

“We never built a home computer until the Color Computer,” he said.

Actually, when Tandy entered the microcomputer market they did not know which sector of the market they would concentrate on.

“We didn’t design the Model I as a business computer,” Juge said. “We didn’t know what we were building. We decided, ‘That’s dandy, let’s build 3,500 of them and see if they sell.’”

If they didn’t he said, Radio Shack would have put them in their own stores to use for inventory control.

In any event, when Tandy brought out the Model I for the first time at a convention, they all sold in a day. It was after that that Tandy began trying to find out who was using them.

“We have analyzed our user base pretty carefully,” Juge said. “We never had the real sweatshirt, tennis shoe computer hobbyist, because he wants to play with the hardware, and we don’t have any hardware that’s really accessible.”

About the threat of Japanese microcomputer competition, Juge is unconcerned.

“The Japanese companies that are making the most noise at present aren’t the ones who have the distribution capabilities in the U.S.,” he said. He referred to such companies as Sony or Panasonic as true competitors, if and when they enter the market.

Without distribution, he said, companies won’t be able to get their products, however good, to the consumer. He did not comment directly into which category Sharp Electronics fell. Sharp, makers of the Pocket Computer, introduced its first microcomputer at the National Computer Convention in Chicago last month.

by Bert Latimore
80 Staff

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**Color Computer Programs Promised**

Color Computer owners, take heart. The software is coming.

Nineteen new programs for all areas of home use are being developed by Tandy Radio Shack, Fort Worth, TX, according to Bill Walters, consumer information manager.

Ed Juge, Tandy’s director of computer merchandising, said most of them will be brought out in the form of ROM (Read Only Memory) packs rather than on tape.

Walters said the programs will cover everything from keeping your personal accounts to games.

Tandy’s policy is to produce only home use programs for the Color Computer, which they regard as strictly a home machine, Juge said.

The programs are in various stages of development, they said, and would be released individually as they are ready.

They declined to give details of any specific programs because some may not be released if certain bugs in them cannot be eliminated.
Most people just sell disks.
I sell you a complete system, and then
I help you make it work.

It's called support, and it's a rare commodity
in the microcomputer world.
It's also one big reason why they call my programs
"the standard of the industry."
I'm Irwin Taranto, the one who changed the
TRS-80 into a serious business computer. When you
buy my TRS-80 systems (or, for that matter, one of
my own computers that says "Taranto" on it), you
buy me.
You buy my experience in making TRS-80 systems
work in thousands of businesses around the world.
You buy the corrections, modifications and
upgrades I constantly make on my TRS-80 systems.
And you buy my telephone number. You see, most
of those thousand businesses needed a little help
getting their systems up and going, and they called.
We answered all their questions, and talked them
through their problems. Every time the questions
got really tough or really unusual, I'd answer them
myself, on the phone, right then and there. I still do.
That pays off in two ways. It makes sure you get
your systems working. It also alerts me to any little
operating inefficiencies I might have designed into
my systems. If there are any general business pro-
grams anywhere in the world, of any kind, that are
checked out any better than my TRS-80 systems,
I'd like to know about them.

The Model I, II and III business systems.
So far, I have six systems for the Model I,
at $99 each:
Accounts Payable  General Ledger
Accounts Receivable  Payroll
Invoicing  Inventory Control
For the Cash Journal option on the General Ledger, add $50.
I also have six systems for the Model II:
General Ledger/Cash Journal $ 299
Accounts Payable/Purchase Order 349
Open Accounts Receivable/Invoicing 349
Additional for Sales Analysis 100
Balance Forward Accounts Receivable 399
Payroll, without Job Costing 299
Additional for Job Costing 100
Inventory Control 399
For the Model III, we offer expanded versions
of the six Model I systems, at $199 each.
Just call the number below and I'll send you any
or all of the Model I or Model III systems by return
mail. If you call about the Model II, I send you
a questionnaire before I'll send you any systems.
That lets me individualize the programs to your
specific applications.

Why I call them “systems,” not “programs.”
There's a one-word answer: interaction. Each
of the three sets of programs links to the General
Ledger, and wherever it's useful, they cross-link
to each other. For instance, "Sales Analysis" figures
in a salesman's commission rate, so it links to
"Payroll." Since it computes profitability within
product categories, it links to "Invoicing."
That's what a system is. And that's one big
difference between the Taranto TRS-80 business
systems and somebody else's collection of business
program disks.

If you like, I'll sell you the hardware, too.
I offer the TRS-80, Model II, along with selected
peripherals. If you buy the computer from me,
you get some extra advantages—hardware that's
absolutely tailored to the programs, plus even
more hand-holding from Taranto & Associates.
The equipment won't cost you any more.
I can sell you a truly serious, completely supported,
though proven business computer system for
as little as $8000, hardware and software both.
There's nothing else like it in the market. Believe
me, it's a far cry from that collection of program
disks they're selling down the street.

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Authorized dealers throughout America.

The Total System Store

* A trademark of the Tandy Corporation
**NEW PRODUCTS**

**Percom Sells Computer Desks**

Percom Data Co. is selling custom designed, low cost computer furniture including a system desk with modular add-in and add-on components and a style-compatible printer stand.

The furniture, in TRS-80 compatible colors of pumice with black trim, is available from Percom Data Co., 211 N. Kirby, Garland, TX 75042.

Reader Service ▶ 336

**Game Features Complex Maze**

"Asmodeus" is a maze game for the TRS-80 Level II with 16K memory which features a world of 30 levels and more than 250 rooms which you explore in real time. You seek more than 500 treasures and deal with more than 500 monsters including Asmodeus, the ruler of evil.

The battle system includes six command options for attack or defense. It costs $39.95 from Serpent Software, 19 French Cres., Regina, Sask., S4T 6N3.

Readers Service ▶ 345

**Three Challenges From Epyx**

"The Datestones of Ryn", "Morloc's Tower" and "Rescue at Rigel" are available in an introductory three-pack of games from Epyx by Automated Simulations, Inc.

In "The Datestones of Ryn" the player has 20 minutes to find the Datestones and defeat the monsters of an underground maze where they have been hidden using 14 command options from firing an arrow to searching for secret doors.

In "Morloc's Tower" the player must catch Morloc in his maze before the wizard destroys the city.

In "Rescue at Rigel" the player has 60 minutes to find the 10 humans held captive somewhere inside an alien moonbase while dealing with monsters and armed robots and aliens.

The games are compatible with the 32K TRS-80. The kit costs $49.95 from Automated Simulations Inc., PO Box 4247 Mountain View, CA 94040.

Readers Service ▶ 338

**Power Pollution Controlled**

The Super Isolator includes a heavy duty spike/surge suppressor and three individually dual-PI filtered AC sockets to control electronic pollution for microprocessors.

The Super Isolator will control pollution for an 1,875 watt load with each socket handling a 1,000 watt load.

It is available from Electronic Specialists, Inc., 171 S. Main St., Natick, MA 01760 for $95.

Reader Service ▶ 328

**Percom System Desk**

**New Language Out**

PLI-80 is a new all-purpose application programming language for 8080, Z80 and 8085 microprocessors.

The program has four major components: the PLI-80 compiler and run time library; the LInK-80 linkage editor; and the RMAC relocatable macro assembler. It generates industry standard Microsoft relocatable codes so users can link load subroutines created by other language translators.

The package comes with three comprehensive manuals and a programmer's quick reference guide for $500 from Westico Inc., 25 Van Zant St., Norwalk, CT 06855.

Reader Service ▶ 347

**Program Allows BASIC Editing**

The Full Screen BASIC Text Editor from Computer Applications Unlimited allows insertions, deletions, copying and moving characters of lines or blocks of lines in Level II or disk BASIC on the Model I and Model III TRS-80.

The cursor can be moved to any position on the screen which can be scrolled up or down through the program text. Also included are global search and change commands and 26 user-definable "macro" keys.

The program is available for the Model I at $24.95 and the Model III at $29.95 from Computer Applications Unlimited, PO Box 214, Rye, NY 10580.

Reader Service ▶ 349

**Disk Double Zap Available**

The DOUBLE-ZAP/II program from Software, Etc., zaps NEWDOS 2.1/+ and
NEW PRODUCTS

NEWDOS/80 for double density operation with the Percom Doubler.

for personal and small business computers creates a compact computer work area with an optimum table height with shelves above and below to hold monitors, disk drives and other hardware and reference books.

It is available for $39.95 for the NEWDOS 2.1+/ and $49.95 for NEWDOS/80 from Software, Etc., 1839 Chamberlin Dr., Carrollton, TX 75007.

Reader Service  330

Quiet Dothead Lives Longer

The Micro-Nine-A printhead for Epson America, Inc.'s, MX-80 dot matrix printer reduces noise levels for the printer to below 60 dB with the addition of a sound damper around the unit and has a life expectancy of 100 million characters.

It retails for less than $40 from Epson America, Inc., 23844 Hawthorne Blvd., Torrance, CA 90605.

Reader Service  326

Control Program Primer Offered

CP/M Primer explains the control program for microcomputer operating systems for users of all levels of experience.

The book includes the latest CP/M version 2.0, a tear-out reference card, disk allocation and extents and a list of CP/M software.

The cost is $11.95 from Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, IN 46268.

Reader Service  329

INV Controls Inventory

INV is an advanced inventory control system that keeps track of more than 2,000 items per disk on a 32K TRS-80 system.

The program is designed to produce minimum inventory investment, maximum customer service and low-cost plant operation at the same time.

INV is available from Micro Architect Inc., 96 Dothan St., Arlington, MA 02174 for $89.

Reader Service  333

Five Printers Introduced

Okidata Corporation has added a total of five new printers to its Microline and Slimline Series including a new high speed serial matrix printer, the Model 2350.

This machine prints bi-directionally at speeds to 350cps, features two-color printing and a program-controlled font selection. It does sub and superscripts, underscores and handles six standard, condensed and extra wide fonts.

The Microline 84 is the new top of the line model of Okidata's low cost Microline Series printers. It prints bi-directionally at 200 cps using a nine pin head for both text and graphics and can reproduce anything that can be displayed on a CRT screen.

The Slimline MacroGrafx responds to simple commands to print tags, tickets, forms and labels.

The Microline 82A operates bi-directionally at 120 cps using a nine pin head.

The Microline 83A is a wider printer, producing 136 columns on four-part forms to 15 inches in width at 120 cps.

Information on the printers is available from Okidata Corporation, 111 Gaithersburg Drive, Mt. Laurel, NJ 08054.

Reader Service  337

Software Drives Disks

New OASIS software eliminates the need for the user-written disk driver by supporting the Cameo disk controllers which interface with a variety of 2.5- to 10-Mbyte cartridge disk drives, including the TRS-80 Model II, Tandy II and S-100.

The package is supplied with Cameo drivers at a nominal charge, OASIS is available separately for $500 for single-user and $850 for multi-user versions from Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA 94621.

Reader Service  334

TRS-80 with Typewriter

The KGS-80 keyboard actuator interfaces a TRS-80 with an IBM Selectric or SCM typewriter without modifying the typewriter.

The KGS-80 does not need software to operate and is fully compatible with popular word processing systems.

Information is available from NIK International Trading Inc., 114 Liberty St., Suite 204, New York, NY 10006.

Reader Service  343

Speak, Computer

You may not be able to talk to the animals, but with Cheaptalk your TRS-80 will talk to you.

Cheaptalk connects to an amplifier through the cassette output plug. Spoken words are digitized and stored in memory as self-contained subroutines, each re-

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NEW PRODUCTS

Mince Edits Texts

Mince is a new video text editor for the TRS-80 Model II and other microcomputers based on the "Emacs" editor available on large minicomputer systems.

Mince allows you to move texts between files and manipulate it by word, sentence or paragraph as well as character, line and entire screen. It is compatible with 8080/8280 micros, 16-bit micros and minicomputers allowing the user to upgrade his hardware while keeping the same text editor.

Mince is available for $125 for both software and documentation from Westico, Inc., 25 Van Zant St., Norwalk, CT 06855.

Reader Service 332

Pamphlet Outlines Disk Care

Mr. Floppy teaches operators and users of floppy disks how to properly store and handle them in "Care and Feeding of Floppy Disks."

The updated version of the pamphlet is available from Advance Access Group Inc., 2200 S. Main St., Lombard, IL 60148.

Reader Service 185

Program Tracks Grades

CLASSFILE is a classroom record keeping program for the 16K TRS-80 Model I or III that keeps track of up to 25 grades for up to 35 students.

It will: List all students in a class and their grades, list all students whose grades fall below a set cut-off point, list all students and their averages in rank order to the class average; and allow elimination of particular students from the class average. It also allows elimination of all grades to start a new term without retyping the names, and its companion, the CLASS ROSTER GENERATOR PROGRAM, formats the student list and prints a grading roster.

The program package is available for $19.95 from Teach Yourself By Computer Software, 40 Stuyvesant Manor, Geneseo, NY 14454.

Reader Service 342

Commercial Bulletin Board Uses Host TRS-80 Microcomputer

UEMS is a commercial oriented bulletin board system developed by Harry Lee which uses a host TRS-80 computer and allows billing users for their time on system and monitored access to individual pieces of mail.

The program stores messages of up to 2K bytes and maintains only pointer tables in memory, leaving more space for messages.

It costs $150 for three diskettes one containing the program and two containing data, and the user documentation. For an additional $150 you can obtain the commented source code and technical manuals from Small Business Systems Group Inc., 6 Carlisle Road, Westford, MA 01886.

Reader Service 183

Interface Cable Assemblies Introduced

Belden Corporation's new line of shielded interface cable assemblies comply with EIA Standard RS-232C and feature a 25-conductor cable in lengths from 5 to 70 feet and male or female subminiature D connectors mounted within a special molded handle.

The cable is designed to reduce bit error rate and maximize system performance and protect nearby equipment from signal radiation.

They are available from Belden Corp., Interconnect Systems Operation, 105 Wolfpack Rd., Gastonia, NC 28052.

Reader Service 184

Shielded RS-232C Interface Cable Assemblies

Care and Feeding of Floppy Disks

Inotec's Business Software Kit gives several pages of data on a variety of business software packages to help businessmen select the programs they need.

It is available from Inotec, Inc., PO Box 1587, Clemson, SC, 29631 for $39.95.

Reader Service 327

Kit Details Software
TOTAL DISKETTE BACKUP

DO NOT TAKE UNNECESSARY RISKS WITH YOUR SOFTWARE.

If your diskette software library is not completely backed up, mail the order below immediately! Or, if you are wasting diskettes by making backup copies of all your diskettes, your problem is solved! Using DUMPCRAT, these diskettes can be safely dumped to tape. The hi-speed tape option allows six 35 or 40 track diskettes to fit on one C60 cassette. This machine language utility will pay for itself the first time one of your valuable programs will not load.

- TRS-80 Model I 16K - 48K
- TRS80 or NEWDOS80 Compatible
- May be used to back-up TRS80, VTOS 4.0, NEWDOS, MICRODISK, or data disks. (Single Density)
- Tape verification routine included.
- Single drive owners are no longer required to keep switching diskettes to create a backup.
- Backup without having to remember Master passwords.

YES! RUSH ME MY COPY OF DUMPCRAT IMMEDIATELY

-- $15.95 ON MY CAREFULLY PACKED TRS80 OR NEWDOS80

-- $16.95 ON Cassette $19.95 on Diskette

Name:
Address:
City: _______ State: _______ Zip: _______

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NEWBURGH, INDIANA 47630

GREEN LOOKS GOOD
BUT AT THIS PRICE,
GREEN LOOKS GREAT!

These high quality "CRYSTAL GREEN" filters are specially made for the TRS-80 model1 video CRT. This unique design uses NO TAPE or GLUE! So it only takes SECONDS TO INSTALL.

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NEW PRODUCTS

Primer Teaches Pascal

Sams' Pascal Primer teaches hobbyists, novices and computerists the basics of Pascal in enough detail to allow the reader to write powerful Pascal programs. Written by David Fox and Mitchell Waite it is available for $16.95 from Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, IN 46268.
Reader Service » 329

Primer in Second Edition

Sams' Books has released a second edition of its Microcomputer Primer to reflect the latest developments in microcomputer technology in the business and personal areas.
Authors Mitchell Waite and Michael Pardee introduce the microcomputer to the reader and cover the central processing unit, memories, I/O interfacing, programming, operating systems and numbering systems.
The Microcomputer Primer costs $11.95 from Howard W. Sams & Co., Inc., 4300 W. 62 St., Indianapolis, IN 46268.
Reader Service » 329

Financial Planning Program Announced

MINIMODEL is a financial planning program for the TRS-80 Model II with CP/M-like operating system.
It handles cash flow projections, financial forecasting, venture analysis, long range planning, project planning, risk analysis, and other financial tasks.
It costs $495 from Westico, Inc., 25 Van Zant St. Norwalk, CT 06855. Documentation alone costs $50.
Reader Service » 348

DOS Plus System Designed for Model III

DOS Plus is now usable on the Model III TRS-80 microcomputer. A double-density system, it is the first to be offered by a company outside of Radio Shack.
The disk operating system, which also works on the Model I, will run single or double-density on either machine.
It is available for $99 from Micro-Systems Software Inc., 5846 Funston St., Hollywood, FL 33023
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They are made of special formulation tape from industry leader Agfa-Gevaert of Germany encased in a five-screw construction shell of high impact styrene designed to maintain close tolerances for optimum tape to head alignment and control.
They are available from Micro-80 Inc., E-2685 North Busby Road, Oak Harbor, WA 98277.
Reader Service » 350

Condominium Books Programmed

The Condominium Association Management (CAM) program is a general ledger accounting system for the TRS-80 Model II with a CP/M operating system, 16 K of memory, dual diskette drives, an 80 column by 24 line video terminal and an 80 column printer.
It will keep a running trial balance, balance sheet, profit and loss statement, budgeting statement, 12 month fee receipts history (by unit, name, address and telephone number), monthly fees, security deposits and additional fields that are user defined.
The checkwriter automatically prints vendor names and addresses on checks, allocates cash disbursements in up to nine different expense accounts and notifies the user when cash disbursements are greater than cash available. A customized accounts chart is also included.
A demonstration diskette with system manual is available for $35, which can later be applied to the full system price of $650, from A-T Enterprises, 221 N. Lois, La Habra, CA 90631.
Reader Service » 344

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The Genisco C series dual function common mode filters eliminate both line-to-line and line-to-ground noise emissions to meet a wide range of international EMI specifications.
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By John Allen from Acorn
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Steal the ball, duck around your opponent and slam toward the basket for a layup! The graphics are based on a 3-dimensional depiction of a basketball court, and ball dribbling sounds add to the realism. It's all there but the cheers in this fast, machine language game.

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Advanced Graphics Techniques—Part III

Bob Boothe
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Part 2 of this series demonstrated how to create high resolution graphics with a dot matrix printer. Many readers probably could not use the programs because they don’t own a printer with graphics capabilities; others may have converted the program to work on the video screen using low resolution graphics.

There is a better application for line drawing routines on the video. The program presented this month will manipulate representations of three dimensional objects on the video screen. The program also contains a routine which will print a design on the printer, and a routine which will reverse graphic characters on the screen.

All the views of an object this program produces have no hidden lines: All pictures will be optical illusions in which two different sides could be facing the viewer.

Program Listing 1 is a very simple BASIC routine which will draw a design similar to one of the designs from last month. The design is reproduced in Fig. 1. The routine at line 1500 can draw a line between any two points unless they form a vertical line. If you decide to use this BASIC routine instead of the machine language routine, the program can be easily modified to draw vertical lines.

The BASIC routine in Program Listing 1 took 36 seconds to draw Fig. 1 on the video screen. Dividing this time by 16, for 16 lines, I find it takes 2.25 seconds per line. Pretty fast right? Wrong. Now try the machine language BASIC combination. The same design using Program Listings 2 and 3 takes 2.4 seconds. Taking out line 1660 and running the program, I found that the BASIC portion of the program takes 1.9 seconds.

The machine language portion took only a half a second for the entire design, or 0.031 seconds per line. That, my friends, is high-speed graphics.

**Machine Language**

This month, I will use four machine language routines, using four disk commands. First is the Line routine which draws a line between two points on the video screen. Next is the Save routine which produces hard copy on a Base 2 printer. The Field routine clears the screen with graphic blanks (128's) instead of normal blanks (32's). Finally, the Reset routine will reverse all the graphics on the screen. As a matter of fact, the Reset routine doesn’t care what is on the screen: If the screen doesn’t contain graphics, the program will produce a nice mess suitable for use as a secret code.

The Line routine is similar to last months program. The first section of the program automatically enables the disk commands by loading the new addresses directly into reserved RAM. In lines 220-270 two bytes are reserved for each variable. (Only two bytes are reserved because the largest number which can be used is 127, which fits comfortably into one byte with a bit to spare).

After the registers are saved in line 260,
lines 290–370 compute and store the direction for the X coordinate. This process is repeated for the Y direction in lines 380–460. Lines 470–470 optimize the directions for maximum speed.

Lines 680–690 step across the line setting each block until the other end is met.

The part that differs is the Set routine. Last month, I had complete control over the organization of the individual points in each byte. This month the Set routine conforms to video memory. The easiest way to write a Set routine is not to write a routine at all, but to call the routine from ROM. However, since I have the old ROM and new computer users have the new ROM, I have written my own routine to set a point.

Whenever my routine is called, it first finds the point which needs to be set and puts it in the A and B registers. Lines 900 and 910 take care of this step. Lines 920–940 test to see if the X coordinate is odd or even. If it is odd, the E register is set to one. The E register will be used later to help determine which bit to set. Line 950 divides the X coordinate by two, because each byte is two blocks wide. This portion of the address is then put into the HL register pair.

Line 980 puts the Y coordinate into the accumulator. Lines 1000–1070 divide the Y coordinate by three and add 64 to the address in HL for each division. The remainder from the division is doubled and combined with the contents of the E register to form the bit which will be set. The bit pattern is then found in the table and combined with the display.

The Field routine is very simple. It puts a graphic blank in the first location of video memory and copies the blank through the entire block. A graphic blank is equal to 128.

This routine must be used instead of CLS because the normal clear screen routine uses blanks with a code of 32. If you want to see the problem, replace the Field command in the program with a CLS.

The Reset routine is almost as easy as the Field routine. The program takes each byte in video memory and executes an XOR 3FH. 3FH is equal to 0011 1111 in binary notation. The following is a demonstration of how this statement would affect a graphic block with a code of 93H:

\[
\begin{align*}
93H & = 0100 0011 \\
3FH & = 0011 1111 \\
ACH & = 1010 1100
\end{align*}
\]

The XOR statement tests each pair of bits; if they are different, the result is one. If the two bits are the same, the result is zero. You can verify that 93H and ACH are opposite graphic characters by finding them on a chart (93H = 147, ACH = 172).

According to my precise measurements, the screen is 7.5 inches wide by 8.75 inches high. The screen is 128 graphic blocks wide by 48 graphic blocks high. By feeding all these numbers to my number cruncher, I found that graphic blocks are exactly 2.4 times higher than they are wide. In simpler terms, they are pretty skinny. The problem is to make a block on the printer that is the same shape as one on the screen.

The Base 2 printer can print in six different character densities: 64, 72, 80, 96, 120 and 132 characters per eight inch line. My first intention was to make the blocks three by four dots, as they are on the screen. The printer prints 72 dots per inch vertically, and the block will be four dots. This means that the blocks should be .0556 inches long by .0232 inches wide. If the blocks are three dots wide, the 132 characters per line mode makes each block .030 inches wide. This is too wide, but it is as close as possible.

When I wrote the program accordingly, I discovered a problem: The printer can't handle high density graphics. Many of the lines would fade and even disappear. The manual

---

**Program Listing 1**

```plaintext
5 REM PROGRAM NO. 1 DEMONSTRATION OF ALL BASIC ROUTINES
10 CLS
20 FOR X=1 TO 27 STEP 8
30 X1=Q1+1
40 X2=B+Y4+1
50 NEXT
60 GOSUB 1500
70 GOTO 999
999 OUT 999
1500 REM BASIC LINE ROUTINE FOR VIDEO
1510 FOR A=X1 TO X2 STEP (X2-X1)/(X2-X1)+(Y2-Y1)
1520 NEXT
1530 RETURN
```

---

**Program Listing 2**

```plaintext
10 REM PROGRAM NO. 2 CALLING ROUTINE FOR MACHINE LANGUAGE
20 REM
30 PI=3.1416
40 OUT 11000
1500 REM LINE ROUTINE
1510 IF X1 < 0 OR X1 > 121 THEN PRINT"X1 ILLEGAL";END
1520 IF X2 < 0 OR X2 > 127 THEN PRINT"X2 ILLEGAL";END
1530 IF Y1 < 0 OR Y1 > 47 THEN PRINT"Y1 ILLEGAL";END
1540 IF Y2 < 0 OR Y2 > 47 THEN PRINT"Y2 ILLEGAL";END
1550 IF INT(X1)+INT(X2) AND INT(Y1)+INT(Y2) THEN SET(X1,Y1);RETURN
1560 POKE 1233,X1
1570 POKE 1233,Y1
1580 POKE 1233,X1
1590 POKE 1233,Y1
1600 POKE 1233,X2
1610 POKE 1233,Y2
1620 POKE 1233,X1
1630 POKE 1233,Y2
1640 LINE
1650 RETURN
```

---

*Fig. 1. This pattern can be created with Program 1 or 3.*
The routine starts as all the other routines, by exchanging the registers. Lines 1520–1610 select 64 CPL and set the vertical spacing at seven dots per line. Line 1620 sets the HL register pair to the start of video memory, and line 1630 initializes the loop for 16 lines of printing.

The output loop is more difficult because each byte covers parts of three different printed lines. My printing section has three subsections called TOPLIN, MIDLIN and BOTLIN which print the top, middle and bottom lines respectively.

Each subsection first calls TRSMIT, which outputs the control sequence to transmit graphics and some leading blanks, and then calls Delay, which gives a delay of a few seconds.

The TOPLIN routine in line 1690 tests bit 0, which is the top left bit, and then calls Spot. Spot prints either a blank or a graphic block. Bit 1 is tested next; it is the top right bit. The spot routine is called again, and this process is repeated for all 64 bytes on the line. Finally, Blanks is called, which fills the remainder of the line with blanks and outputs a carriage return to cause a line feed.

After the top line is finished, HL is set back to the start of the line, and the entire procedure is repeated for bits two and three. BOTLIN repeats this one more time for bits four and five. After BOTLIN is finished, the outside loop counter is decremented, and the loop is continued until all 16 lines from the video have been printed.

Each line in the 64 CPL mode requires 384 bytes of graphical data. The display needs only 256 bytes, and 128 blanks have to be sent. I decided to send 64 before the data and 64 after it, which centers the printout on the paper. The TRSMIT routine outputs the control sequence to inform the printer to accept graphical data, and it sends the first 64 blanks. The Blanks routine outputs the other 64 blanks and sends a carriage return. The Blanks routine uses 128 as a blank instead of zero because the printer does not recognize zeros.

PRTOUT is a routine from the T-BUG manual. The Spot routine outputs either a solid block if the Z flag is not set, or a blank if the Z flag is set. The Delay routine can be modified to waste more time by changing the number of loops in line 2340. If you want to create hard copy with a printer other than the Base 2, you may need to make some modifications to the routine. If you do change the program, be sure the last address does not exceed 7FFFH.

Memory Size 32330

Create and load the machine language portion of the program first. Do not forget to set memory size to 32330.

Listing 2 is the routine which calls the machine language Line program. To use this program, you should write your BASIC program between lines 30 and 1000. Listing 3 is a very simple example of the kind of routine which can be used with this program. It draws the same shape as Listing 1. Any of the programs from last month's article can also be used if they are modified to fit on a 128 x 48 dot screen. To write your own design program, you should compute the endpoints of each line using the variables X1, Y1, X2 and Y2. After the values are assigned, a GOSUB 1500 will draw the line.

Listing 2 checks the values of the points to see if they are in the range, and if the two points are the same. If the points are out of range, an error message is displayed. If the points are the same, one point is set, and the program is continued. If everything is satisfactory, the points are POKEd into the

---

Fig. 2. This shows the direction of each axis, and the direction of rotation about each axis.

Fig. 3. This is a view of a tissue box on its side.

Fig. 4. This is a view looking down the box from the end.

Fig. 5. This is the economy size pack, stretched three times in the Z direction.
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- COSMIC FIGHTER MODEL 1 OR 2

COMPUTER SIMULATIONS COMPANY
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- DARK KINGDOM
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- ASTERIDS
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- BALL TURNT GUNNER
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- CHECKMAT [D]
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- COSMIC PATROL [D]
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- MONEY MANN
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- OTHO
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- TLIS
- UTILTY [D]
- UTILITY [D]
- WARRIORS DELIGHT
- WORDSLINGER

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- TOS/Astro MONOPOLY [D]
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QUALITY SOFTWARE
- DEBUG
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Amount of order

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I have a [ ] k memory

with [ ] Card No. [ ] Expires

Personal Checks please allow 3 weeks.

Signature

name of Computer

Mail to:
Program Listing 3

```
01108 ;LINE DRAWING ROUTINE FOR 16K LEVEL II ON VIDEO
01118 ;SCREEN PRINT ROUTINE IS FOR 8-BIT PRINTER
01128 ;ROB ROBBINS 8-12-88

41A3 C367E ORG 16804-1
41A3 C3567E ORG 16801-1
41A4 C337F ORG 16765-1
41C7 C317F ORG 16760-1
419A C327F ORG 16759-1
419A C327F ORG 16753-1
419C 0298 ORG 16280-1
419C 0298 ORG 16280-1
7E44 0000 0228 STARTX DEFW 0
7E46 0000 0228 STARTY DEFW 0
7E48 0000 0228 ENDBX DEFW 0
7E58 0000 0259 ENDBX DEFW 0
7E52 0000 0268 ENDIRY DEFW 0
7E54 0000 0278 ENDIRY DEFW 0
7E56 D9 0280 LINE EXX HL,(ENDBX)
7E5C 0284 0267 LD DE,(STARTY)
7E5E 06 0030 LD H,
7E60 06 0030 LD H,
7E62 1A 0030 LD A,
7E64 B7 0040 OR A
7E65 B2 0060 SBC HL,DE
7E67 2257E 0030 LD (DIRY),HL
7E6D 0076 0030 LD (ENDY),HL
7E76 0540 0040 LD DE,(STARTY)
7E7C 6C 0040 LD I,
7E7E 2690 0040 LD I,
7E82 5A 0020 LD E,
7E84 1680 0030 LD D,
7E86 87 0040 OR A
7E87 ED5C47E 0040 LD A,
7E90 0500 AND B
7E97 6800 0050 AND B
7E98 6800 0050 AND B
7E9B 4F 0050 LD C,
7ECC CB25 0050 SHIFT RLA L
7E80 CB25 0050 SLA E
7E90 7D 0050 LD A,
7E91 8D 0050 AND B
7E93 8D 0050 AND B
7E9B 4F 0050 LD C,
7EDC CB25 0050 SHIFT RLA L
7EDC CB25 0050 SLA E
7F00 7D 0050 LD A,
7F01 8D 0050 AND B
7F03 8D 0050 AND B
7F0B 4F 0050 LD C,
7F05 8D 0050 AND B
7F06 8D 0050 AND B
7F0B 4F 0050 LD C,
7F05 8D 0050 AND B
7F06 8D 0050 AND B
7F0B 4F 0050 LD C,
7F05 8D 0050 AND B
7F06 8D 0050 AND B
7F0B 4F 0050 LD C,
7F05 8D 0050 AND B
7F06 8D 0050 AND B
7F0B 4F 0050 LD C,
7F05 8D 0050 AND B
7F06 8D 0050 AND B
7F0B 4F 0050 LD C,
7F05 8D 0050 AND B
7F06 8D 0050 AND B
```

Program continues...
Data Acquisition and Control for the TRS-80*

Eight protected analog inputs 0.5 Vdc 8 ± 1 bit accuracy
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A text editing program that uses the keyboard "as is" like a typewriter. All edit and prompt functions are "built in" so instruction or learning is minimum. Text can be generated three pages at a time and printed either numbered, or unnumbered single or double spaced. Also, right justification is optional. Does not require substitution of & for commas or any other character revision. Slowest function is transferring text to and from tape. Neat error free text with large print titles. Excellent for specifications, agreements, instructions, form letters or announcements. Complete with sound for TRS-80 Model I Level II and Microtek printer easily adaptable to other printers. PRICE ... $25.00

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Allows keeping several contracts for up to 20 clients. Enter contracts including either payment amounts or percentages. As bills are sent out and payments received, the program is a record by contract of amounts outstanding and not billed including a summary of receivables and work in progress. Works well with one to 3 projects for a dozen or so clients. PRICE ... $25.00

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All programs require Level II and 16K. Printer is required for MICRO-TYPIT and optional on all others. Don't forget to include the Model number (I or III) with your order.

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80 Microcomputing, June 1981 • 73
“Most readers will notice that the bolt has a hexagonal shaft rather than a round one; well, let’s see you try to draw a circle with straight lines.”
Your best Model III peripheral buy is a modem.

OK, you’ve familiarized yourself with your new TRS-80 Model III, and you’re ready to expand.

You’ve got plenty of peripherals to choose from.

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It includes performance features—like auto dial/answer, programmable I/O porting, variable word length, parity and stop bits—that are either optional at extra cost or unavailable with other modems. It requires no tools to install.

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"I decided I would need to add a time delay to let the printer cool off between lines. The original screen print time was about two and a half minutes long. My first time delay extended the total time to five minutes."

```
76A CDDFF7 01780 CALL SPOT 1,(HL) ;TEST OTHER BLOCK
76F7 CDDFF7 01720 CALL SPOT ;MOVE ALONG
772 23 01730 INC HL ;FINISH THE TOP LINE
775 B7 01750 OR A ;RESET CARRY FLAG
776 ED52 01760 SBC HL,DE ;PUT HL BACK TO START
778 CB3F7 01770 CALL BLANKS ;FILL OUT LINE
77B CDD37F 01780 CALL TRSMIT ;REPEAT FOR OTHER BITS
77F6 CDE7F 01790 CALL DELAY ;SO PRINTER CAN COOL OFF
781 B640 01800 LD B,64
783 CB36 01810 MIDLIN BIT 2,(HL)
785 CDDFF7 01820 CALL SPOT
788 CB36 01830 BIT 3,(HL)
78A CDDFF7 01840 CALL SPOT
79D 23 01850 INC HL
79C 1F3 01860 DJNE MIDLIN
79E B7 01870 OR A
79F ED52 01880 SBC HL,DE
7A2 CB67 01890 CALL BLANKS
7A6 CDD37F 01900 CALL TRSMIT
7AA CDE7F 01910 CALL DELAY
7AB C640 01920 LD B,64
7AE CB66 01930 BOTLIN BIT 4,(HL)
7AF CDDFF7 01940 CALL SPOT
7A3 CB66 01950 BIT 5,(HL)
7A5 CDDFF7 01960 CALL SPOT
7A8 23 01970 INC HL
7A9 1F3 01980 DJNE BOTLIN
7AB CDC17F 01990 CALL BLANKS
7AD 1EAB 02010 DJNZ LOOP
7BF 1D9 02020 ENK ;GET LINE COUNTER
7BD CB56 02030 POP BC ;FINISH LINES
7BF 1E6B 02040 RET
782 CB3 02050 RPT LD A,27 ;ESCAPE
78B CDD47F 02060 CALL PRTOUT
78B C640 02070 LD A,99 ;TRANSMIT GRAPHICAL DATA
78A CDD47F 02080 CALL PRTOUT
788 CDC47F 02090 CALL BLANK
78D CDC47F 020A0 CALL BLANK
791 CDC47F 020B0 CALL BLANK
794 388D 020C0 LD A,13 ;CAUSES LINE FEED
79C CDC47F 020D0 CALL PRTOUT ;NUMBER OF BLANKS
799 C5 020E0 LD A,128 ;BLANK
79C CDC47F 020F0 CALL PRTOUT
7A1 1EPF 02100 DJNZ BLANK
7A3 CB3E 02110 RET
7A4 E5 02120 PRTOUT PUSH HL ;SAVE HL
7A5 21E837 02130 LD HL,37E8 ;LP POINTER
7A7 CB7E 02140 PRTLP8 BIT 7,(HL) ;BIT 7 ON MEANS BUSY
7A9 28FC 02150 JR NS,PRTLP8 ;THAT'S NOT MY LABEL
7AB 77 02160 LD (HL),A ;LP READY, SO PRINT
7AD C7 02170 POP HL ;GET BACK OLD HL
7AF CB9 02180 RET ;THAT WAS QUICK
7B9 2609 02190 SPPOT JR 1,WOSPOT ;I FLAG IS PASSED
7C1 37F7 021A0 CALL A,7PF ;ALL 7 BITS MAKE 1 BLOCK
7C3 CDD47F 021B0 CALL PRTOUT ;MAKE TWO LINE
7C6 CDD47F 021C0 CALL PRTOUT
7C9 1F3 021D0 DJNZ RET
7CA CB64 021E0 BLANK LD B,64
7CC 318E 021F0 LD A,128 ;NUMBER OF BLANKS
7CD CDD47F 02200 CALL PRTOUT
7D0 1E6B 02210 DJNZ BLANK
7D2 CB3 02220 RET
7D3 CB3E 02230 NOSPOT LD A,128 ;BLANK
7D6 CB3E 02240 JR TWOLN
7D8 1E65 02250 CALL DELAY LD B,2 ;NUMBER OF TIME LOOPS
7DC 02260 C5 02250 OUTLPY PUSH BC ;SAVE OUTSIDE COUNTER
7E0 00000 02270 C660 LD BC,0 ;DO 65536 LOOPS
7E4 CB4C 02280 TICTOC DEC BC
7E5 78 02290 LD A,B
7E6 B1 022A0 OR C
7EF 28F8 022B0 JR NS,TICTOC
7F1 CB4C 022C0 POP BC
7F5 CB4D 022D0 DJNZ OUTLPY
7FCC C9 022E0 RET ;ADDRESS SHOULD BE 7FFH OR LESS
8000 TOTAL ERRORS

8000 TOTAL ERRORS
```

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Transfers your TRS-80 Software
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- Machine language COM FILE
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80 Microcomputing, June 1981
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included data for a tissue box, a bolt and a hat.

The program will read data from the end of the program and then present a menu. The menu has five functions. The first three rotate the object. Fig. 2 shows the direction of each axis and the direction of rotation.
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“The manual said that the printer was getting too hot. I said, ‘How can it get too hot on the first line?’ The darn manual didn’t even reply.”

Fig. 9. This is a front view of the 80 Microcomputing hat.

Data Set 3: Hat with visor

```
3010 DATA 0.100.10.0.0.0
3020 DATA 0.100.10.0.0.0
3030 DATA 0.100.10.0.0.0
3040 DATA 0.100.10.0.0.0
3050 DATA 0.100.10.0.0.0
3060 DATA 0.100.10.0.0.0
3070 DATA 0.100.10.0.0.0
3080 DATA 0.100.10.0.0.0
3090 DATA 0.100.10.0.0.0
3100 DATA 0.100.10.0.0.0
3110 DATA 0.100.10.0.0.0
3120 DATA 0.100.10.0.0.0
3130 DATA 0.100.10.0.0.0
3140 DATA 0.100.10.0.0.0
3150 DATA 0.100.10.0.0.0
3160 DATA 0.100.10.0.0.0
3170 DATA 0.100.10.0.0.0
3180 DATA 0.100.10.0.0.0
3190 DATA 0.100.10.0.0.0
3200 DATA 0.100.10.0.0.0
3210 DATA 0.100.10.0.0.0
3220 DATA 0.100.10.0.0.0
3230 DATA 0.100.10.0.0.0
3240 DATA 0.100.10.0.0.0
3250 DATA 0.100.10.0.0.0
3260 DATA 0.100.10.0.0.0
3270 DATA 0.100.10.0.0.0
3280 DATA 0.100.10.0.0.0
3290 DATA 0.100.10.0.0.0
3300 DATA 0.100.10.0.0.0
3305 DATA 0.100.10.0.0.0
3310 DATA 0.100.10.0.0.0
3315 DATA 0.100.10.0.0.0
3320 DATA 0.100.10.0.0.0
3325 DATA 0.100.10.0.0.0
3330 DATA 0.100.10.0.0.0
3335 DATA 0.100.10.0.0.0
3340 DATA 0.100.10.0.0.0
3345 DATA 0.100.10.0.0.0
3350 DATA 0.100.10.0.0.0
3355 DATA 0.100.10.0.0.0
3360 DATA 0.100.10.0.0.0
3365 DATA 0.100.10.0.0.0
3370 DATA 0.100.10.0.0.0
3375 DATA 0.100.10.0.0.0
3380 DATA 0.100.10.0.0.0
3385 DATA 0.100.10.0.0.0
3390 DATA 0.100.10.0.0.0
3395 DATA 0.100.10.0.0.0
```

:REM NEXT 4 LINE ARE THE VISOR

:REM REST OF THE DATA IS THE LABEL

80 Microcomputing, June 1981 • 79
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80 • 80 Microcomputing, June 1981

expand the image to fill the screen. Line 690
finds the center of the image.

Lines 700-740 draw the object. The coor-
dinates of the object are multiplied by scal-
ing factors which compensate for the
shape of the graphic blocks. For this
reason, no matter how an object is rotated,
every angle will remain correct.

Lines 750-790 scan the keyboard for an
M, R or S. If you do not have a printer cap-
able of printing graphical data, you can elim-
nate line 780. The reverse video routine was
included in case somebody wanted to view the
object on a white background.

The routine between lines 1500 and 1680
is the line drawing program.

Data set number one is for a simple tis-
see box. The data in each line is in the order
X1, Y1, Z1, X2, Y2, Z2. Line number 3999
must be included at the end of the data. Fig.
5 was created by stretching the tissue box

Fig. 10. This is a view from a 45 degree angle
above the hat.

Program Listing 4

```
15 DEFINT Q,B
20 CLS
30 PRINT"READING DATA"
40 PI=3.1415926
50 DIM X(1800,2),Y(1800,2),Z(1800,2)
60 N=1
70 READ X(N,1),Y(N,1),Z(N,1),X(N,2),Y(N,2),Z(N,2)
80 IF X(N,1) <> 1800 THEN N=N+1:GOTO 70
90 N=1
100 PRINT;"DATA LINES WERE READ"
110 PRINT"1" = ROTATE AROUND X AXIS"
120 PRINT"2" = ROTATE AROUND Y AXIS"
130 PRINT"3" = ROTATE AROUND Z AXIS"
140 PRINT"4" = STRETCH OR SHRINK"
150 PRINT"5" = DISPLAY"
160 INPUT"ENTER FUNCTION NUMBER";F
170 IF F=0 OR F=2 THEN 300
180 ON FCOD198,198,198,589,600
190 ON FCOD126
200 ON FCOD126
210 ON FCOD126
220 ON FCOD126
230 T=ATN(X(Q,B),Y(Q,B)/X(Q,B))=0 OR Y(Q,B)=0 OR 2*(Q,B)
240 IFY(Q,B)ETTHEN'=PI
250 R=SQR(X(Q,B)2*Y(Q,B)2+Y(Q,B)2)Y(Q,B)
260 Y(Q,B)=COS(T)*R
270 Z(Q,B)=SIN(T)*R
280 NEXTNEX
290 GOTO 110
300 FOR=C01+FORB=19702
310 T=ATN(X(Q,B),Y(Q,B))/X(Q,B)2*PI/100
320 IFX(Q,B)<0 THEN T=T+PI
330 R=SQR(X(Q,B)2*Y(Q,B)2+X(Q,B)2)
340 X(Q,B)=COS(T)*R
350 Z(Q,B)=SIN(T)*R
360 NEXTNEX
370 GOTO 110
380 FOR=C01+FORB=19702
390 T=ATN(X(Q,B),Y(Q,B))/X(Q,B)2*PI/100
400 IFX(Q,B)=COS(T)*PI
410 IFX(Q,B)=COS(T)*PI
420 X(Q,B)=COS(T)*R
430 Y(Q,B)=SIN(T)*R
440 NEXTNEX
```

Program continues
This is the most powerful and comprehensive forecasting system available for any microcomputer.

- **COMPREHENSIVE**
  This package can fully analyze all your important data. Whether you want to find the trend line for your sales and plot the results or build a simultaneous equation forecasting model, this system will do the job. This is a product you will grow into, not out of. The package contains several forecasting methods to fit your precise needs, and includes:
  - Advanced Multiple Regression with Auto Correlation correction
  - 10 Data Transformation options
  - Disc Data Management System
  - Adaptive Filtering option…And much more

While these are sophisticated techniques, this package has been designed to be easily used by the non-technical businessman. Small businesses through large corporations have reaped the benefits of AEA's Business Planning & Forecasting Package (BPFP).

- **VERSATILE**
  With the "BPFP", you can create a data series, store it on a disk, and analyze the data by using the various system modules. The results of the analysis can then be listed as a table or plotted as a graph. As an option, results from the "BPFP" can be stored on disk for use as a VISICALC® File.

- **CONVENIENT**
  To use the package, just load "BPFP" and you're off. Every part of the process has a menu to simplify responses. A second disk in the package, the Econdata File, covers over 30 vital topics, including the GNP, retail sales, money supply, and mortgage rates from the 1st quarter of 1955, through the 4th quarter of 1980. Users will also receive our User Notes for the "BPFP", which contain useful analytical examples.

- **PACKAGE CONTENTS**
  A sturdy three ring binder
  Over 70 pages of instruction and documentation
  2 mini diskettes with the programs on one disk and the Econdata File on the other

- **HARDWARE REQUIREMENTS**
  TRS-80® with at least 48 K of RAM for Mod I & III, 64 K of RAM for Mod II
  One disk (two are preferred)
  TRSDOS®

To order, check software desired:
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- Box-Jenkins Forecasting
- United States Simulation Model
- Risk Analysis
- Econdata File

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(201) 852-3573

Name (print)_________________________ Title __________________________
Company ___________________________ Address __________________________
City __________________ State _______ Zip _______ Tele. No. ____________
450  GOTO110
450  INPUT"ENTER A FACTOR FOR X, Y AND Z IN THAT ORDER";
X,Y,Z
510  IF X=0 OR Y=0 OR Z=0 THEN PRINT"ZERO IS INVALID.";
RETURN
520  FOR=0:FORB=1702
530  X(Q,B)=X(Q,B)*X;Y(Q,B)=Y(Q,B)*Y;Z(Q,B)=Z(Q,B)*Z:NEXT
540  GOTO110
600  FIELD
610  HY=Y(1,1);LY=LY-HZ=Z(1,1):LZ=HZ
620  FOR=4:FORB=1702
630  IF Y(Q,B)>HY THEN HY=Y(Q,B)
640  IF Y(Q,B)<=HY THEN LY=LY+Y(Q,B)
650  IF Z(Q,B)>HZ THEN HZ=Z(Q,B)
660  IF Z(Q,B)<=HZ THEN LZ=LZ+Z(Q,B)
670  NEXT:NEXT
680  W=HY-LY+LY-HZ+HZ-LZ
690  S=(-(HY-LY)/2:SL=-((HZ-LZ)/2)
700  FOR=1:FORB=1702
710  X1=X1+3.5*(Y(Q,B)+ST)/W*2.4448:Y1=23.5-(Z(Q,B)+SZ)/W*48
720  X2=X2+3.5*(Y(Q,B)+ST)/W*2.4448:Y2=23.5-(Z(Q,B)+SZ)/W*48
730  GOSUB1500
740  NEXT
750  SIS=INKEYS:IF SIS=""THEN50:
760  IF SIS="WTHEN110
770  IF SIS="RTHENRESET:GOTO50
780  IF SIS="STHENSAVE:GOTO110
790  GOTO750
800  SIS=0:FOR=1:FORB=1702
1500  REM LINE ROUTINE
1510  IF X1 > X2 OR X1 > X2 THEN PRINT"X1 ILLEGAL":END
1520  IF X2 > X1 OR X2 > X1 THEN PRINT"X2 ILLEGAL":END
1530  IF Y1 > X1 OR Y1 > X2 THEN PRINT"Y1 ILLEGAL":END
1540  IF Y2 > Y1 OR Y2 > Y1 THEN PRINT"Y2 ILLEGAL":END
1550  IF INT(X1) = INT(X2) AND INT(Y1) = INT(Y2) THEN SET(X1
1560  RETURN
1600  POKE32331,X1
1610  POKE32333,Y1
1620  POKE32335,X2
1630  POKE32337,Y2
1640  LINS
1650  RETURN

three times in the Z direction.

The second data set draws a bolt. Most readers will notice that the bolt has a hexagonal shaft rather than a round one; well, let's see you try to draw a circle with straight lines. Fig. 8 was created by stretching the bolt into a cross-wire for hexagonal screws. A top view of the bolt looks like a hexagonal wheel which can be put on a cart to hold all these special parts we are designing. I hope that everyone realizes the tremendous value of a wheel that won't roll away.

The third data set defines a special 80 Microcomputing hat. This is the only object for which its direction can be determined. For example, if the label has an 80 on it, you are looking at the front, but if the label has an 80 on it, you are looking at the back. The hat is made of the same material as the transparent tissue box and the transparent bolt. The hat will be upside down when the data is first read, but it can be turned over by rotating it 180 degrees around the X axis.

Fig. 11. This is a view from the rear of the hat looking up through the bottom.

You should be easily able to make your own shapes by drawing them first on paper and assigning coordinates to each point. After coordinates have been assigned, type in one data line for each line in the drawing.
What has nine lives, three forms, multiple faces and a price tag that almost disappears?

The Magical Microline 80 Printer

It's magic! Well, almost. The Microline 80 will run all day at 80 cps with no duty cycle limitations. The head is warranted for 200,000,000 characters. That translates to over nine years on your TRS-80™ APPLE® or other small computer.

Want to change forms? The magical Microline 80 is three printers disguised as one. There is a whisper-quiet rubber platen for cut sheets and roll paper, pins on nine inch centers for pin feed stock and optional snap-on tractors that adjust to suit all your other forms. The Microline 80 also saves paper by letting you tear off as close as one inch from the last print line.

Want to change your image? The magical Microline 80 really does tricks. It prints upper and lower case, condensed and double width characters and block graphics for charts, graphs and diagrams.

The Microline 80 is not a toy. With two motors, a rugged cast aluminum base and a head you never have to throw away, the Microline 80 is built to handle the most demanding business applications.

Which brings us to the biggest magic of all, the price tag, the one that almost disappears. If we're not the lowest, we are so close that it doesn't matter. There are stocking Microline distributors throughout the country. Call or write today for the name of the one near you and the price of the Magical Microline 80.

OKIDATA

Okitdata Corporation, 111 Gaither Drive, Mount Laurel, New Jersey 08054 609-235-2600

Okitdata is a subsidiary of Oki Electric Industry Company, Ltd.
80 Microcomputing's Buyers Guide To Printers

Though our charts are far from complete, 80 Microcomputing started with an exhaustive list of manufacturers and OEM's in hopes of bringing you the most complete picture of the printer industry. The editors tried to eliminate all the intelligent terminals and those keyboard models that we felt were not comparable on a price/feature basis. The following chart lists all of those manufacturers who were thoughtful enough to reply.

<table>
<thead>
<tr>
<th>Company</th>
<th>Model</th>
<th>Char./Sec.</th>
<th>Line/Min.</th>
<th>Line/Inch</th>
<th>Char./Inch</th>
<th>Char./Line</th>
</tr>
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<tbody>
<tr>
<td>Coosol Inc.</td>
<td>101B-80E</td>
<td>160</td>
<td>60</td>
<td>6</td>
<td>11-13</td>
<td>88</td>
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<td>Coosol Inc.</td>
<td>101B-48E</td>
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<td>50</td>
<td>6</td>
<td>14</td>
<td>48</td>
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<td>Dip Inc.</td>
<td>81</td>
<td>100</td>
<td>60</td>
<td>6</td>
<td>5-10</td>
<td>40/80</td>
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<tr>
<td>Printel Inc</td>
<td>Sidewinder</td>
<td>30</td>
<td>—</td>
<td>9</td>
<td>9.6</td>
<td>132</td>
</tr>
<tr>
<td>Radio Shack</td>
<td>LP7</td>
<td>30</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>80</td>
</tr>
<tr>
<td>Radio Shack</td>
<td>QP2</td>
<td>64</td>
<td>120</td>
<td>6</td>
<td>18/9</td>
<td>32/16</td>
</tr>
<tr>
<td>Base 2, Inc.</td>
<td>800</td>
<td>100</td>
<td>60</td>
<td>6</td>
<td>11</td>
<td>64/32/80</td>
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<tr>
<td>Comprint</td>
<td>912-S</td>
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<td>170</td>
<td>5.8</td>
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<td>80/9/120/132</td>
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<td>170</td>
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<td>132</td>
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<tr>
<td>Heath Computer</td>
<td>H-14</td>
<td>45</td>
<td>—</td>
<td>6/8</td>
<td>—</td>
<td>80/96/132</td>
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<tr>
<td>Okidata Corp.</td>
<td>Microline 80</td>
<td>80</td>
<td>86-28</td>
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<td>5/10/16.5</td>
<td>20/40/80</td>
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</table>

<table>
<thead>
<tr>
<th>Interface 1</th>
<th>Baud Rates 2</th>
<th>Form Feed 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = Parallel</td>
<td>A = 50-9600 baud, F = 600 baud</td>
<td>T = tractor, DS = double sheet</td>
</tr>
<tr>
<td>R = res-232</td>
<td>B = 110-9600 baud, G = 50-19200 baud</td>
<td>P = pin, A = auto sheet</td>
</tr>
<tr>
<td>T = 20mA</td>
<td>C = 399-9600 baud, H = 15-9600 baud</td>
<td>F = friction, C = cutsheet feeder</td>
</tr>
<tr>
<td>I = IEEE</td>
<td>D = 110-4800 baud, I = 75-9600 baud</td>
<td>SS = single sheet, S = adjustable width sprocket</td>
</tr>
</tbody>
</table>

84 • 80 Microcomputing, June 1981
The printer industry is one of the most aggressive segments of the microcomputer peripherals market. According to one study by Dataquest, a Cupertino, CA, market research firm, the total printer market is expected to grow from the 425,000 units shipped in 1980 to 760,000 units in 1983. By 1983 the total value of the market is expected to exceed $2 billion.

"The most competitive slice of the printer market falls under the $1,000 bracket."

The most competitive slice of this market, according to Electronics News, an industry trade journal, is the under $1,000 bracket. Supported largely by consumer microcomputer owners, this market is expected to more than triple over the next three years, growing from 65,000 units shipped in 1980 to 275,000 units in 1983. The total dollar value of the market will grow by less than 300 percent over this same time period because of the expected price breaks and mass market technologies that will prevail.

Dataquest set the dollar figure at $52 million last year and pegs it at $137.5 million for 1983. This under $1,000 bracket includes both impact and non-impact printers.

A Creative Strategies International survey which grouped so-

<table>
<thead>
<tr>
<th>Interface</th>
<th>Brand Name</th>
<th>Paper Width</th>
<th>Form Feed</th>
<th>Technology*</th>
<th>Head Type*</th>
<th>Dot Matrix Format</th>
<th>Multi-line</th>
<th>Bidirectional</th>
<th>Upper and Lowercase</th>
<th>Char. Set (number of ASCII char.)</th>
<th>Print Head Life (millions of characters)</th>
<th>Cable Included</th>
<th>Weight (lbs.)</th>
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<tr>
<td>P,R</td>
<td>B</td>
<td>1-10</td>
<td>T</td>
<td>I</td>
<td>DM</td>
<td>5 × 7 to 10 × 14</td>
<td>Y</td>
<td>N</td>
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<td>I</td>
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<td>N</td>
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<td>T,P</td>
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<td>5 × 7 to 10 × 14</td>
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<td>Y</td>
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<td>128G</td>
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<td>96</td>
<td>100</td>
<td>Y</td>
<td>30</td>
<td>$695</td>
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Technology*  
I = impact  
T = thermal  
E = electrostatic

Head Type*  
DM = dot matrix  
D = daisy  
T = thimble

Character Set*  
G = TRS-80 graphic characters  
l = international characters  
F = foreign sets  
OC = optional characters  
HS = high speed  
LQ = letter quality  
P = proportional spacing  
M = monospace

80 Microcomputing, June 1981 • 85
### LPV Graphics Executed in Expanded Mode from Radio Shack

<table>
<thead>
<tr>
<th>Company</th>
<th>Model</th>
<th>Char./Sec.</th>
<th>Line(s)/Min.</th>
<th>Line(s)/Inch</th>
<th>Char./Trch.</th>
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<td>5-16.5</td>
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<td>100</td>
<td>60</td>
<td>6/8</td>
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<td>42</td>
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| Anadex Inc.                   |       |            |              |              |             |            |
| Centronics Data Computer Corp.|       |            |              |              |             |            |
| $901–$1200                    |       |            |              |              |             |            |
| Dataroyal Inc.                | IPS-5000 | 125       | —            | 6            | 10/16.7     | 80/132     |
| Dataroyal Inc.                | IPS-5000A | 150       | —            | 6            | 10          | 80         |
| Olivetti Peripheral Equipment | TH 240 | 320        | 240          | 6            | 10          | 80         |
| Radio Shack                   | LP4   | 100        | 22           | —            | —           | 80/130     |
| Radio Shack                   | LP6   | 100        | 33           | —            | —           | 132        |

| Anadex Inc.                   |       |            |              |              |             |            |
| Anadex Inc.                   |       |            |              |              |             |            |
| $1201–$1600                   |       |            |              |              |             |            |
| Dataroyal Inc.                | IPS-5000 | 125       | —            | 6            | 10          | 136        |
| Dataroyal Inc.                | IPS-5000A | 150       | P            | 6            | 10          | 136        |
| Infoscribe Inc.               | 500   | 150        | —            | 6/8          | 10/12/16.5  | 136/163/224|
| Infoscribe Inc.               | 1000  | 180        | —            | 6/8          | 10/12/16.5  | 136/163/224|
| Integral Data Systems         | 460   | 160        | 60           | 6/8          | 10/12/16.5  | 136/163/224|
| Okidata Inc.                  | Microline 83 | 120      | 212-76       | 6/8          | 5/10/16.5   | 132        |
| Teletype Corp.                | 4220  | 30         | —            | —            | 10/13       | 80/132     |

### Interface

- **P** = Parallel
- **R** = rs-232
- **T** = 20mA
- **I** = 1EEE

### Baud Rates

- **A** = 50–9600 baud
- **B** = 110–9600 baud
- **C** = 399–9600 baud
- **D** = 110–4800 baud
- **E** = 110–1200 baud
- **F** = 600 baud
- **G** = 50–19200 baud
- **H** = 15–9600 baud
- **I** = 75–9600 baud

### Form Feed

- **T** = tractor
- **D** = double sheet
- **F** = pin
- **A** = auto sheet
- **S** = friction
- **C** = cutsheet feeder
- **S** = single sheet
- **S** = adjustable width sprocket

---

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<table>
<thead>
<tr>
<th>Interfac</th>
<th>Hand Rate</th>
<th>Paper Width</th>
<th>Form Feed</th>
<th>Technology</th>
<th>Head Type</th>
<th>Dot-Matrix Format</th>
<th>Multigra</th>
<th>Bidirectional</th>
<th>Upper and Lowercase</th>
<th>Char Set*</th>
<th>(number of ASCII char.)</th>
<th>Print Head Life</th>
<th>Unlimited of characters</th>
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**Technology**
- I = impact
- T = thermal
- E = electrostatic

**Head Type**
- DM = dot matrix
- D = daisy
- T = thimble

**Character Set**
- G = TRS-80 graphic characters
- I = international characters
- F = foreign sets
- OC = optional characters

** asterisk**
- HS = high speed
- LQ = letter quality
- P = proportional spacing
- M = monospace

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called low-cost printers together sets their 1980 market value at over $100 million for approximately 125,000 units sold. By 1985, Creative projects the figures at 475,000 units shipped for a total market value in excess of $300 million.

Each study has impact printers outperforming non-impact varieties. Two technologies are currently used in most printer manufacture, impact or non-impact. Impact employs the traditional method of printing whereby a character is pressed onto the paper via a ribbon. Non-impact methods employ thermal, electro-static, ink jet and laser techniques and usually are more expensive.

For most microcomputerists, impact printers are the norm. Of all the different types of impact printers available, the dot matrix is most popular with the microcomputerist and provides him with the greatest benefits at the lowest price.

The dot matrix printing technique is straightforward. A matrix, or rectangle, consisting of between 63 and 81 solenoid driven pins, impacts on to a sheet of paper through an inked ribbon. The matrix pin configuration is determined by the character the printer is to reproduce. The denser the matrix (the more pins), the better defined the characters will be.

Dot matrix techniques have evolved to the point where print quality approaches that of a good typewriter. Another impact technique prints fully-formed characters. The so-called daisywheel mechanism uses a revolving wheel to place print characters in front of a hammer. The wheel is cut into thin fingers which resemble the petals of a flower. Each finger has a character on it and a wide range of type styles can be had by simply changing print wheels.
Print quality of daisywheel units is high, but because of the mechanics involved in rotating the wheel, the speed is not great. In addition, daisywheel units are usually more expensive than dot matrix units.

The most frequently seen type of non-impact printer is the thermal or heat sensitive unit. This printer uses a heated dot matrix head to reproduce characters on special, heat sensitive paper. Other configurations of this type of printer exist but, in all cases, special paper is required—a definite drawback when large amounts of copy are necessary.

Though fully formed character printers have long dominated the market, printing at speeds of up to 1100 lines per minute at the standard 132 characters across, their prices have kept them out of reach of the home user, or those customers without heavy word processing needs. In the under $1000 bracket that is causing much market activity, it is the influx of a number of reliable dot matrix printers that account for the projected growth rates.

In the low price market that is capturing the attention of the home

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<table>
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<tr>
<th>Interface</th>
<th>Basic Rate</th>
<th>Paper Width</th>
<th>Form Feed</th>
<th>Technology</th>
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<th>Character Set</th>
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*Technology*  
I = impact  
T = thermal  
E = electrostatic

*Head Type*  
DM = dot matrix  
D = daisy  
F = foreign sets  
T = thimble  
OC = optional characters

*Character Set*  
G = TRS-80 graphic characters  
I = international characters  
F = foreign sets  
OC = optional characters  
HS = high speed  
LQ = letter quality  
P = proportional spacing  
M = monospeed

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Sample Graphics from the new Centronics Model 739

The Centronics Model 737
user, Japanese imports such as Epson, Oki-data and Itoh are making their greatest advances.

Further, technology is also transforming our consumer habits. The increased speeds of dot matrix and the improved character shaping, available at a fraction of the price of traditional line printers with fully-formed — so-called letter quality — characters has hastened our judgment about the clarity of letter quality printers versus the dot matrix.

This activity can only be accelerated by IBM's addition of their 5225, a high-speed dot matrix printer manufactured by Dataproducts. As standards of readability are altered by the limits of technology, and technology continues to upgrade the performance of dot matrix printers by means of overlapping dots or double-pass methods, this market will see continued growth. Already small businessmen and home users are finding the dot matrix character sufficient for internal reporting and some word processing needs.

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---

**Interface**
- P = Parallel
- R = RS-232
- T = 20mA
- I = IEEE

**Baud Rates**
- A = 50-9600 baud
- B = 110-9600 baud
- C = 399-9600 baud
- D = 110-4800 baud
- E = 110-1200 baud
- F = 600 baud
- G = 50-19200 baud
- H = 15-9600 baud
- I = 75-9600 baud

**Form Feed**
- T = tractor
- P = pin
- F = friction
- SS = single sheet
- DS = double sheet
- A = auto sheet
- C = cut sheet feeder
- S = adjustable width sprocket

---

90 • 80 Microcomputing, June 1981
Though high speed fully-formed character printers such as those manufactured by Qume and Diablo still lead the sales market, they are meeting competition from traditional typewriter manufacturers who are turning their attention to the printer market. Induced by the success of dot matrix printers costing less than $1,000, major and minor manufacturers of thimble, daisywheel, element and drum printers are hastening to introduce fully-formed character printers that run slower and cost far less.

"It is the influx of reliable dot matrix printers that account for projected growth rates..."

Among those manufacturers are Pertec, Olympia and Olivetti. Pertec has introduced its Stylist 360, manufactured by its parent firm, Triumph Adler of Germany. It is a daisywheel that operates between 17 and 20 characters per second and will cost much less than the 45 to 55 character counterparts from Qume and Diablo. They will be a price-compatible alternative to current dot matrix printers.

The Olivetti DM80/180

<table>
<thead>
<tr>
<th>Interface</th>
<th>Band Rate</th>
<th>Paper Width</th>
<th>Form Feed</th>
<th>Technology</th>
<th>Head Type</th>
<th>Dot Matrix Format</th>
<th>Multitask</th>
<th>Bidirectional Char.-Set*</th>
<th>Upper and Lowercase Char.-Set*</th>
<th>Print Head Life</th>
<th>(millions of characters)</th>
<th>Cable Included</th>
<th>Weight (lb.)</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>15</td>
<td>F</td>
<td>Opt.T,A</td>
<td>I</td>
<td>D</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>P,R</td>
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<td>F</td>
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<td>128</td>
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<tr>
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<td></td>
<td>Head Type*</td>
<td></td>
<td>Character Set*</td>
<td>*</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I = impact</td>
<td>D = dot matrix</td>
<td>G = TRS-80 graphic characters</td>
<td>I = international characters</td>
<td>F = foreign sets</td>
<td>OC = optional characters</td>
<td>HS = high speed</td>
<td>LQ = letter quality</td>
<td>P = proportional spacing</td>
<td>M = monospeed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

80 Microcomputing, June 1981 • 91
The price of progress is innovation.

The Xerox 1740 And the Model II

Dr. James H. Nestor
39114 Route 303
Grafton, Ohio 44044

Nestor's Law states that Radio Shack will always have the hardware and/or software I need six months (or more) after I need it. That statement may earn me a place of prominence with Murphy's Law, Parkinson's Law, and the Peter Principle. Think about it.

No Foreign Equipment

I have endured the tirades of Radio Shack personnel for more than two years, ever since I hung a Per déc drive on my Model I instead of waiting six months for a "legitimate" drive. They have preached to me about the importance of using only Radio Shack peripherals. I have even conceded that for many people it is wise to get everything from one source. Where the argument breaks down is when I have a specific need and they are unable to fill it.

As case in point, I cite Scripsit, Radio Shack's word processing program. It was released about two years after I bought Electric Pencil and modified my Model I for lowercase.

When I purchased a Model II the problem remained. In fact, I think it got worse. While Scripsit for Model I was now available, there was no version for Model II. Nor were the folks in Fort Worth even talking about a release date. Here I sit with the perfect machine for word processing: 80 × 24 display with true lower case, 1/2 megabyte of disk storage, full keyboard, and both parallel and serial printer ports. Not to mention reverse video and 64K of RAM! But, alas, there was no software and no letter quality printer. Phooey again!

Undaunted, I set out in search of counterfeited means to enjoy my machine. The search, though hectic, was worthwhile. In fact, I'm going to share my secrets with you in this very article.

Finding a Printer

If all else failed, I thought I might be able to write some word processing software. I would never presume to be able to build a printer. Therefore, I set out in search of a printer first. Finding one wasn't really all that tough. I excluded the various Selectrics because of their slow print speed and mechanical complexity.

That left three candidates: NEC Spinwriter, Qume Sprint, and Xerox 1740. All three are daisywheel types with a minimum of moving parts and excellent print quality. Although all three appear to be excellent printers, I settled on the Xerox 1740 because of availability of local service. The same machine is marketed through dealers as the Diablo 1640. I should point out that although Xerox manufactures both models, they will only service the Xerox 1740.

Getting the Printer to Work

I selected a 1740 RO (Receive Only) version because I didn't need another keyboard. The printer has an RS-232 serial interface. Since the Model II also has two RS-232 serial ports, I assumed it would be a plug-in installation. Not true.

Although the plug on the 1740 would fit either Port A or Port B, I could not get the Model II to talk to the printer. Or possibly, the printer wasn't listening to the Model II. If Xerox wouldn't service a Diablo printer, just maybe the 1740 refused to respond to so lowly a driver as the Model II. Panic!

Problem One: Hardware

At this point I assumed that I had a hardware problem and proceeded accordingly. I read and re-read the Xerox tech manual which came with the 1740. I reset all of the switches, and tried the Self Test (sounds Freudian). It worked. The printer produced several lines of perfect print. I read and re-read the Model II owner's manual.

Article Two of Nestor's Law says that "Adequate documentation, especially technical manuals, shall immediately follow discontinuation of any given model."

The only item of value in the Model II manual was a pin-out diagram of serial ports A and B. I compared it to the diagram in the Xerox manual. They were identical. At first I thought that was terrific. They are both RS-232, so they should be identical. It even made sense, so I knew it had to be wrong.

Digging further into the respective manuals, I discovered the "rub". After studying the concept of handshaking, I concluded that the pin-outs should not be identical. The clear-to-send line of one device does not connect to the clear-to-send of the other. Rather, it goes to the request-to-send pin. I'll not keep you in suspense any longer. In order for the Xerox 1740 to work with the Model II, a few changes must be made in the wiring of the connecting cable.

Solution One: Hardware

The cable is soldered in place inside the printer, so the modifications must be made to the wires inside the connector on the cable end. Four wires in the plug must be switched, and a jumper must be soldered.
Vista

Eight Inch Floppy Disk Drive Subsystem Model V1000
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Prices: Starting as low as $395.00

Model V1000

Model V500

Model V80/800/8000
“In spite of the delays and other minor problems, I still am satisfied with my Model I and Model II...”

<table>
<thead>
<tr>
<th>Printer Plug</th>
<th>Pin Number</th>
<th>Model II Plug</th>
<th>Pin Number</th>
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</thead>
<tbody>
<tr>
<td>Ground</td>
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<td>Ground</td>
<td>1</td>
</tr>
<tr>
<td>Transmitted Data</td>
<td>2</td>
<td>Transmitted Data</td>
<td>2</td>
</tr>
<tr>
<td>Received Data</td>
<td>3</td>
<td>Received Data</td>
<td>3</td>
</tr>
<tr>
<td>Request to Send</td>
<td>4</td>
<td>Request to Send</td>
<td>4</td>
</tr>
<tr>
<td>Clear to Send</td>
<td>5</td>
<td>Clear to Send</td>
<td>5</td>
</tr>
<tr>
<td>Data Set Ready</td>
<td>6</td>
<td>Data Set Ready</td>
<td>6</td>
</tr>
<tr>
<td>Signal Ground</td>
<td>7</td>
<td>Signal Ground</td>
<td>7</td>
</tr>
<tr>
<td>Carrier Detect</td>
<td>8</td>
<td>Carrier Detect</td>
<td>8</td>
</tr>
<tr>
<td>Terminal Ready</td>
<td>20</td>
<td>Terminal Ready</td>
<td>20</td>
</tr>
</tbody>
</table>

Instructions:
Remove the cover on the printer plug. The pin numbers are stamped inside the front part of the connector by the pins. Carefully note the pin numbers and the color of the wires connected to each pin.

Unsolder the wires from pins 2 and 3. Reverse the wires (82 to 3, 3, to 2) and resolder.

Unsolder the wires from pins 4 and 5. Reverse the wires (4 to 5, 5 to 4) and resolder.

Solder a small gauge wire from pin 6 to pin 8 to pin 20. Do not remove the wires already soldered to these pins.

Fig. 1. Pin Diagram of Xerox 1740 and TRS-80 Model II

across three of the pins. Fig. 1 shows the connections. The only problem I encountered in making the modifications was that the connector was of the crimp-on type. Consequently, I had to cut and splice the wires. If I were to do it again, I would replace the DB-25P connector with a solder tail type. It would even be possible to make a small jumper cable to install between the printer cable and the Model II. Fig. 2 shows such an adapter.

The printer is connected to Port B in the Model II. It was selected because Port A is configured with the additional signals required for a modem. If you have a modem hooked to Port A, you can leave it there. If not, you will need a “dummy” plug in Port A. Fig. 3 shows such a shunting plug. This point has caused me some confusion. The confusion relates to the fact that some Model IIs seem to work without the dummy plug. So far, I have found at least three machines which work without the plug. I have discussed the problem with Radio Shack technical personnel. They were not aware of the fact, and as of yet have no explanation.

A minor complaint is that the serial port connectors do not have any type of devices to hold the plugs in place. The addition of a threaded post, such as the ones on the TI-810, would have cost another penny or two, but would make life easier. In fact, the connectors are attached to the plastic cabinet with small bolts and nuts which are not
attached to the case. If you attempt to remove the connectors (as I did), the nuts fall inside the case and are murder to retrieve. Once you have loosened the bolts, you must open the case to tighten them.

Poor planning! The only solutions to the loose connector problem are epoxy, duct tape, or nerves of steel. If you bang the keys, the connector falls off. I settled for tape.

Problem Two: Software

Did I mention that the printer still didn't work with the Model II? Since I was absolutely sure that the hardware was correct, the problem had to be in the software. The first thing I discovered after resorting to reading the Model II manual was that TRSDOS 1.1 did not include serial port

If you mis-typed the command, or for any other reason wish to change it, you must first turn the channels off. This is done with a SETCOM A = OFF, B = OFF command. If you use a reset, it is necessary to use the SETCOM sequence again. So much for SETCOM for the moment.

The next command to learn is FORMS. It sets the number of columns per line and lines per page. The default is for 32 columns per line and 60 lines printed out of the 66 lines per page. These are correct for 14 7/8" wide paper. The width would have to be reduced to 80 columns for 8 1/2" stock. A third command tells the Model II if your printer uses a special control code. I don't know what that really means, but so far I haven't found a printer that used it anyhow. The final option is between a parallel and serial printer. Parallel is the default, so we have to specify that this is a serial printer. If the FORMS command were entered in full it would read:

```
FORMS { P = 66, W = 132, L = 60, C = 0, S }
```

Since we are going to use the defaults for all but the last item, we can get by with:

```
FORMS (S)
```

The complete sequence is:

```
SETCOM B = "600,N,1", A = OFF
FORMS (S)
```

If all is well, the display will respond with:

```
FORMS SET P = 66 L = 60 W = 132 C = 0
PRINTER READY? (Y/G) . . . The answer is Y.
```

The printer should advance one line in response to a test signal sent from the Model II. If it doesn't and responds with ERROR 45, you have problems. ERROR 45 means that the printer is NOT READY. Check it out.

The next sequence is:

```
ALIGN PAPER TO TOP OF PAGE
PRESS ANY KEY TO CONTINUE
```

Align the paper and press a key. All is well with the world. The display will read:

```
Top, Repeat, or Quit?
```

This one really confused me. The correct answer is Q for Quit. It should return you to:

```
TRSDOS READY
```

The serial port is now ready to drive the printer. You can use a DIR PRT command to print a disk directory. You can now go into BASIC and use LLIST or LPRINT at will. You can return to TRSDOS without disturbing the serial driver. However, if you reset the machine, the SETCOM and FORMS commands will have to be given again.

Solution Three: The DO File

Since it is cumbersome at best to type all of that stuff each time the machine is turned on, an easier way had to be found. The SETCOM and FORMS statements were incorporated into a DO file which I call PRINTER. The command BUILDPRT is used to create the file. SETCOM B = "600,N,1", A = OFF is entered as the first line. FORMS S is the second. Since I generally program in BASIC, I added a third line: BASIC MENU -F.5. It loads BASIC, allows for five files, and RUNs a program called MENU. You can modify the contents, but this is an example of a useful DO file. From TRSDOS you can accomplish all of these things by typing DO PRINTER.

If you want a true "turnkey" operation, type AUTO DO PRINTER. The machine will respond with AUTO SET 'DO PRINTER'. Whenever the Model II is turned on or reset, it will automatically setup the printer channel, load BASIC, and run the program.

Actually, the discussion of TRSDOS 1.2 is a bit off the track since there was not any sophisticated word processing software available to run under that operating system. However, I do use the printer with other programs which run under TRSDOS.

My shots at Radio Shack were taken in good fun. I realize that they can't be all things to all people. In spite of the delays and other minor problems, I still am satisfied with my Model I and Model II equipment. In fact, the personnel at the local store and repair center have been quite helpful. My thanks go to Dave Robinson, Dave Starkey, Lew Crawford, Joe Crossen, and Charles Brickenhauser for their efforts.

I suppose I should caution you that I am a professional computer hobbyist, and that you should not attempt these stunts unless you have your parents' approval and your unit is no longer under warranty. If you are still interested, try it!
Achieve complete control of matrix print head needles through clever software manipulations.

A Tiger With Dots

George Somers
33 Deerfield Lane
Aberdeen, NJ 07747

A computer with only a CRT monitor is limiting—there are so many times when hard copy can be helpful, even essential. It wasn't long before I began to look for a printer. My final choice, after a great deal of comparison shopping, was the Integral Data IDS-440 Impact Printer, known also as the Paper Tiger. The features included both a normal and enhanced mode for four different type densities. Yet, for me, the most attractive characteristic was an optional graphics feature that, if installed, would permit program control of each individual dot in the printhead matrix.

My first graphics programming project was to design a routine that would dump the contents of the TRS-80 video screen to the printer using the Tiger's dot control graphics feature to faithfully reproduce those unprintable graphic codes.

Software Control Codes

The IDS-440 achieves a great deal of its flexibility by employing a series of control codes: non-printable characters represented by 00H-1AH (0-31 decimal). Table 1 summarizes these software control codes. Control code 03H is very important because it allows the printer to suspend interpretation of all the subsequent bytes that it receives as printable ASCII characters, and enables the graphic function.

Raster Scan Dot Printing

Once in the graphics mode, the printer operates under a raster scan technique, printing columns of up to seven vertical dots across the page. Fig. 1 graphically documents this path across the page.

Individual Dot Access Via Software

The individual printhead needles (there are seven of them) are activated according to the printer's decomposition of the byte received into its component bits. If a 23H is received, then bits 0, 1, 2 and 4 are turned on and their respective printhead needles are energized to print dots. Due to the nature of the scan technique, the owner's manual recommends that bit 7 remain off (0) at all times. This is necessary because bit 0 of the
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"My first awkward attempts at printing dots were far from successful... At seemingly random times, extraneous strings of dots were printed along with the legitimate ones."

ensuing printhead pass overlays bit 7 of the previous pass. No byte larger than 127 (equivalent to all six low order bits activat-
ed) or 7FH should be output to the printer.

**Graphics Control Code Flag**

Once in the graphics mode, control codes must be preceded by a 03H control code. This bars the printer from interpreting the intended control code as dot printing data. Escape from the graphics mode is accomplished by printing a 03H followed by either a 01H (enhanced mode control character) or a 02H (normal mode control code). The printer then resumes standard character printing.

**Two Final Control Codes**

Two final details conclude the preliminary programming instructions. The vertical tab code causes the printhead to terminate the present horizontal graphics scan and initiate the next scan six dots down on the page. Following the previously detailed conventions, the printer must receive both a 03H and a DBH. Finally, to turn on bits 1 and 2 alone, two 03H bytes are required in order to signal the Paper Tiger's interpretive ROM that data 03H is intended and not a prefix to a control code.

**On to the Programming**

My first awkward attempts at printing dots were far from successful. It was soon apparent that, once in the graphics mode, the BASIC LPRINT command was useless as a means of sending graphic bytes to the Paper Tiger. At seemingly random times, extraneous strings of dots were printed along with the legitimate ones. The bit pattern of these extraneous dots corresponded to a 0AH—the standard control code for a line feed.

Obviously, upon receipt of a 0CH the ROM attempted to perform a form feed by outputting a string of line feeds, being unaware that the 0CH was not a control code in the graphics mode. POKEing the printer port (14312 decimal, 37EH) with hundreds of random graphic bytes elicited no such unexpected results, confirming the diagnosis of incompatibility between the LPRINT command and the requirements of the printer while printing in the graphics mode.

**How to Send the Graphic Bytes?**

I then wrote a very short assembly language driver that would pass the byte to print from BASIC to the driver, check the ready status of the printer port, and, when all was in order, send the byte to the printer. After studying the TRS-80 ROM, I found that calling 05D1H would perform the printer port status check. A disassembled listing of this useful subroutine is in Program Listing 1. In addition, calling 0A7FH solved the problem of obtaining the byte to print (the byte is passed through the USR command variable to the HL register pair). The complete driver is in Program Listing 2.

**Packing the Driver**

For convenience and increased portability, I POKEd this short assembly language driver into a BASIC string. This saves loading a separate system tape every time graphics printing is desired. Graphics programs may be built around this string, or the string itself may be appended to a program that exists already. Program Listing 3 is a simple BASIC program that accomplishes the string packing.
Graphic Blocks to Dots

With the mechanics of sending the byte out of the way, determination of a practical algorithm for converting graphic codes to a dot matrix representation of the blocks was the remaining programming roadblock.

After studying the user’s manual concerning the width and density of dots in the graphics mode, I estimated that a reasonable interpretation of the graphics block represented by decimal 191 (all six component pixels turned on) would consist of a dot matrix composed of twelve vertical dots by four horizontal dots in the 12 character per inch printing density. (See Fig. 2.) In this scheme, each pixel would be represented on paper as two horizontal dots by four vertical dots.

Using the POINT Command

In order to determine which individual pixels are set on the screen, the Microsoft BASIC ROM has provided the POINT command. It takes the form of POINT (X,Y), where X and Y are coordinates of the pixel to be examined for its on or off state. With the aid of this handy function, a program can determine the corresponding bits in the printhead matrix and turn them on twice (for two horizontal dots). The one complication is that the next lower pixel must also be checked to see if it is necessary to turn on the bottom two dots of the six-dot printhead pass as well.

A vertical tab must then be sent at the end of a printhead pass so that the next scan (to print the bottom half of the graphic block) can occur.

The Procedure Summarized

The analytical procedure can be summarized in this way:

- Examine each graphic block as three vertical and two horizontal pixels by using the POINT command.
- Print the dot representation in two scans of six vertical dots each, allowing four vertical dots and two horizontal dots for each individual pixel.

The First Program

Program Listing 4 is a BASIC language version of the screen dump procedure described above. It is not intended to be run on its own, but, rather, to be added to those BASIC programs with graphics output that are worthy of transfer to hard copy. Access to the subroutine is done by a simple GOSUB50000 statement. To jump to this

route via a GOTO50000 statement would necessitate changing the Return statement in line number 50090 to an outright GOTO statement. However, logic flow always seems to remain clearer when minor routines are called through GOSUBs.

At the heart of the subroutine are two FOR—NEXT loops. The first loop (line
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Program Listing 6. Graphics Driver (Assembly)

00010  PA = PEEK (PR) ; IF PA > 122 THEN PA = 32 ; Set clear, convert graphics to spaces
00025  PAH = PA + CHK (PA) ; Concave new character to strip to print
00026  NEXT PR = 1 ; Continue till every character on line is part of PAH
00027  LPRINT PAH ; Print line of characters
00030  PS = 64 + 1 ; PS now is start of next line of characters
00032  FU = USB (3) ; FU = USB (3) ; Convert, back to graphics mode
00030  FOR PX = 0 TO 107 ; 1st pass vertical counter
00040  IF PX = 0 THEN PR = 15 IF upper pixel
00040  IF POINT (PAH PX) THEN PR = IF middle pixel
00050  IF PR = 64 THEN PR = IF lower pixel
00060  IF PX = 0 OR PX = 63 THEN PR = IF upper pixel
00070  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF lower pixel
00080  IF PR = 1 THEN PR = IF horizontal pixel
00090  IF PX = 0 OR PX = 63 OR PX = 64 THEN PR = IF horizontal pixel
00100  IF PR = 3 THEN PR = IF diagonal pixel
00110  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF diagonal pixel
00120  IF PR = 3 THEN PR = IF diagonal pixel
00130  IF PX = 0 OR PX = 63 OR PX = 64 THEN PR = IF horizontal pixel
00140  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF lower pixel
00150  IF PR = 64 THEN PR = IF lower pixel
00160  IF PR = 1 THEN PR = IF horizontal pixel
00170  IF PX = 0 OR PX = 63 OR PX = 64 THEN PR = IF horizontal pixel
00180  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF lower pixel
00190  IF PR = 3 THEN PR = IF diagonal pixel
00200  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF diagonal pixel
00210  NEXT PX = 1 ; Go back 1 continue until last scan is done
00220  PU = USB (3) ; PU = USB (11) ; Go Vertical Tab
00230  FOR PX = 0 TO 107 ; 2nd pass Vertical counter
00240  IF POINT (PAH PX) THEN PR = 3 IF middle pixel
00250  IF PR = 64 THEN PR = IF lower pixel
00260  IF PR = 3 THEN PR = IF diagonal pixel
00270  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF lower pixel
00280  IF PR = 64 THEN PR = IF lower pixel
00290  IF PR = 1 THEN PR = IF horizontal pixel
00300  IF PX = 0 OR PX = 63 OR PX = 64 THEN PR = IF horizontal pixel
00310  IF PX = 63 OR PX = 64 OR PX = 127 THEN PR = IF lower pixel
00320  NEXT PX = 1 ; Continue until every horizontal line is done
00330  PU = USB (3) ; PU = USB (11) ; Go Horizontal Tab
00340  PU = USB (3) ; PU = USB (11) ; Go Vertical Tab
00350  NEXT FY = 1 ; Continue until every vertical line is done
00360  PU = USB (13) ; Pu Carrier Return
00370  RETURN 1 ; Return to the Basic program location that called the print routine

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5000S) allows variable PY to hold the Y coordinate of the top pixel of each graphic block. It is incremented by steps of three in order to skip over the middle and bottom pixels of the graphic block, which are examined individually by the POINT statements within that loop. The second loop, which appears once for each of the two printhead passes (in lines 50006 and 50025), places the X coordinate of each screen pixel into variable PX.

PR5 (line 50000) holds the assembly language coding listed in Program Listing 2 after having been packed by the BASIC routine listed in Program Listing 3. The USR command pointer (locations 16526 and 16527' decimal) is POKEd with the address of this string-packed assembly program after the address is determined by the VARPTR function in line 50001. All subsequent USR calls are thus directed to the contents of PR5. The remainder of the program is self-explanatory with the aid of the various program comments.

Are Graphics Enough?

With a fully operative graphics program behind me, I attempted to revise the program in order to add supporting characters as well as graphics. This kind of program would be far more helpful for those programs whose numeric screen data are of equal importance to the graphics, as is the case with many business and scientific programs that employ screen graphs.

Two Problems to Solve

The addition of characters to the screen printing program brought with it two difficulties. The first solution was relatively easy. It necessitated creating the automatic line feed upon receiving a carriage return—done by setting switch 5 on DIP switch 4 on the Paper Tiger to its off position. This permits an initial pass for printing the screen characters, followed by a carriage return (now, minus the line feed), and then the required two passes for the graphics. Both were terminated by vertical tabs that, when combined, are equivalent to a line feed.

The second problem required a software solution and a necessary compromise in the final printed result. The problem was evident in the slight but significant incompatibility between the width of characters and the interpreted graphics blocks. It is a great deal less glaring when a compromise in the final printed screen is accepted; characters are printed in the 12 character per inch density and graphics are printed in the 10 character per inch density.

The printed graphics took a bit more faithful to the original screen graphics when they are printed at the 12 character per inch size, but for all practical purposes, this difference in appearance is insignificant, particularly in scientific and business graphic applications. Even with this adjustment, graphics can slightly overrun characters by the end of a printhead pass. I decided to compensate slightly every twenty-one horizontal pixels, for the minor disparity; again, with very little change in the final result.

The Second Program

Program Listing 5 is a listing of my results in the attempt to code a subroutine that would support both characters and graphics. Much of this program is the same as Program Listing 4. Lines 50121 through (and including) 50129 are the additions that handle the character printing. At the end of each character scan, PAS holds the string of characters to be printed. Any non-characters encountered are converted into spaces (line 50124).

Because a string is being manipulated during this routine, it is wise to clear 200 extra bytes of string handling space beyond the main program's requirements. The compensation for the disparate printing of characters and graphics is accomplished both in lines 50163 and 50242-50244. In addition, since the compensation on the second pass (at line 50242) may result in a 03H, that...
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situation is also provided for on the same lines. All other program operations are documented in the comment statements.

These programs require that switch 6 of DIP switch 53 be set to its on position in order to allow the Paper Tiger to receive the software control codes.

The Speed Factor

As both of these programs are written in BASIC, they tend to run slowly, particularly Program Listing 5. Because of this, I soon translated both programs into assembly language code, and include my results here as Program Listing 6 (graphics only) and Program Listing 7 (both characters and graphics) for those readers who wish to maximize the speed aspect of the printer. It is not within the scope of this article to discuss details of the assembly language translations of the BASIC programs; the assembly techniques employed closely parallel those of their slower counterparts, and the listings are commented liberally to assist in their deciphering by willing readers. Comparisons of run time speed for one full screen dump will all pixels turned on follow:

- Graphics only:
  - Program Listing 4 (BASIC) : 4 1/2 minutes
  - Program Listing 5 (Assembly) : 25 seconds

- Graphics and characters:
  - Program Listing 5 (BASIC) : 8 1/2 minutes
  - Program Listing 6 (Assembly) : 48 seconds

Parting Comments

All of these programs do their respective jobs efficiently, but no program should ever pretend to be the final word on a computing procedure. There can always be a better way. With this in mind, I encourage readers to experiment, make improvements, and add features. For instance, with very little effort, both of the assembly languages could be shortened (though, perhaps, suffering a loss of clarity in the process) and stuffed into a BASIC string so that they may be as portable as the little driver already present in the two BASIC programs.

I will be very happy to respond to any comments, questions, and suggestions that are addressed to me. And now, it's back to work. You see, I have visualized a custom designed character set, and since I can control those dots..."
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A review of those cryptic error messages your 80 keeps sending you.

To Err Is...Forbidden

John D. Adams
13126 Tripoli Ave.
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Easy as it is to use, the TRS-80 is an exacting little tyrant when it comes to following the rules. If I wrote here that this article was prepared on a typewriter, you might lift your eyebrows a little, but from the context you'd know what I meant. Although the human mind may not be bothered by little details such as this, the computer is. Therefore, the computer needs ways of dealing with human error and omission.

The '80 has as complete a set of error handling routines, as might be expected from a computer in its price range. From the old WHAT, HOW and SORRY of Level I we jump to a set of 23 messages that are far more specific. Let's examine these messages in detail.

Error Codes

NF (error code one)—NEXT without FOR: We can get a lot of work done efficiently by using a loop that automatically increments or decrements. Consider the following lines:

```
10 FOR X = 1 TO 100
20 ............
30 NEXT
```

When line 10 is executed, the value 1 will be set in variable location X, and the value 100 will be stored internally. Information must also be stored to point to line 10, so the computer will know where to go for the next pass of the loop when line 30 has been executed. If the computer reads a NEXT instruction and no line contains FOR to store that pointer, it will not know where to go, and the NF message is returned.

Using FOR without NEXT will not return this error message, but neither will the loop cycle. At times the TRS-80 will return an NF error when loop structure is correct: This is an idiosyncrasy of the machine. (See Hubert Borrmann's article "The 'Next' Trap" in the September 1980 80 Microcomputing.)

SN (error code two)—Syntax Error: This is probably the most frequently encountered error message. Syntax refers to the terms and symbols of a language, what they mean, and how they are arranged to produce logical results.

The part of your computer that translates BASIC into machine language is simple-minded; if we deviate ever so slightly from the rules it will not compensate. Common causes of syntax errors are:

- Misspelled Instructions: Entering PRIBT instead of PRINT.
- Missuse of Delimiters: Symbols such as quotation marks, semicolons, colons, and commas mean more than punctuation to the computer.
- Illegal Signs: Trying to run the line, 10A = 3 x 4, will not get you the product you want. For example, an asterisk is used to indicate multiplication in BASIC. Such signs as the slash bar and up arrow have specific operational meanings, and no substitutes are accepted.
- Illegal Statements: Dialects of BASIC differ, some contain words that others don't. Using terms such as CALL or PLOT in Level II BASIC will generate a syntax error.
- Unmatched Parentheses: We often use multiple levels of parentheses to indicate how we want expressions evaluated. These symbols must be matched: one close parenthesis for each open parenthesis.
- Improper Notation of Arguments: Many instructions in BASIC require some information be given afterward. This information is called the argument. Some arguments, such as AUTO mm,nn and DEFSTR n, do not require parentheses, while others, such as MID$(n$,p,n), SET(x,y) and SQR(x), do. Punctuation is critical in some arguments; for the PRINT@ n instruction, a comma must follow the display position. Appendix A of your manual sets forth the correct notation for all arguments.

Faulty Program Line Construction: Computer evaluation of mathematical expressions is done on the right side of the equal sign; and results are assigned to the left, so equations must be formatted accordingly. The line, 100 PRINT USING A$ TAB(30);B, is an invalid expression, but 100 PRINT TAB (30) USING A;$B is acceptable. Writing comprehensive guidelines for line construction is a difficult task—experience is the better teacher. If a line will not work as written, experiment with other arrangements.

When the computer finds a syntax error it automatically goes into edit mode and supplies the line number in which the error occurred. Typing an L will furnish the com-
“The part of your computer that translates BASIC into machine language is simple minded....”

Complete line. All other error messages shift the computer into command mode, returning the prompt sign and ready message.

Stored Locations

RG (error code three)—RETURN without GOSUB: This is a paired command, similar to the FOR—NEXT duo. Subroutines are sometimes placed at the end of the main program. When GOSUB is executed, its location is stored so the computer can return to the right place after the subroutine’s termination. If a RETURN is read and there is no GOSUB location stored, the program can’t continue, as it has no re-entry point. This can happen when we revise a program and delete or change GOSUB lines and forget about the RETURN.

OD (error code four)—Out of Data: READ DATA instructions are used when many constants must be stored in the body of the program to be read when needed. If there are fewer items in the data line than called for in the READ line, this error message is returned. An example would be:

```
10 READ A,B,C
20 DATA 5,8
```

When the computer attempts to load location C, there is no data available. This error can also occur when an INPUT #n instruction calls for data not available from tape. The OD message should not be confused with the double question mark (?), which indicates insufficient response to an INPUT instruction. In this case, more data is needed.

FC (error code five)—Illegal Function Call: This indicates a command which is mathematically impossible or not within the capability of the machine or the language. For example: requesting the square root or logarithm of a negative number, using a negative number in the argument of the LEFT$, RIGHT$ or MID$ instructions, or setting up an array with negative dimensions. Many of us use hybrid programs in which the USR instruction is used to access a routine in machine language from BASIC. If the entry point of the machine language routine is not specified, an FC message is returned.

OV (error code six)—Overflow: There are limits to the value of numbers the TRS-80 can process. Integers must be in the range -32768 and +32767 inclusive. Single and double precision numbers must be in the range \(-1.7 \times 10^{10}\) and \(+1.7 \times 10^{10}\) inclusive. The latter are given in exponential notation which is a sort of shorthand way of writing very large, or very small, numbers. To convert, move the decimal to the right—or to the left, if the exponent of 10 is negative—

the number of places designated by the exponent of 10. Thus, \(-1.7 \times 10^{8}\) becomes 17 followed by 37 zeros. Fortunately, this range is sufficient for most programs.

OM (error code seven)—Out of Memory: This message indicates that all of the available RAM has been used up or reserved. This can come as a surprise if you are not aware of what is called “memory overhead.” Each time we write a program line, five bytes are used, in addition to the byte space used to store the characters in the line: two for the line number, two for the line pointer and one for the carriage return. Dimensioning arrays, specifying double precision, using string variables, FOR—NEXT loops, parentheses and GOSUBs all eat up RAM. Programs which are running short on RAM space can be streamlined—see “Storing Memory Space” on page 11/1 of your manual.

UL (error code eight)—Undefined line: Instructions have been given to branch to a line which does not exist. This happens in program revision when line numbers have been changed. Also, make sure all branch instructions have valid destination points.

BS (error code nine)—Beyond Subscript: The individual spaces in an array are designated by using subscript numbers which are included in parentheses following the variable name. The location A$(12) indicates the 12th element or member in the string array called A$.

On power-up, the TRS-80 is prepared to handle the 11 element array. Larger arrays must be dimensioned using the DIM instruction. If an array has been dimensioned at 100, it will accept only that many elements. Attempts to enter additional elements return the BS message. Arrays should be properly dimensioned at or near the beginning of the program.

DD (error code 10)—Redimensioned Array: The process of setting up an array is complex, and once done, may not be re dimensioned. If there is no way to avoid a size change, set up a new array with correct specifications and transfer the contents from the old to the new by using the matrix transposition routines found on page 6/5 of the manual.

Division by Zero

J0 (error code 11)—Division by Zero: The laws of mathematics state that division by zero is undefined. This error occurs when division is being performed with numbers generated in another part of the program. A screening line such as, 200 IF A = 0 THEN GOTO ... may be used to bypass this situation.

ID (error code 12)—Illegal Direct: The INPUT instruction is for use in the execute mode of your computer, and may not be used as a direct statement. There are other ways of getting data entered: It may be embedded in the program (10 PI = 3.1416), or it may be read (10 READ PI;DATA 3.1416). INPUT stops execution and can be used with manual keyboard entry only while the program is running.

TM (error code 13)—Type Mismatch: An attempt has been made to use string data in a non-string application or vice versa. In the line 10 A = JANUARY, the variable A is for non-string data (value data); to load a word it should be named A$. Loading a number into a string location and then trying to use that number for computation will also generate this message.

OS (error code 14)—Out of String Space: Check the memory map of the 16K Level II TRS-80 on page D/2 of your manual. String data is stored from the top of memory down, and below that, the stack is built downwards. It is necessary to set some boundary between the two. On power-up you are allotted 50 bytes for string storage. The OS message is returned if that allotment is exceeded. If more string space is needed, reserve it by using the CLEAR n instruction at the beginning of the program. Be careful: If you execute this instruction after data has been entered, that data will be lost.

LS (error code 15)—String too long: You have exceeded the maximum string length of 256 characters. Break the string up into smaller units.

ST (error code 16)—String Formula Too Complex: If the computer decides the operation you are requesting is beyond the capability of the microprocessor, it will return this message. Rewrite the operation so it is handled in simpler blocks.

CN (error code 17)—Cannot Continue: When it is necessary or desirable to stop program execution, the CONT instruction allows us to continue program flow without loss of stored data. It may not be used after the edit mode has been entered or lines have been added or deleted. An error trapping routine is the best solution for the problem. Programs cannot be continued after termination with the END instruction.

NR (error code 18)—No RESUME: Error trapping is handled like a subroutine, with the ON ERROR GOTO instruction sending execution to a specified line number. When the routine is finished, it must return operation to a given point; the RESUME statement furnishes this instruction. The NR message is returned if it is missing.

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<td>OR BASIC PROGRAMS ON DISK</td>
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Next month: Error trapping.

RW (error code 19)—RESUME is similar to the RETURN instruction after a GOSUB. If no ON ERR ERROR instruction has been read by the computer, there is no location stored for a return point.

UE (error code 20)—Unprintable Error: The ERROR instruction, used in conjunction with the error code, allows us to simulate error conditions for constructing and testing error trapping routines. This code indicates that you are using an illegal number code and the instruction cannot be executed. See page B/1 of the manual for error code numbers.

MO (error code 21)—Missing Operand: To perform a computation we must have some data and be told what to do with it. The symbols which tell us what to do (+, -, *, /) are called operators. The items of data on which these signs operate are called the operands. If this message is returned, you have specified some operation but have not furnished all the data needed to complete the operation.

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FD (error code 22)—Bad File Data: This indicates you have received some bad data from an external source, usually the notorious cassette player. This can be especially aggravating because Level II doesn't allow verification of data dumps as it does with program data using the CLOAD? instruction. When large amounts of data are involved it pays to use top quality tape and to make multiple dumps.

L3 (error code 23)—Disk BASIC Error: This error means that an attempt has been made to use a Disk BASIC term without having Disk BASIC in your machine. Two other messages are sometimes returned which indicate that something is amiss. They are:

Extra Ignored: This is used in conjunction with the INPUT instruction and indicates you need entered too much data. Should you specify loading locations A and B with the INPUT instruction 10 INPUT A,B, and then enter 1,2,3, the computer has no instructions as to what to do with the third item. It loads 1 into A, 2 into B and ignores the data which follows.

REDO: Level 1 allowed us to enter an expression, such as 12+3 or a variable name, in response to the INPUT prompt. This is not acceptable in Level II. Evaluate all of the needed expressions first and then enter them as simplified values. If it is necessary to get the contents of location X into location Y, do not use the INPUT route, assign the values instead as in 50 Y = X.
### Disk Drives

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<td>100</td>
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<td></td>
<td>280</td>
<td>5¼&quot;, 80 Track</td>
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### Add-on Drives for Zenith Z-89

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<tr>
<td>Z-87</td>
<td></td>
<td>Dual 5¼&quot; system</td>
<td>$995</td>
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### Raw Drives

- 8" Shugart 801R 5¼" Teac or Tandon: $425

### Morris Designs/Thinkermat

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<td>2 + 2</td>
<td>1 Drive $1259</td>
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<td>Hard Disk</td>
<td>M26 $3990</td>
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- 8" Scotch $50 Maxell $55 BASF/Verbatim $36.00
- Plastic file box – Holds 50 5¼" diskettes $19.00
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### Monitors

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### Printers

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<td>R.O. with tractor feed $2295</td>
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<td>C-ITOH</td>
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<td>$620</td>
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<td>Micrhone 83</td>
<td>120 c.p.s. uses up to 15&quot; paper</td>
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<td>Centronics</td>
<td>730 $95 799 $969 737 $749</td>
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<td>Sargon 2</td>
<td>$29.00</td>
<td></td>
</tr>
<tr>
<td>Hi-Res Football</td>
<td>$35.00</td>
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<tr>
<td>Mystery House</td>
<td>$21.00</td>
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</tr>
</tbody>
</table>

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**80 Microcomputing, June 1981 • 111**
Part 1 of this article explained the use of Radio Shack's Editor/Assembler program and explored some fundamentals of assembly language programming. The primary purpose of assembly language programming is speed of execution. We promised to draw a football field on the TRS-80's screen so fast that the user would be unable to see it happen.

As a step along the way, we wrote, debugged and executed an exciting program which displays the letter X at screen position 15600, in almost as efficient a manner as could be done by using PRINT @ 240, X in BASIC. The pre-game ceremonies are now complete. Let's get the playing field ready.

In order to print X, we used the following assembly language program:

```
00100 ORG 7F63H ;STORE AT 32
01110 LD A,5H ;"X" = 56 = 56H
00120 LD (3CFOH),A ;SCREEN LOCA
01130 JP LOOP ;ENDLESS LOOP
00140 TICN 15600=3CFOH
00150 LOOP JP LOOP
```

We're going to substitute some TRS-80 graphics characters for X, and put them in other screen locations. Otherwise, we have all the assembly language statements needed to put a gridiron on the field.

We want a double-width sideline, extending from screen position 15744 (PRINT @ 384) through 61 tab positions to screen position 15805. We could write:

```
LD A,63H ;CHR$(121)
LD (3D80H),A ;SCREEN POSITION 15
744 = 3D80H
LD (3D81H),A ;SCREEN POSITION 15
745 = 3D81H
LD (3D82H),A ;...and so on.
```

We would be awfully tired of entering code by the time we finished. A loop is better. In BASIC, we would write:

```
100 FOR I = 384 TO 444
110 PRINT @ I, CHR$(121)
120 NEXT I
130 PRINT
```

No FOR...NEXT routine exists in assembler. Accordingly, we must set up a loop counter. Use register B for that purpose, load it with the value 61, decrement it by one each time the loop is executed, and exit the loop when it is down to zero. Could we have started at zero and exited at 61? Sure; but as you'll see, assembly language contains a convenient test for zero, but none for 61.

We need to increase the screen position by one each time the loop is executed. Load the two byte HL register pair initially with 15744, and it will be up to 15804 when we exit the loop.

We need three new statements:

```
DEC B, which means: Decrement the value in the B register by one.
INC HL, which means: Increment the value in the HL register pair by one.
JP NZ, (address), which means: Jump to the stated address if the result of the last operation was not zero.
```

If the last operation was DEC B, the value in the B register would be zero after 61 loops. Thus, if "address" is the place in memory at which the first statement of the loop is stored, the program would execute DEC B, test for zero, and go back to "address" 61 times, before falling through the loop on the 62nd attempt.

One way to figure out what address to use would be to count the machine language codes used prior to the address and set the next one for the first statement in the loop. But, we used a label in our PRINTX program to permit EDTASM to compute this address for us, and we'll do the same here. A label called LOOP1 will show where the 61-iteration loop begins, and LOOP2 will be used to set up an endless loop while we look at the result.

Reload EDTASM, and enter the text appearing in Listing 1. I have changed the ORG address; we're going to need more room.

Assemble the program, record it on cassette, go back to BASIC, set memory size to 32570, load the machine code as NONAME using the System command, and enter / 32571 following the prompt. It works! Or does it? That doesn't look like the right place on the screen. Go back and check the text. Have you found the error? 15744 decimal is 3D80H, not 3C80H.

This is one of the most common errors made in assembly language, other than typos. Check the decimal to hex conversions, and then check them back, hex to decimal. Fortunately, it's easy to fix, using EDTASM's edit routine.

Reload EDTASM and the text (using L). Now let me warn you of another EDTASM idiosyncrasy—tapes don't always load. You set EDTASM up to read the text back in, push all the right buttons (and maybe some wrong ones), and the next thing you know, there are unblinking asterisks and the other signs of a bad load. You push the reset button, right? Wrong! If you do, you'll lose EDTASM, and have to read it back in again. Somehow you have to get EDTASM to cough up an error message. Rewind the tape, and continue the read. Wait until the bad parameters message appears (who thought that one up?), and then start your load again.
"EDTASM will also renumber the lines automatically, starting wherever you wish..."

Enter E130, space over to the offending C, press C (for change), and put in a D. We can now go on to the other sideline.

Enter D180 and D190. Line 180 was a temporary endless loop for demonstration purposes, and line 190 is no longer the end. The lower sideline is almost a carbon copy of the upper, as shown in Listing 2.

Did you catch that error? We forgot to reset the loop counter to 61. Press Break, enter H185, and add line 185 to read:

00185 LD B,3DH $61 LOOPS

This is like adding a new line to a BASIC program; though it was entered last, it will execute in the proper order. EDTASM will also renumber the lines automatically, starting wherever you wish and using whatever increment you prefer. To do that, enter N100, if you want to start at 100 and increment by the default value of 10. Or, enter N500,100, if you want to count by 100's from line 500.

Cleaning Up The Text

We have a section of code which will draw the upper sideline, and another section which will draw the lower sideline. Let's put descriptive labels on them, and separate them by a few spaces.

Enter T90,1 to insert lines at line 90 with an increment of one. Then enter lines 90 through 92:

00090;
00091: UPPER SIDELINE
00092:

Listing 1. Top Sideline

<table>
<thead>
<tr>
<th>Line</th>
<th>ORG</th>
<th>7F3EH</th>
<th>;STORE AT 32571</th>
</tr>
</thead>
<tbody>
<tr>
<td>88186</td>
<td>LD</td>
<td>A,3BH</td>
<td>;CHRS(131)</td>
</tr>
<tr>
<td>88187</td>
<td>LD</td>
<td>B,3DH</td>
<td>;61 LOOPS</td>
</tr>
<tr>
<td>88188</td>
<td>LD</td>
<td>HL,3CH</td>
<td>;SCREEN POSITION</td>
</tr>
<tr>
<td>15744=3CH8H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88189</td>
<td>LOOP1</td>
<td>LD</td>
<td>(HL),A</td>
</tr>
<tr>
<td>88190</td>
<td>INC</td>
<td>ML</td>
<td>;SCREEN POSITION + 1</td>
</tr>
<tr>
<td>88191</td>
<td>DEC</td>
<td>B</td>
<td>;COUNTER - 1</td>
</tr>
<tr>
<td>88192</td>
<td>JP</td>
<td>NE, LOOP1</td>
<td>;BACK TO 'LOOP' IF NOT</td>
</tr>
<tr>
<td>88193</td>
<td>LOOP2</td>
<td>JP</td>
<td>LOOP2</td>
</tr>
<tr>
<td>88194</td>
<td>END</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Listing 2. Bottom Sideline

<table>
<thead>
<tr>
<th>Line</th>
<th>ORG</th>
<th>7F3EH</th>
<th>;STORE AT 32571</th>
</tr>
</thead>
<tbody>
<tr>
<td>88195</td>
<td>LD</td>
<td>A,3BH</td>
<td>;CHRS(176)</td>
</tr>
<tr>
<td>88196</td>
<td>LD</td>
<td>HL,3FH</td>
<td>;SCREEN POSITION 16256</td>
</tr>
<tr>
<td>88197</td>
<td>LOOP3</td>
<td>LD</td>
<td>(HL),A</td>
</tr>
<tr>
<td>88198</td>
<td>INC</td>
<td>ML</td>
<td>;SCREEN POSITION + 1</td>
</tr>
<tr>
<td>88199</td>
<td>DEC</td>
<td>B</td>
<td>;COUNTER - 1</td>
</tr>
<tr>
<td>88200</td>
<td>JP</td>
<td>NE, LOOP3</td>
<td>;BACK TO 'LOOP3' IF NOT</td>
</tr>
</tbody>
</table>

Do the same thing before the code for the lower sideline, using new lines for this purpose. Then use N100,10 to renumber everything. After you hit A, the text ought to look like Listing 3.

End Zones

Has it occurred to you that we could have combined Listing 1 and 2 into a single loop of 61 iterations? Let's try to draw the double-width lines in the end zones in a single routine. One line should start at screen position 15744 (PRINT @ 384), and extend downward for nine screen lines. We want a similar line five tab positions to the right, another 51 tab positions to the right of the second line, and then still another five tab positions to the right of the third.

We can't efficiently INC HL five times, much less 51 times; we need to add to the screen position contained in HL:

LD DE,HL
ADD HL,DE, which means "Load the value 5 into register pair DE. Then add the contents of DE to whatever is already in register pair HL."

We could later add 51 to HL in the same way. Five and 51 are one byte numbers. They can't be stored in register A, and then be written ADD HL,A because if one is a register pair, the other must be also. Could we have written ADD HL,5H, intending to add the value directly to HL? No. Why? Who knows?

Listing 4 demonstrates what we can write. Start with 15744 in HL, add 5, add 51,
"Our amateurish, inefficient program put the football field on the screen so fast you couldn’t time it."

add 5, and then add 3. Start another iteration of the loop without changing the contents of HL: 5 + 5 + 5 + 3 = 13. By adding the final three, we adjusted HL to the value of the screen position which starts the next screen line.

The yard lines on the left side of the field are drawn by the repetitive use of CHR$(170). On the right side, they use CHR$(149). The 50-yard line is double-width: That will be automatic if we use CHR$(170) at tab position 30 and CHR$(149) at tab position 31. At the top and bottom the yard lines will write over the sidelines. We will therefore need L shaped characters at the point of intersection.

In Listing 4 there was a lot of repetition; ADD HL,DE and LD (HL),A had to be written three times. In BASIC, we would have used a subroutine, and we can do the same thing in assembler:

CALL 2136H, which means: Jump to the subroutine at memory location 2136H, do whatever those instructions say, and return when instructed.

Then write the subroutine instructions, and return by writing:

RET, which means the same as RETURN in BASIC.

Better yet, we can use a label at the point the subroutine begins. Just as in looping, EDTASM will determine its address for us.

We want to use a double loop. The outer loop should provide the seven iterations necessary to draw the vertical yard lines and the inner loop should provide the five iterations needed to draw five lines. Use register C as an additional loop counter. Listing 5 contains the text.

The yard lines on the right half of the screen are a mirror image of those on the left; the only other task is to join the yard lines to the sidelines. We need L shaped characters at the intersection of the yard lines with the sidelines: CHR$(171) in the upper left, CHR$(186) in the upper right, CHR$(151) in the lower left, and CHR$(181) in the lower right.

Finally, place an endless loop at the end of the program so we can see the results on the screen. Listing 6 shows the complete program after assembly.

We have noted a few programming techniques which might have been done in easier ways, by combining loops, and through use of subroutines. There are many other improvements we might have made to save operations and key strokes. Show this program to an accomplished assembly language programmer: he’ll tell you how bad it really is.

Let’s run it, bad though it may be. Record the machine code (after using A) and then use W to record the text. Exit EDTASM, using B. Enter 32570 as the memory size, and load NONAME, using the system command. When the prompt appears, get your stopwatch ready to time it (BASIC took 3.4 seconds, you’ll recall). Now enter /32571 to run the assembly language version.

That stopwatch wasn’t much help, was it? Our amateurish, inefficient program put the football field on the screen so fast you couldn’t time it. If you want speed, this is the way to get it!

Memory Requirements

Go back to Listing 6. Note the first column of numbers; these are the hex representations of the places in memory in which this program is stored. The first is 7F3BH, or 32571 decimal. The program starts there because we told it to, using ORG. Look at the second column. These are the hex representations of the data stored at these memory locations. Some are instructions; some, especially those requiring two byte numbers, require three codes to store. Some powerful instructions require only one byte. The memory locations in the first

Listing 3. The Complete Sidelines Program

Listing 4. End Zones

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```
08510: ;CHR$(176)
08520: ;\n08530: ;\n08540: LD A,RAAN ;\n08550: LD B,7H ;\n08560: LD HL,3DAH ;SCREEN POSITION 15818=DC
08570: AH
08580: XOR A ;OUTER LOOP
08590: LD DE,5H ;INCREMENT OF 5
085A0: LD C,5H ;INNER LOOPS
085B0: LD DE,5H ;\n085C0: LD C,5H ;\n085D0: LOOP7 CALL SUBRT ;\n085E0: DEC C ;\n085F0: JP NZ,LOOP7 ;\n08600: LD DE,2AH ;BACK TO 'LOOP7' IF NOT ZE
08610: DEC B ;\n08620: ADD HL,DE ;INCREMENT OF 9
08630: JP NZ,LOOP6 ;SCREEN POSITION + 9 (NEW LINE)
08640: DEC B ;\n08650: ADD HL,DE ;\n08660: JP NZ,LOOP6 ;BACK TO 'LOOP6' IF NOT ZE
08670: SUBRT ;INNER COUNTER - 1
08680: ADD HL,A ;LOAD CHARACTER INTO SCREE
08690: RET
086A0: RETURN TO INSTRUCTION FOLLO
```

Listing 5. Left Yardlines

Using the Program as a BASIC Subroutine

Now we have a machine language program; how do we hook it up to a BASIC program?

Reload the text using ETASAM, and replace lines 1330 and 1350 as follows:

```
01330: ;RETURN TO BASIC
01350: ;RETURN TO BASIC
```

CALL will be part of the BASIC program.

Record the revised program after reassembly, exit ETASAM, and load NO-

NAME as before, being careful to set memory size to 32570. Enter the BASIC program shown in Listing 7.

Run it—it works. Those two POKEs put the starting address of the machine language subroutine into the BASIC monitor (as usual, it's done the hard way). The starting address was 32571, or 7F3BH, a two byte number in hex. The most significant byte—the one that really counts in evaluating the size of the number—is 7F. The least significant byte is 3B. Now reverse them (don't ask me why) and you get 3B, 7F. Translate them into decimal and you get 59, 127, which is what you POKEd into 16526 and 16527. That's all you do to set up the starting address.

To call the subroutine, write X = USR(0) and it's done. Note also that we finally cleared the screen in line 100, and that line 170 prevents the screen from scrolling when the end of the program is encountered.

Using Data Statements Instead of System

Loading machine code through the System command may be confusing to users of your football game. To make it easier for them, there's another way of mak-

column increase by one, two or three, depending on the number of bytes required by the previous instruction.

Some instructions require no code (ORG and END are examples). The labels used are listed at the end of the assembly, each with its computed location in memory. These are not translated into code: all are used in assembly, but neither they, nor the line numbers, nor explanatory comments, actually require memory space after assembly. The last memory location is 7FEAH, or 32746 decimal, which means the entire inefficient program will require 176 bytes of machine code. In contrast, the BASIC program shown in Part I required 374 bytes.
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- Each key has a sound that plays when the key is pressed
- The character codes are registered to the memory

Saving Memory

We're using a lot of memory—more, even, than the original BASIC program we used to draw the same graphics. We must protect a minimum of 174 bytes of high memory to store and operate the subroutine. Lines 10 through 70 in Listing 8 require an additional 626 bytes. This may be important, but more likely you're subject to Parkinson's Law of Programming, and you need every byte you can find.

By adding a line to the code in Listing 8, we can save 626 bytes. Try this:

99 DELETE 10-99

Run it: All you get is a READY and a prompt. Run again—there's our field. Now LIST—lines 10 through 170 are all that remain (the machine code must still be in 32571 through 32744, or there would be no field).

What happened? Lines 10 through 70 were executed in the usual way, with 174 bytes POKEd into high memory. When the computer encountered DELETE 10-99, it did as it was told, and lines 10 through 99 self-destructed. The program then halted, awaiting instructions from the keyboard. You told it to run, and it did—beginning at

Listing 6. Complete Program

```
A
00100 :
00110 :
00120 :
71F3B
71F38
73F3 3E83
73F3 D63D
73F3 218B3D
71F3B
70 F42 F5 45
F45 2247F
0F1 F6 NOT ZERO
F48 3E8F
F44 6D3D
F4C 218B3F
UPPER SIDELINE

<table>
<thead>
<tr>
<th>CHAR</th>
<th>LOAD</th>
<th>SCREEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>63H</td>
<td>1CHRS (313)</td>
</tr>
<tr>
<td>B</td>
<td>30H</td>
<td>+61 LOOPS</td>
</tr>
<tr>
<td>H</td>
<td>38H</td>
<td>+SCREEN POET</td>
</tr>
<tr>
<td>N</td>
<td>1,1A</td>
<td>+LOAD 131 IN</td>
</tr>
<tr>
<td>D</td>
<td>58H</td>
<td>+LOAD 0</td>
</tr>
<tr>
<td>L</td>
<td>2,25H</td>
<td>BACK TO 'LO</td>
</tr>
</tbody>
</table>

LOWER SIDELINE

<table>
<thead>
<tr>
<th>CHAR</th>
<th>LOAD</th>
<th>SCREEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>38H</td>
<td>+1CHRS (176)</td>
</tr>
<tr>
<td>B</td>
<td>30H</td>
<td>+61 LOOPS</td>
</tr>
<tr>
<td>L</td>
<td>3F8H</td>
<td>+SCREEN POET</td>
</tr>
</tbody>
</table>

Program continues
```
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7F49 77 0027B LOOP3 LD (HL),A ;LOAD 176 IN
7F5E 23 0028B INC HL ;SCREEN POS1
7F51 05 0029B DEC B ;COUNTER - 1
7F52 C3A7F0 0020B JP NZ,LOOP3 ;BACK TO 'LO
OP5 IF NOT ZERO 0031B END Zones
0032B 0033B ;
7F55 3EBF 0034B LD A, #8FH ;CHR(191)
7F57 06F9 0035B LD B, #9H ;9 LOOP
7F59 21B33D 0036B LD HL, #3DH ;SCREEN POS1
7F5C 77 0037B LD (HL),A ;LOAD 191 IN
7F5D 110500 0038B LD DE,5H ;INCREMENT O
F 5 7F60 19 0039B ADD HL,DE ;SCREEN POS1
7F61 77 0040B LD (HL),A ;LOAD 191 IN
TO SCREEN 7F62 113300 0041B LD DE,3H ;INCREMENT O
F 51 7F65 19 0042B ADD HL,DE ;SCREEN POS1
7F66 77 0043B LD (HL),A ;LOAD 191 IN
TO SCREEN 7F67 110500 0044B LD DE,5H ;INCREMENT O
F 5 7F6A 19 0045B ADD HL,DE ;SCREEN POS1
7F6B 77 0046B LD (HL),A ;LOAD 191 IN
TO SCREEN 7F6C 110300 0047B LD DE,3H ;INCREMENT O
F 3 7F6D 19 0048B ADD HL,DE ;SCREEN POS1
TO SCREEN PLUS 3 (NEW LINE) 7F6E 05 0049B DEC B ;COUNTER - 1
7F71 C257F 0050B JP NZ,LOOP4 ;BACK TO 'LO
OP4 IF NOT ZERO 0051B ;
0052B 0053B ; YARDLINES (LEFT HALF)
7F74 3EAA 0054B LD A, #AAH ;CHR(199)
7F76 06D7 0055B LD B, #7H ;7 OUTER LOOP
PS (EXCLUDING TOP AND BOTTOM SIDELINES) 7F78 21CA3D 0056B LD HL, #3CAH ;SCREEN POS1
7F7D 15818=3DCAH 0057B ;
0058B 0059B ; OUTER LOOP
7F7B 110500 0060B LOOP6 LD DE,5H ;INCREMENT O
F 5 7F7E 0050B 0061B LD C,5H ;5 INNER LOOP
PS 0062B 0063B ; INNER LOOP
0064B ;
0065B ; LOOP7 CALL SUBRT ;SUBROUTINE
7F83 0D 0066B DEC C ;INNER COUNT
ER - 1
7F84 C2807F 0067B JP NZ,LOOP7 ;BACK TO 'LO
OP7 IF NOT ZERO 7F87 112700 0068B LD DE,2H ;INCREMENT O
F 39 7F8A 19 0069B ADD HL,DE ;SCREEN POS1
TO SCREEN + 39 (NEW LINE) 7F8B 0070B DEC B ;OUTER COUNT
ER - 1
7F8C C27BF 0071B JP NZ,LOOP6 ;BACK TO 'LO
OP6 IF NOT ZERO 0072B ;
0073B 0074B ; YARDLINES (RIGHT HALF)
7F8F 3E05 0075B LD A, #5H ;CHR(149)
7F91 0607 0076B LD B, #7H ;7 OUTER LOOP
PS (EXCLUDING TOP AND BOTTOM SIDELINES) 7F93 21DF3D 0077B LD HL, #3DFF ;SCREEN POS1
7F94 15839=3DE8 0078B ;
Program continues
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"Don't expect to read the EDTASM manual as you would a detective novel."

the first remaining line.

You can use a controlled crash like this to be doubly sure that the user remembered to set the memory size. Add the following lines to the program:

80 CLS : PRINT "IF 'MEMORY SIZE?' WAS ANSWERED '3250',": PRINT "TYPE 'RUN' AND PRESS 'ENTER'": PRINT "OTHERWISE, START AGAIN"

This, of course, will also self-destruct, and the total memory requirement for the graphics routine is now 174 bytes, plus the controls in lines 140 through 160.

If you want to go on in machine language, you're now ready to read and understand any of the several excellent texts available at your local computer store. Don't expect to read the EDTASM manual as you would a detective novel; it wasn't really intended as an instruction text in the first place.

I think you'll want to go further, if for no other reason than to save yourself trouble by using more powerful instructions. You can use assembly language without knowing very much about it. And the way to learn a lot is to begin by learning a little.]

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80 Microcomputing, June 1981 • 121
Suburban police departments computerize, then network, in their fight against crime.

Dragnetwork

Alicia Kennedy
5030 N. Sheridan Road
Suite 1906
Chicago, IL 60660

Why a microcomputer network? Perhaps when the chief of a small Illinois police department purchased his TRS-80 Model I, he had not thought of the possibility of a network.

Ironically, about a year later, through personal determination and exploration, he and several neighboring departments found themselves joined together to form what is believed to be one of the few suburban microcomputer networks in the country. Presently the chief is active in educating other department audiences on the how-to’s of the microcomputer communications networks.

Originally purchased as the department’s “Boy Wonder,” the 80 was intended to alleviate administrative procedures. The department later discovered that pertinent files could be maintained to graph and plot crime tendencies in addition to tracking down offenders.

Word of the project has spread to surrounding police departments, who have since become the elements of a microcomputer network, joined by phone modem. Ultimately, about eight Du Page County Illinois police departments hope to join the network.

Though the I.B.M.s and Honeywells may shine in the blinding path of computer technology, the microcomputer could be considered the progeny of the computer sensation. When the Hanover Department decided to expand their system, they were able to accommodate their own needs while also staying within the department’s minimal budget.

Components and Cost

This network, constructed by the police department, uses a host multiplexer (a device that can provide multiple I/O to a computer) and a disk drive. Installing the Corvus IIT Disk Drive and Constellations proved to be a wise decision. The multiplexer enables two or more microprocessors to share the same data base simultaneously. The data base, or drive in this case, stores ten million
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Unlike other high speed tape input devices, FASTLOAD uses standard format cassettes. Therefore, there is no need to re-record on other media. At 8000 baud, FASTLOAD is faster than disk for short programs. FASTLOAD reads tapes at the fast-forward speed of the CTR-41 cassette recorder. The recorder can also be used for CSAVE at the normal speed.

FASTLOAD connects to the 40 pin I/O or to the Expansion box. The control program does not use computer memory because it is in a built-in PROM. Other valuable features are keyboard debounce program, automatic key repeat routine and keybeep via cassette speaker. Price is $188.00 for FASTLOAD and $95.00 for the modified CTR-41 recorder.

Personal Micro Computers Inc.
475 Ellis Street, Mountain View, CA 94043 (415) 968-1604

*TRS-80 is a trademark of Tandy Corp.
bytes of information—all of which are accessible within seconds to each and every computer involved (The data rate transfer is a little over 50 kilobytes per second.).

The Constellation's eight ports will allow up to eight computers to feed into the disk drive. However, eight Constellations can be chained to a single Corvus Drive allowing up to 64 computer connections. The drive interfaces to the TRS-80 via a card and an expansion cable.

The Constellation and drive give maximum performance in a minimal space (a little over a cubic foot for both). Chips in the Constellation decipher the various departments and allow each computer to talk to the drive. Information is transferred within a matter of seconds, the Constellation acting as a core to which microprocessors are connected in a "celestial" fashion. Four drives may be connected in any combination of 10 and 20 megabytes.

Enlisting components like the Corvus Drive and Constellation may prove to save thousands. The Drive is equivalent to 94 Radio Shack disk drives, each of which cost $499. Even if you could fit 94 disk drives to the Model I, it would cost approximately $46,000. The 10 megabyte Corvus Drive lists for approximately $5,350. The Constellation, which allows multiple entry on all programs stored on the disk, lists at a price of $750.

Twenty megabyte drives are available for approximately $6,400.

Should the disk become filled, there is another device, the Corvus Mirror, which inexpensively stores 100 Megabytes of information. The Mirror uses a two-hour video cassette tape. Ten million bytes of information can be transferred in less than 15 minutes. Besides its backup capability, the Mirror can be used for retrieving any file or program within minutes, without operator intervention.

It's apparent that the small businessman will no longer have to wonder how to afford microcomputer precision through interfacing. Microcomputer networks will become as common as the calculator.

Fig. 2
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See List of Advertisers on page 306
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Complete instructions and sample schematics are included to help you design your own simple stand-alone microcomputer systems. THESE SYSTEMS CAN BE AS SIMPLE AS FOUR ICs, one TTL circuit for clock and reset, a Z-80, an EPROM, and one peripheral interface chip.

When the In-Circuit-Emulation cable is plugged into the Z-80 socket of your stand-alone system, the system becomes a part of your TRS-80. You can use the full power of your editor/asseller’s debug and trace programs to check out both the hardware and the software. Simple test loops can be used to check out the hardware, then the system program can be run to debug the logic of your stand-alone device.

Since the program is kept in your TRS-80 RAM changes can be made quickly and easily. When your stand-alone device works as desired, you use the Development’s PROM PROGRAMMER to copy the program into a PROM. With the PROM, and a Z-80 in place of the emulation cable, your stand-alone device will work by itself.

The DEVELOPMATE is extremely compact. Both the PROM programmer and the In-Circuit-Emulator are in one small plastic box only 3.5" x 5.4". A line plug mounted power supply is included. The PROM programmer has a "personal" module which defines the voltages and connections of the PROM so that these devices can be accommodated directly. However, the system comes with a universal personality module which handles 2756, 2764,81, 27616, 2716, 2516 (16K), 2532 (32K), as well as the new electrically alterable 2764 and 48016 (16K EPROM). The COMPLETE DEVELOPMATE I with software, power supply, emulation cable, TRS-80 cable, and universal personality module, is ONLY $329. The PROM PROGRAMMER is available separately for ONLY $239.

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LDOS is the latest generation of sophisticated operating systems for the TRS-80 computers. LDOS is completely documented in a 252-page reference manual. Total support is provided from some of the most knowledgeable people in the industry. You owe it to yourself to investigate this system. Call or write for details. LDOS is priced at $184 plus $4 S&H.

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Application in Real Time

Russell M. Genet
Fairborn Observatory
1247 Folk Rd.
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Some of you probably work in an environment where you monitor a complex, real-time control task that can be more efficiently handled by a computer. While some organizations remain in the dark ages, monitoring such tasks with relays and mechanical timers, many have discovered dedicated microprocessors with their high speed machine language controls stored in ROM.

Still others have discovered microcomputers, such as the TRS-80, that can handle control requirements in BASIC without resorting to machine language at all.

While I'd love to show you how I use an '80 to control my oil refinery in Houston, you'll have to settle for my application at the Fairborn Observatory, where it helps me take photoelectric measurements of the color and brightness of variable stars.

Interface

Since the TRS-80 can't be directly connected to machinery, nor does it provide for remote communication to an operator, some sort of interface is required.

The ideal interface would be low in cost, have just a few chips, be convenient to modify, easy to check for proper operation via built-in indicators, and would come in a nice looking cabinet. Also, it ought to handle the remote communications, have a built-in clock, and relieve the TRS-80 of mundane tasks like counting.

Fortunately, the state of the art in programmable peripheral LSI interface chips is such that these requirements are easily met with an interface of just a half dozen chips. The port structure of the TRS-80 makes this job straightforward, and the peripheral chips can be programmed and controlled in BASIC. The data lines on all the good LSI peripheral chips are tri-stated, so that they can be connected to the TRS-80's bus without buffers. In the smaller control interfaces, address decoding is not required, as address lines A4-A7 (after inverting) can be used directly as the CS signals for the LSI chips.

To interconnect the chips within the interface, one could, of course, develop a PC board, run off a thousand, keep one and toss 999. But, for this project there is really nothing wrong with sticking some breadboard sockets together or wirewrapping on a perf board, as long as one doesn't forget to put it all in a nice looking cabinet!

A 40 pin DIP jumper to the breadboard interface on one side, and an edge card connector to the computer on the other joins the two; another DIP jumper and long cable connect the interface to the operators and machines.

In the Observatory

The initial system at the observatory was entirely manual. As observations were made, starlight output was recorded on a strip chart recorder. Annotations were written by hand to identify the star, time, and filter color. Not only did this use up clear weather observing time (a very scarce resource in Ohio), but, the next morning, it actually took longer to read the strip chart and make the required data reductions than it did to make the observations the previous night.

When the backlog of unreduced strip charts piled up in a run of good weather, I used to hope for bad weather just so I'd have a chance to catch up.

After some thought, I decided that here was a situation for a real-time computer.

I rated all the available computers against pre-established criteria. I was almost disappointed when the TRS-80 was the clear winner. Who would believe that something you could buy at the corner store was the best choice for this exotic, astronomical, control task venture? Except for its inability to stand out from the computer crowd, I never regretted the choice and enjoyed a surprise dividend in terms of local experts and readily available equipment.

In the interface I designed, an Intel 8255 Programmable Peripheral Interface (PPI)
LSI chip controls input from the keypad encoder. It also issues and receives timing and other commands using the bit set/reset features of Port C. Two Intel 8253 Programmable Interval Timers (PIT) LSI chips provide the precision timing signals, control counters and timers.

Each PIT chip contains three, independently controlled, computer set, 16-bit counters. Each counter can be operated in one of five different modes.

The system is relatively idiot-proof. As darkness falls, the operating program is loaded into the computer, and the month and Julian date are also entered. The video monitor in the computer room is turned off, along with the lights, and the door is locked for the night. (The first night, I sneaked a peek to see if the printer was really working.)

Meanwhile, out in the observatory, once the remote video monitor warms up, the main menu is displayed. As the seconds tick in the clock, the interface is set against the tick from the National Bureau of Standards radio station WWV. This is exact to within a thousandth of a second. Once the seconds are synchronized with WWV, the program returns to the main menu and the clock is then set "at the tone."

The first star pair is selected from a displayed list and a controlled sequence

---

**Photo 2:** The main menu shows the functions the observer can select. Once a function is completed, control automatically goes back to the main menu so another function can be selected.

---

**Fig. 1:** The small interface ties the TRS-80 to the observatory some 60 feet away. A hand held hexadecimal keypad and remote video monitor provide observer/computer communications. Starlight falling on the photomultiplier is amplified and converted to digital pulses in the voltage-to-frequency (V/F) converter.

---

**Fig. 2:** The complexity of the interface is minimized by using programmable interface chips that connect directly to the TRS-80 bus. The top 8253 is used as a clock divider and software setable delay (1 ms steps), while the second 8253 counts up the pulses from the photometer, controls the integration time (software setable), and keeps track of the time. An 8255 provides parallel I/O, and an encoder and clock oscillator round out the interface.
asked for. The computer tells the operator which star to record and where to set the knobs and levers. Once this is done, the “go button” is pressed and the computer takes full control.

Displays Light Curve

As the TRS-80 records the light from the star, it displays the light curve on the monitor—twinkles and all. A thin, unnoticed cloud drifting by will cause the line on the display to go bananas, which is a hint to the operator that when the TRS-80 asks him what to do with the observation, he should either repeat or terminate, not data ok, continue.

As each observation is made, it is added to a matrix displayed on the monitor. It is easy then to see if, on the last observation, the operator, somewhat sleepy and cold at 2 am, forgot to flip a mirror or change a filter. He has a chance to repeat the observation before a bad one ruins the whole sequence.

At the end of each sequence, the printer is ordered to print the raw data for the record. The data is then reduced by the computer right on the spot and results printed and displayed.

The computer also includes a statistical analysis of the sequence, giving the operator nearly instantaneous feedback about the weather. If the night is bad for photometry, it’s nice to know after the first star. One can then hang it up, instead of charging along until the wee hours, only to find the next day, after hours of data reduction, that it really was a hopeless night.

If you have a complex real-time control task eating your lunch that would be better handled by a computer, you ought to consider seriously the TRS-80 and an adaptable interface. Be forewarned, however, that you can quickly become addicted to the efficiency, flexibility, and power of a full computer operating in a high level language. It may become the most important “person” on your staff.

Photo 3. The “brain” of the Fairborn Observatory is an unattended TRS-80 and small six-chip interface designed by the author. Once the program is loaded, the video monitor is turned off and control is maintained from the telescope, some 60 feet away.

---

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See List of Advertisers on page 306

80 Microcomputing, June 1981 • 129
A new level of sophistication for disk-equipped Model Is.

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$149

First of all, let me relieve the suspense by stating that, in my opinion, LDOS is by far the best disk operating system (DOS) currently available for the Model I TRS-80.

I've owned a TRS-80 disk system for some time and have had the opportunity to play with ULTRADOS, two versions of NEWDOS, two version of VTOS, two of DOS PLUS (including DOUBLE-DOS), and three of TRSDOS. So my statement is based on solid experience.

I'll evaluate the two major aspects of a DOS, its user support (including documentation) and the DOS itself.

Documentation

The current official version of LDOS documentation (Ldocs) is 253 pages which, according to Bill Schroeder of Galactic Software, LDOS project leader, took about one and a half years to write. It's broken down into sections which describe the features and commands of the system for the everyday user, and sections with specialized technical information for the systems level programmer.

Every command has its own section in the documentation and each of these sections has its own sequence of page numbers. The manual lacks an index, and the repetitive numbering scheme may make it difficult to provide one in the future.

The writing style is a little more technical than it needs to be. For instance, tracks are usually referred to as cylinders, and hexadecimal numbers are shown in the old Data-point format—for example 5C00H is shown as X'5C00'. But no one should be stymied by the language, thanks to the numerous examples. For instance, two pages deal with Purge and include five specific examples showing how it is used with its various parameters, and detailing the results in each case.

Similar explanations are also provided for key LDOS concepts, such as the nature of logical devices, device independence, partial filespecs, and wild-card characters. For example, I learned that a phantom device does not relate to ectoplastic displays; it refers to a technique that allows you to link two devices which ordinarily can't communicate directly. This is done by creating a third logical device to act as a bridge. I also learned that a device-independent DOS is an operating system that allows executive commands relating to I/O routing to override subsequent I/O routings specified at lower command levels. What this means is that you can do tricks like having LPRINTs go to a disk file or the video, instead of a printer, which is quite handy when you have no printer available.

A sampling of information in the Ldocs technical section includes such goodies as maps of system entry points, (including some in Level II ROM), explanations of the directory, Device Control Blocks (DCB's), File Control Blocks (FCB's), and file formats.

This section also contains comprehensive explanations of the more arcane features of the DOS. A case in point: FILTER is a command that was introduced by VTOS 4.0, but with little information on what to do with it. LDOS also has FILTER. The documentation has over a page of information on how to use it, including several examples. And further, the feature section includes an additional page and a half of commentary, plus five pages of commented, assembled source listings that demonstrate how to write your own filter routine.

Finally, Ldocs also contains a five-page glossary and a six-page error dictionary which goes through each of the 41 LDOS error messages.

Other Aspects of User Support

The LDOS team has taken an interesting approach to the piracy problem. There is no special protection against backing up the LDOS master disk, nor are the Ldocs printed in copyproofof turquiose. Instead, LDOS offers extensive customer support, and does its best to make it available only to registered purchasers of LDOS. Here's how:

● The LDOS development team is constantly working on upgrades and patches. Any certified user may send in his/her master disk, plus return postage, and, for no additional charge, receive the latest version of LDOS by return mail.
● A newsletter containing suggested uses for LDOS features and offering new patches will be mailed quarterly to registered users only.
● Valid users have access to an LDOS bulletin board on Micronet.
● A toll free number exists for the sole purpose of user support, not ordering. If you have questions about LDOS, or are experiencing difficulties, you can call this number and provide the LDOS consultant with your name and valid registration number.

I tested the LDOS customer service number to check on the quality of their assistance. I asked a technical question and was
You owe yourself some fun time and you have just loaded the new Star Warrior into your computer. Suddenly, you are one of the Furies... and retribution is your business.

The Interstellar Union of Civilized People has been annexed by a soul-crushing dictator. You have been given the mission to destroy the installation. That’s Scenario 2.

In Scenario 1, you are on a diversionary mission for the assassination attempt. You want to do as much damage to the enemy units as possible.

The terrain is dangerous and difficult; the enemy forces are powerful and varied. (You may not see the enemy even when you are both in the same general area... but, on the other hand, the enemy may not see you either.) There is always the chance of an attack by an invisible enemy.

There are two scenarios and five levels of difficulty... level three is almost impossible to win. There are usually no fixed playing times for Scenario 2; you play until you get the governor and the attack is started. But you can vary fixed playing time in Scenario 1.

You have the choice of suits and equipment, and of movement and special commands.

In other words, like all EPX games, there are enough variations in the game so that you will never tire of playing. Each game is different and fresh. You will never get bored playing the game. Not in your or your computer’s lifetime.

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soon speaking to one of the members of the
LDOS development team. Aside from knowing
his subject thoroughly, he had good
communication skills and did not try
to make me feel like an idiot for knowing less
than he. I asked what their reaction would
be if I were to unearth a major bug in their
system. He told me that if anyone reported
a repeatable failure of LDOS to perform as
documented, the problem would be ad-
dressed immediately and a remedial patch
developed within days. Any users who had
reported the problem would be called back
given the fix. Others would be informed
through the newsletter. Of course, the error
would be zapped for all future releases.

DOS Features

The features of LDOS are too numerous
to relate in-depth. Instead, I will touch upon
a number of items which I especially like,
and then move on to some of the major fac-
tors which I feel make LDOS really out-
standing.

LDOS offers various changes and im-
provements to the TRS-80 keyboard re-
sponse. Debounce is, of course, one of
them. So is auto-repeat. A key-stroke multi-
ply (KSM) package allows the user to cus-
tom define the keys. In this connection, the
clear key is used as a special control key.
Shift, down arrow functions as a standard
control key. If your system hangs up during
disk operation because you forgot to insert
a disk in drive 0, or close the drive door,
etc., LDOS allows you to correct the situa-
tion by pressing Shift Break to restart the
drive, thus allowing I/O to resume.

During a system boot, depressing clear,
not quite as handy for disk editing as one of the ZAP family monitors because the user has to load the information off disk, alter it in memory, and then write it back to disk. There is also a sort of mini-monitor available right from the DOS, via the Memory command. LDOS honors HIGHS, which means that it protects programs in high memory, as does BASIC. Memory tells you the current HIGHS (Memsized reserved or, you can use it to set HIGHS to a new value. You can also use Memory to inspect any word in memory or to alter any byte or word in RAM. And you can use Memory to jump directly from DOS to any specified address. I think this mini-monitor is one of LDOS's fine touches.

Major Features
LDOS offers a surprisingly comprehensive Job Control Language (JCL), extended device independence, and a wide spread acceptance of partial filespecs (with wildcard characters).

The way the system handles defaults for file name extensions is an excellent example of how LDOS was designed to support sophisticated users while making things as simple as possible for the beginner. Consider a case familiar to all TRS DOS veterans. I have a machine code business applications package saved on my disk under the file name INVADES/CM (all right, so it's not a business program). If I want to run it, I have to enter its name, but I don't have to type the /CMD at the end. The system fills that in for me as a default extension. Likewise for DUMP and /CIM.

LDOS provides many automatic default extensions not found in other DOSs. Suppose I enter the command LIST REVIEW. Because .TXT is the default extension for LIST, the system searches for a file called REVIEW.TXT. However, if such a file is not located, the system doesn't return with a File Not In Directory message. Instead it does a second search, this time for a file called Review.

Another aspect of the LDOS design philosophy is manifested in its upward compatibility with TRS DOS. It does not promise to mesh perfectly with NEWDOS files, but its PROT command does attempt to render alien disks readable by LDOS without diminishing their readability by the other system.

Device independence (DI) is an important mainframe feature which this DOS brings to the TRS-80. Some of you might be familiar with VTOS's DI. LDOS, like VTOS, allows routing, linking, copying, filtering, appending, setting and resetting of devices/files, as well as the creation of your own new logical devices. Unlike VTOS, LDOS provides adequate documentation on how to exploit these capabilities.

Still another feature that has been expanded by LDOS is Job Control Language. For those of you not familiar with JCL, it's a sort of high-level language that lets you preprogrammed commands to the DOS.

The earliest versions of TRS-80 JCL were limited to a simple concatenation of direct DOS commands. For example, on power up you could automatically turn on Verify, the Clock, and Trace, then go to BASIC, set an appropriate memory size, file number, and load and run a BASIC program.

VTOS 4.0 made some impressive additions to JCL, such as conditional execution (much like BASIC's IF...THEN...GOTO statement), keyboard input during a job (like BASIC's INKEY$ statement), nested JCL files analogous to chained BASIC programs, and token replacement (something like BASIC's variables).

LDOS retains these features and has added procedure labeling. Labels may be used in a JCL file to create a space saving procedure-library (Proc-Lib). The Flash micro has been altered to flash a single line instead of the whole video screen, and Alert has been changed to put variable audio tones out the cassette port instead of wearing out the relay. A new input macro is similar to BASIC's input statement.

JCL may seem complicated at first, but the manual has several thorough examples. By the way, LDOS has enhanced the utility of the BUILD command, normally used to create JCL files, by introducing hex and append parameters. The former allows the input of values not normally possible through the keyboard. The latter facilitates extending old files without a total rewrite.

But what about that partspell and wildcard stuff? Well, suppose that you had given all your Scrapsit files names with /SCR extensions, and that you wanted to know what Scrapsit files were present on your disks. You could enter DIR /SCR and LDOS would respond with a list of all the Scrapsit files on the disks currently on-line. /SCR is an example of a partspell. Now for that wildcard character. Suppose you had the following four files on a disk: Cat, Cot, Pat and Car. Entering DIR S$ would return Cat and Pat. DIR CET would return Cot and Cat. DIR C$ would return Cat and Car. The use of partspells and WCO's is not limited to DIR. LDOS commands accept them wherever the system designers thought it useful.

Whenever a disk file is created or updated, the date is included in its directory entry. It may be displayed by the DIR (A) command. Also, files which have not been backed up since their creation or last update are tagged in the directory by placing a plus sign (+) next to their name. You can use a class backup procedure to copy all such flagged files with a single command.

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“Now that I’ve extolled its virtues, I’d like to devote some space... to some of LDOS’s drawbacks.”

There are three kinds of backup available in LDOS: mirror image backup, backup by class and backup reconstruct. Mirror image backup refers to the familiar one-on-one backup. A form of backup by class was ex-emplified in the preceding paragraph. Backup reconstruct applies to backups from one type or size disk to another.

The XFER command, and the (X) parameter for the copy, backup, load and run commands, make it possible for one drive owners to use and manipulate material on non-LDOS disks. You can even use RUN (X) to run machine language programs on non- system disks, as long as they’re formatted.

PATCH is a command which some DOS’s offer to modify existing software. Once a patch has been created, it is easier to use than the ZAP method of code replacement. LDOS allows patches to be created in either of two modes: the D (for Direct) mode is disk space efficient but irrevocable. The X (or hex) mode uses more disk space, but can be undone at any time via a Yank.

LDOS comes with the best Spoiler I’ve yet seen for the TRS-80 Model I. Spoiling allows your computer to go about its other business while feeding information to a printer which can’t keep up with it. This is done by buffering the printer-bound output and sending it a little at a time during interrupt processing. LDOS’s Spoiler allows you to specify whether the buffer is to be in memory, on disk, or both.

Also present on the LDOS disk is a utility called CMDFILE. This is somewhat like Tapedisk or LMOFFSET, except that it goes farther than either. CMDFILE allows transferring object files from tape to disk and vice versa. It allows the merging of several object files into one load module. Files may be offset before being resaved, with an optional relocating appendix. You can offset only a section of a file, if part of that file leads to video memory or the system vector page of RAM. You may specify the status of interrupts and keyboard debounce in the file to be dumped. When CMDFILE reads in a file it displays the memory block(s) occupied by that file as well as the file’s transfer address. This, as well as the entire CMDFILE dialogue, can be logged to a printer.

LDOS boasts an extremely powerful terminal program called LCOMM. In combination with LDOS’s RS232 drivers, it allows reliable telecommunications at up to 300 baud without handshake. LCOMM automatically uses all available memory to buffer incoming data. LCOMM offers an on-screen menu, which can be called when needed, and supports full and half duplex modes—with or without echo. LCOMM provides for ASCII disk file transferance, and has several other features. My only complaint about this utility are: ASCII files are the only kind which may be sent/received, and when disk files are being transferred, the user is responsible for opening and closing the file, and positioning the file to its beginning or end. Failure to remember some of the details could result in information being lost.

For all you word processing buffs, LDOS comes with patches to make ScripSit and the Electric Pencil LDOS compatible. These patches also contain enhancements. Patched Pencil will honor HIGHS, leaving high memory intact. It will also work with LDOS’s keystroke multiply feature. Patched SCRIPSit, which also honors HIGHS, allows you to view disk directories. It will also use whatever driver is pointed to in the printer DB.

Drawbacks

Now that I’ve extolled its virtues, I’d like to devote some space to what I think are some of LDOS’s drawbacks.

One feature which may not be popular is the absence of Disk BASIC from the LDOS master disk. The user must copy BASIC over from a TRSDOS 2.2 or 2.3 disk. However, once that has been attended to, LDOS patches BASIC and offers several enhancements.

Other features available on competing DOSs but not offered in the current release of LDOS include ULTRADOS’s selection of three BASICS with three different trade-offs of features versus memory and NEW- DOS’-80’s MINIDOS. LDOS also lacks NEW- DOS’-80’s new file modes, but it does have a few new and extremely useful ones. At this time, LDOS does not support the Percem double density board, but plans to in the future. LDOS does offer immediate double density to those who have the Lobo expansion interface.

The most serious problem I’ve come across is the possibility of losing data if you kill a file while it’s still open. The consequences of killing an open file in LDOS are nowhere near as dire as they were under early releases of TRSDOS. I have reported my findings to LDOS customer service and corrections are being made. In the meantime, users will be cautioned in the newsletter.

A similar problem is that innocent files may be overwritten if a disk fills up while the printer is routed to a file. A warning exists in the Ldoss, that tells you to make sure you have sufficient disk space before engaging such a routing.

On the whole, I’ve found LDOS to be as error-free as any DOS I’ve ever worked with. In human engineering, system integration, and flexibility it runs circles around the others. I think it’s well worth its price.
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CONSTRUCTION

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Plug Compatible Processor

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I wanted to speed up my TRS-80 as soon as I got my Model I home and started playing backgammon. Explaining to friends why a game of backgammon took longer on a “high speed computer” than playing the old fashioned way was embarrassing.

A glance at the schematic revealed that the clock frequency on the Z-80 CPU chip was 1.7 MHz. I checked into the various clock mod kits available. They were certainly cheap enough, $25 to $40, but would they do the job? The first thing I noticed is that I would have to open the keyboard to install the clock mod. Of course, this would void the warranty. No problem, after the 90 day warranty period was up.

To install the clock mods, one must solder several wires, cut one or more traces and even drill a few holes in the cabinet. I began to wonder how much damage a butcher like me could do. Also, I had heard rumors about a marginal power supply in the Model I, and the technical manual warns against adding more of a load. I wondered how an already hot transistor voltage regulator would respond to the increased load of the extra components in the clock mod.

I could see no reason for increasing speed if it would be unreliable. There seemed to be little point in running a program twice as fast if the result might be wrong. Most of the clock mods don’t guarantee 4 MHz, and some of the instructions for it seem formidable. Also, you may have to buy more parts.

A return trip to the schematic revealed some of the problems with trying to operate at 4 MHz. The Z-80 in the Model I is only guaranteed to 2.5 MHz. The solution is easy enough—buy a Z-80A for $15, which is guaranteed to 4 MHz. The second problem isn’t so easy to solve. The memory timing circuit violates several timing specs on the RAM if the clock is simply sped up. Plugging in faster RAM won’t help—the problem is in the circuitry which generates the CAS, RAS, and MUX signals. This means that memory read/write errors can occur. I began to despair. I needed something reliable that I could just plug in.

The MicroCompatible Inc. Plug Compatible Processor (PCP) is just what the name implies—a plug compatible (it plugs into the keyboard expansion port) processor (a complete Z-80A processor and support circuitry). The 13 x 2 x 3 inch PCP sits on the desk behind the keyboard. A 40-pin connector plugs into the keyboard expansion port. The cable to the expansion interface plugs into the top of the PCP. All that remains is to plug the power cord into the wall.

The PCP contains a 4 MHz Z-80A CPU. But merely speeding up the Z-80A to 4 MHz will exceed the timing specifications on the 4116-2 RAM chips. Support circuitry in the PCP generates special RAS, CAS, and MUX signals which allow reliable 4 MHz operation without inserting wait states to allow the CPU to wait on the RAM. In fact, after simply changing a jumper plug inside the PCP, I’ve been running reliably at 4.6 MHz.

Several additional problems could arise with 4 MHz operation. The Model I uses software timing loops to generate certain timing signals. In order to read a tape which was written at normal speed, the processor must again be slowed to the original speed. Of course, a tape may be written and read at high speed (and at twice the baud rate). Floppies will not work at high speed with TRSDOS. When the TRS-80 is running at high speed, the control signals timed by the software loops are no longer compatible with the Floppy drives. The software keyboard debounce routine also uses a timing loop. At high speed the time in the loop is more than cut in half. If the processor is not slowed down during keyboard accesses, some keybounce may result. The PCP automatically returns to 1.77 MHz during disk accesses and keystrokes to avoid these problems. A high speed disk switch is provided for NEWDOS 80 users.

When you first get your PCP, you’ll notice two more jumper plugs which must be set to configure the PCP for your particular system. Radio Shack has continually had problems driving the RAS, CAS, and MUX lines to the expansion interface. If these signals do not arrive at the RAM chips with the correct
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 timing, RAM read/write errors will result. Radio Shack has tried many fixes, and these modifications necessitate setting the jumper plugs properly.

As a final coup de grace to the RAM error problem, Radio Shack did a total redesign of the expansion interface board somewhere between the boards numbered 200,000 and 220,000. The new expansion interfaces receive the RAS signal from the keyboard (or PCP) and generate the MUX and CAS signals on the same card as the RAM. Unfortunately, the processor must slow down to normal speed during RAM accesses to the top 32K of memory in the expansion interface.

However, all's well, or nearly well, in the end. This high order memory access slowdown doesn't really cost too much time because most of the memory accesses are to the BASIC ROMs and not to the top 32K of RAM. The last jumper in the PCP allows the high order RAM access slowdown to be switched off for optimal operation with the older expansion interfaces.

Owners of early Model I which haven't been modified receive an additional benefit. The PCP allows the use of the expansion interface. Early Model I had a +5 volt lead brought out to the keyboard edge connector. This same pin was conveniently grounded in the expansion interface. Plug the early Model I into an expansion interface and ZAP!, no more +5. This is why the first page of the Expansion Interface Manual states: "Note: Don't connect the Expansion Interface to a Level 1 TRS-80. The two are not compatible." Thank you, Radio Shack.

3. Simutek, P.O. Box 13687-Z, Tucson, AZ 85732.
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The sound of the klaxon is calling you! Cruel and crafty invaders have been spotted in battle formation warping toward Earth at an incredible speed. Suddenly, your ship materializes just below the huge flock of invaders. Quickly and skillfully you shift right and left as you carefully fire your lasers at them. But watch out! A few are breaking out of the convoy and flying straight at you! As the whine of their engines gets louder, you place your finger on the fire button knowing all too well that this shot must connect—or your mission will be permanently over! With sound effects!

Your TRS-80 screen has been transformed into a maze-like playground for this game. As your ship appears on the bottom of the screen, eight alien ramshacks appear on the top. All of them are traveling at flank speed directly at you! Quickly and boldly you move toward them and fire missiles to destroy them. But the more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the wrath of the keepers of the mazefield: the menacing “Flagship”. You must destroy him fast because, as you will find out, that guy’s accurate! With sound effects!

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As you look down on your space viewer you can see the stranded astronauts that are crying out for you to rescue them. But first you must maneuver your shuttle down through the asteroids & meteors before you can reach them. Great! You’ve got one! But now can you get back to the space station to save your fellow shipmate or will you crash and kill both of you? You can fire your lasers to destroy the asteroids, but watch out, because there could be an alien FLAGSHIP lurking behind! Includes sound effects!

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EYE-80

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It's exciting when your computer accomplishes a task that you couldn't or wouldn't do yourself. Such an occasion recently came up when we were investigating a problem of automated data collection.

The Problem

During the spring semester the College of Charleston offers a course in Operations Research which covers topics in queuing theory and simulation. To apply the queuing theory and simulation modeling techniques, we hoped to gather the actual arrival times of customers entering a bank for service. However, to obtain meaningful results it would be necessary to collect this data for a prolonged period—perhaps several weeks. The thought of asking class members to spend several weeks collecting data seemed impractical, and the idea was nearly scrapped.

Fortunately, we had a TRS-80 handy. Surely the TRS-80 wouldn't mind sitting in a business for several weeks and probably wouldn't complain about being cooped up in a box, particularly if the box contained a fan.

Using the photo cell interface described here will allow the TRS-80 to detect an object and to some extent determine its speed and direction. This interface opens the door for many applications including security, energy management, and the data collection system described below.

Data Collection Application

A bank is a perfect environment in which to apply queueing and simulation models if sufficient data can be collected. Anyone who has been in a bank knows that there are lines and servers, and that you have to wait in order to be served. You probably wondered why that bank didn't have more tellers. It would certainly be pleasant never to wait in a line at a bank. However, this would require an enormous number of employees, particularly during busy periods, and thus would be cost prohibitive.

To find the optimal number of tellers one must strike a balance between the bank's cost of serving and the customer's cost of waiting. Since the latter cost is nearly impossible to obtain, it is difficult to determine the optimal number of tellers needed by a bank. Simulation and queueing models can provide useful information about system performance under various staffing levels. The first bank we called agreed to help.

The bank we selected used a single line to feed all the tellers. This made our job even easier. We could place the device at the beginning of the line and record customer arrivals and bails (leaving the line after entering) as they occurred. These were

Fig. 1. Schematic for EYE-80
written on disk, and at the end of the day, one of the employees would collect the disk and turn off the TRS-80.

In addition to collecting the arrival and bank times, we also recorded the elapsed time between the two photocells. From this information the speed of the object passing through the cells could be determined. This information was quite useful in detecting false entries and banks which could be caused by swinging arms.

In total, nearly 10,000 pieces of data were collected during the three weeks. This data was transmitted to the school's mini-computer where it was examined and false entries and banks were removed. The students analyzed the data then estimated the parameters of queuing models. In addition, they developed a simulation model of the bank's teller system in which they not only provided for different system configurations but also provided a graphic simulation of the bank's operation. The graphic simulation was particularly interesting since the manager could schedule tellers and then watch the performance of the proposed schedule.

**Hardware**

Our data collection device is called EYE-80, the heart of which is the photocell. The photocell by definition is a light-dependent resistor. This means that the resistance of the device will change depending on the intensity of the light that falls on its sensing surface. In our design we used RS part #276-116 which will change its resistance from about 100 Ohms in bright light to five megohms in total darkness. The variation in resistance is used to control the conduction of a transistor switch. Therefore, the eyesight suggested by the project name is blurred at best, as it can detect only the presence or absence of light.

Refer to the schematic diagram (Fig. 1) as we discuss how the characteristics of the photocells are put to use. Notice that the diagram contains two identical circuits. The parts for one complete detector will be designated by 1s, and the second detector by 2s.

As indicated in Fig. 1, the photocell for circuit 1 (LDR1) is placed across the emitter and base of Q1. The operation of a PNP transistor requires a potential difference between the emitter and base with the base more negative than the emitter. This condition will result from our configuration when the photocell is darkened, thus presenting little impedance to normal emitter base current flow. This causes the transistor to be turned on, and consequently a +5 volt (logic 1) is presented at output #1.

Now let's see what happens when the photocell is well lit. LDR1 will now present a low impedance to the emitter base junction (100 Ohms). This shunts the bias for the transistor through the photocell causing the transistor to turn off. Resistor R1 is used as a pull-down resistor so that a logic 0 is now presented at output #1. Resistor VR1 is used to set the bias level for Q1, and therefore its sensitivity to light changes. The other half of the circuit is identical in composition and operation.

**Interface Connections**

The connection of the EYE-80 is simple and straightforward. All that is necessary is to connect the output #1 and output #2 bits from the EYE-80 to two bits of the input port you choose. We used the PPI-80 parallel port as described in the Sept. 1980 issue of 80 Microcomputing. After providing a common ground connection from the host computer to the EYE-80 and to all unused input port bits, you must provide a +5 volt regulated source.

Since EYE-80 only produces two information bits, it can be interfaced to the TRS-80 through the PPI-80 parallel port or it could be attached, with the appropriate cabling, to any parallel port.

If the PPI-80 is used, one of the 8255's ports must be configured as an input port. This can be done quite easily by sending the appropriate control word to the 8255's control port. See line 1 of the BASIC listing (Program Listing 1). Once the port is properly configured, receiving information from the port is easy. We will discuss how this can be done in the context of our application.

**Software Considerations**

Our application required not only the direction, but also the speed of each entering customer, we felt it was necessary to use assembly language to monitor the photocells. However, since we needed to write the collected data to disk, we decided to write part of the program in BASIC. The programs were linked by the USR () function.

As discussed earlier, EYE-80 generates a +5 voltage if the photocell is shadowed. This voltage is the standard voltage associated with a binary 1. Therefore, to detect the shadowing of a photocell, look for a positive number on the port being scanned. Receiving a positive

---

Program Listing 1. EYE-80 BASIC Listing

1 OUT 1,128 ; 'OPEN PPI-80 PORT FOR INPUT
5 DEFUSR=..EH99E
10 DEFINT T,A,H,L
15 "INITIALIZE T, T1, T2 TO 0 WHERE :
16 'T' = HAS VALUE OF 1 IF PERSON IS ENTERING
17 'T' = VALUE OF 2 IF PERSON IS EXITING
18 'T' = NUMBER OF FULL COUNTS OF 256 REACHED BY TIMER BETWEEN AN ENTRANCE OR AN EXIT
19 'T' = PARTIAL COUNT OF 256 REACHED BY TIMER
20 T=8:T1=8:T2=8
20 A=VARPTR(T)
30 GOSUB 1000
40 'NOW POKE ADDRESS OF T INTO ASSEMBLER ROUTINE AT VAR
50 GOSUB 1000
60 POKE -5734,LB
70 POKE -5733,HB
80 A=VARPTR(T1)
90 GOSUB 1000
100 'NOW POKE ADDRESS OF T1 INTO ASSEMBLER ROUTINE AT VAR
110 'T1'-5734,4B
120 POKE -5733,HB
130 B=USR(B) ;'JUMP TO MACHINE LANGUAGE PROGRAM
140 PRINT T,T1,T2
150 GOTO 130
160 HB=INT(A/256)
170 LB=..-(HB*256)
180 RETURN

---

Program Listing 2. EYE-80 Assembler Listing

- E996 00100 ORG 59800 ;COMING OR GOING VARIABLE
- E996 00200 VARG: DEFW 0 ;TIME 1 VARIABLE
- E996 00300 VAR1: DEFW 0 ;TIME 1 VARIABLE
- E996 00400 VAR2: DEFW 0 ;TIME 2 VARIABLE
- E996 00500 ;WAIT UNTIL BOTH BEAMS ARE CLEAR
- E996 DB01 0600 CLEAR: IN A1, (1) ;GET BYTE FROM PORT
- E9A5 00700 JR OR 0 ;CHECK TO SEE IF EITHER BEAM
- E9A5 00800 HAS BEEN BROKEN
- E9A5 20PA 0900 JR N2,CLEAR;CONTINUE UNTIL BOTH BEAMS CLEAR

Program continues
number implies one of the bits on the port has been pulled high by the photocell. All that remains is to determine which cell has been activated.

Sensing Direction

Two photocells can be used to sense the direction of an object moving in a line parallel to the cells. As soon as one of the photocells has been activated (shadowed), the computer must recognize which cell produced the signal. If the photocells occupy bit 0 and bit 1 on the port, then the problem is to decide whether the bit pattern on the port is 00000000 or 00000010. For example, see lines 900 through 1500 in the assembler program (Program Listing 2).

By determining the activated photocell, it is possible to determine the direction of an object passing between the cells. If an object shadows photocell 1 and then shadows photocell 2, it is going in direction A. On the other hand, if photocell 2 is shadowed followed by photocell 1, the object is moving in direction...
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B (see Fig. 2). Thus, to determine direction you must use at least two photocells and poll the associated port until you detect one of the shadowed cells. If the object continues to move, it will shadow the other cell. Note: When the object is smaller than the distance between the cells, only one cell will be covered at a time; otherwise, both cells will be shadowed for some period. Also note that once one of the cells becomes uncovered, you should wait until the other cell is uncovered before trying to determine the direction of any other object.

You may wonder what would happen if one object passes through one photocell, and before that object passes through the second cell, another object passes through the first cell. This problem can be minimized by placing the photocells very close together.

**Sensing Speed**

Determining the approximate speed of an object moving parallel to the photocells is also possible. Once one of the sensors is shadowed, start a counter and continue to count until the other sensor is shadowed. The value of the counter will be proportional to the time it takes the object to pass between the two cells. The exact time can be computed by multiplying the counter by the time it takes to execute the counting loop. The time to execute one pass of the loop is simply the sum of the execution times of the instructions within the loop.

Since the time durations may be small, greater accuracy can be obtained by using assembly language (see Program Listing 2). The time required to execute a loop in assembly language can be obtained from the Editor/Assembler manual. For example, the instruction LD H,E takes 1.0 microsecond (a millionth of a second) to execute on a Z-80 operating at a clock speed of four megahertz. Since the TRS-80’s Z-80 operates at 1.78 megahertz, this instruction would execute in approximately 2.24 microseconds. Thus, knowing the distance between the cells and the time it takes to traverse this distance will produce the approximate speed of the object. (We use the word approximate because photocells are analog devices with different response functions.) Nevertheless, the estimated speed should be sufficient for most non-critical applications.

**Other Applications**

These capabilities give rise to other possible applications, such as security and energy management. It seems reasonable that efficient energy management would require the heating and cooling of only those areas that are being utilized. Since it is possible to keep track of the number of persons in a region, it is possible to heat and light those areas and reduce heat and turn off the lights elsewhere. This was a very satisfying experience for the bank, which received some good information; the students, who were able to work—with some pride—the TRS-80 flawlessly perform three weeks of extremely tedious work.

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31688
Wherein our author discovers the intimate relationship between graphic elements and their ASCII character codes.

Unlocking the Graphic Code

Jerome I. Weintraub
690 Mountain View Rd.
El Cajon CA 92021

One evening as I was hard at work creating an educational program for the students at my school, I had occasion to use one of the graphic elements listed within ASCII character codes 129-191, described on page C/2 of the Level II BASIC Reference Manual. It seems that every time I needed to use one of the characters, I had to set up the program described in the manual, with minor modifications, in order to select the one I wanted. The program:

```
10 FOR X = 129 TO 191
20 PRINT CHR$(X) ; PRINT
30 PRINT X ; PRINT CHR$(X)
40 FOR Y = 1 TO 500 ; NEXT Y
50 NEXT X
```

I seldom take the time to establish a routine that will probably save a good deal of time in the long run. I usually put it off until some indefinite future date, then end up re-inventing the wheel time and again as punishment for having neglected to do it once and for all.

This time I decided to take the time to write or draw all the codes on a sheet of programming paper. Never again would I have to hunt and peck through the graphic elements displayed one by one on my screen.

There are 63 different graphic designs, numbered 129 through 191. As I copied them from the screen onto the programming sheet, a certain symmetry began to appear. Gradually I was able to predict what the next design would look like, and finally I was able to draw them without having to check the screen before or after drawing them (although I must confess I peeked, in order to be satisfied they were correct).

The main reason I discovered this is that I renumbered the designs, from 1 to 63. I then noticed that 17 was exactly the same as 1 and 16 combined; 33 was the same as 1 and 32 combined (Fig. 1).

In other words, 17 = 1 + 16; 33 = 1 + 32; and 59 = 10 + 49. As I studied this development, I searched for those pips that appeared alone within the six-sectored grid. Not surprisingly, I found the following:

```
1 2 3 4 5 6
7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 23 24
25 26 27 28 29 30
31 32 33 34 35 36
37 38 39 40 41 42
43 44 45 46 47 48
49 50 51 52 53 54
55 56 57 58 59 60
```

Finally, I realized I could create any arrangement I desired by selecting the sectors I wanted to use and calculating the appropriate ASCII code. For example, if I wanted a vertical bar on the right side of the grid, I would add 42 to 128, and add 42 to 128 to find the ASCII character code of 170 for the desired arrangement.

Where did I get the 128? The first ASCII graphic code is 129. It produces arrangement 1. 129 – 1 equals 128! All you need to do is:

- Design the arrangement you want on Fig. 3.
- Add up the values of the sectors you selected.
- Add this sum to 128.
- Enter PRINT CHR$(YOUR SUM)

I learned two lessons from this experience. First, of course, was the symmetry and mathematical basis for the graphic code. But more important, perhaps, is the valuable but time-consuming job of documenting routines I have developed. Recording and cataloging your reusable routines will repay generously the time it takes you to do the job right.

Not only did I find perfect symmetry, but it followed the basis of all computer technology: the binary code.

The final two developments followed in rapid succession. First, I drew a composite scheme of all six locations, noting the value appropriate to each sector:

```
1 2
4 8
16 32
```

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(5) ADVENTURE #1 (Scott Adams - Adventure International). A series of games formally only available on the large computers, your goal is to work your way through a maze of obstacles in order to reach the treasure chest or complete a mission. The package includes all 9 Adventures written by Scott Adams. $99.95.

(6) GSIF (Racet Computers). Generalized Subroutine Facility, a series of super-fast machine language utilities that can be called from a BASIC program (no machine language knowledge required). 3000 items in under 500 loc$. All feature parameters, user defined parameter. error checking, error trap points, data block compresses, undeletes, rewrites and erases. $250.00.

(7) DSM (Racet Computers). Disk Sort Merge. sorts and merges large multiple diskette files on a 1 to 4 drive system. NOT AN MEMORY SORT. can actually alphabetize or (any other type of sort) 2 disk drives worth of data. sorts one disk complete disk of information in 10 minutes. diskettes are provided to use with the RS MAILING PROGRAM. works under TRS80. $150.

(8) SSM (Small Systems Software). A machine language monitor and disassembler. can be used to see or edit registers, memory or disk files, examine or change the commands found on the Model I version plus some of the data for the MDD-II version. works under TRS80. $39.95.

(9) BLINK BASIC LINK FACILITY (Racet Computers). Linker for BASIC to other programs, allows the user to access the commands found in the MOD-I version plus some of the data for the MDD-II version. works under TRS80. $39.95.

(10) BASIC CROSS REFERENCES UTILITY (Racet Computers). lists all variables and strings used in a program (with the line numbers in which they appear). lists all GOTO's and GO SUB's with the line numbers in which they appear. searches for any specific variables or strings (with the line number in which they appear). $20.

(11) DEVELOPMENT PACKAGE (Racet Computers). SUPERZIP (to see, print or change any byte on a diskette). disassembler and MOD-II interface to the Microsoft Editor Assembler Plus scheme uploading services and patches for Disk I (a separate directory into memory), save all parts of source to disk, verify deleted file, (ZBUG) extended editor commands. $125.

(12) HARD SOFT DISK SYSTEM (Racet Computers). The software essential to interface any of the popular hard and soft disk systems to your TRS80. allows you to expand the capacity of any small disk system expandable to handle thousands of files. $400.

(13) CAMCO HARD DISK DRIVE CONTROLLER (Camco). Operation is optional. $400.

(14) HARD DISK DRIVES. coming soon (Nov. 17).

(15) H & E COMPUTRONICS, INC. SHARE-A-PROGRAM DISKETTE #1. works under TRS80. a collection of programs with SHARE-A-PROGRAM DISKETTE #2. All share-a-program modules are shareable. existing data base management, all programs for ATARI 800. $20 per diskette. $40 per set.

(16) WASHAB CERTIFIED DISKETTES. $39.95 (per doz.)

(17) FLIP SORT DISKETTE STORAGE TRAY. Stores 20 diskettes. comes complete with index-drawer, liftable trays and adjustable spacing. $44.95.

(18) MASTER PAC 100. 100 essential programs. BUSINESS, PERSONAL, FINANCE, STATISTICS, GAMES. MAILING, GAMING, includes 125 page manual and 2 diskettes. $19.95.

(19) BUSINESS PAC 100. 100 essential business programs INVENTORY CONTROL, PAYROLL, BOOKKEEPING SYSTEM, STOCK CALCULATIONS. TREE SECURE Accounts Receivable. Accounts Payable. includes 125 page manual and two diskettes. $19.95.

(20) EDITOR (Racet Computers). First editor oriented Editor Assembler for the MOD-II version, any editor should be designed to utilize all the features of the MOD-II. It includes innovative features for ease of coding and debugging and complete documentation (over 120 pages). works under TRS80. $299.95.

(21) BASIC COMPILER (Microsoft). changes your source programs into machine language, increases program execution speed 3 to 10 times. $300 (new price for the MDD-II version, works under TRS80. $395).

(22) MAIL FILE SYSTEM from Galactic Software Ltd, stores 2,500 names per disk. No sorting time is required since 2,000 names are sorted daily by first and last name plus Zip Code on input. Retrieve by any combination of fields. $425.00. Supports 11 digit alphanumerics Zip. Supports a message line. Comes complete with 120 page instruction manual. $199.95.

(23) INCOME TAX PAC Professional income tax package. Most forms and schedules. output to video or printer. automatic memory storage of all information data can be loaded from diskettes changed and edited. built in error checking. $199.95.


(1) CP/M (Lifeline Associates). An alternative operating system for the MOD-II that allows MOD-II owners to use any of the hundreds of programs available under CP/M. $175, $250 per complete system.

(2) CP/M HANDBOOK (Sybee). A step-by-step tutorial, takes the reader through each of the CP/M commands, numerous sample programs, practical hints, reference tables. $13.95.

(3) GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, INVENTORY CONTROL. (Compuware). All programs are shareable. existing data base management commands are included. plus many unique commands not found on WORD-STAR. requires CP/M. $495.

(5) MAIL LIST MERGE. An add-on module that allows the user to send copy to multiple addresses (based on WORD-STAR) to any compiled mailing list (using any IBM based mail program). requires CP/M. the compile/free MAIL PROGRAM. requires CP/M. WORD-STAR and any CP/M based mail program. $795.

(6) SELECTOR III (Micro-Ap). complete data management system... user defined fields and codes, manages data defined by the user includes additional modules for simplified inventory control accounts receivable and accounts payable. requires CP/M. $595.

(7) SELECTOR IV (Micro-Ap). the ultimate data consolidation module... user defined fields and codes, manages data defined by the user includes additional modules for simplified inventory control accounts receivable and accounts payable. requires CP/M. $595.

(8) SELECTOR V (Micro-Ap). add on package to the SELECTOR, general ledger that allows the user to define a custom chart of accounts. $395.

(9) CP/M 2.0 A non-standard version of the basic used for many programs that run under CP/M. however does not allow the use of most line number references, requires on much more memory and other limitations.

(10) MICROSOFT BASIC. an enhanced version of the basic as used by the TRS80 BASIC. allows users to access more advanced functions and commands. requires CP/M. a list of IBM based mail programs. $1,000.

(11) MASTER TAX (CP/M). professional tax preparation program. schedules A, B, C, D, E, F, F-1, S-1, etc... works under CP/M. $1,295.

(12) GENERAL LEDGER II (CP/M). allows users to define the content of transactions. generates financial statements, depreciation, loan amortization, journal. balances, statements of changes in financial position, and compilation reports, includes automatic posting to general ledgers. prints payroll register, W2's and payroll comes. $500.

(13) ELECTRIC PENCIL (Michael Shrayer Software). Complete word processor with extensive editing and printer formatting features. $300 (STANDARD TRS80 VERSION). $535 (DIABLO, NEC OR QUME TRS80 VERSION).

(14) BASIC COMPILER (Microsoft). changes your source programs into machine language, increases program execution speed 3 to 10 times. $300 (new price for the MDD-II version, works under TRS80. $395).

(15) CP/M is a REGISTERED TRADEMARK OF DIGITAL RESEARCH.

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BUSINESS 100 PROGRAM LIST

1 RULE78 Interest Apportionment by Rule of the 78's
2 ANNUITY Annuity computation program
3 DATE Time between dates
4 DAYEAR Day of year a particular date falls on
5 LEASENT Interest rate on lease
6 BREAKENV Break-even analysis
7 DEPRSL Straightline depreciation
8 DEPRSR Sum of the digits depreciation
9 DEPRDB Declining balance depreciation
10 DEPDBDB Double declining balance depreciation
11 TAXDEP Cash flow vs. depreciation tables
12 CHECK2 Prints NEBS checks along with daily register
13 CHECKMK Checklist maintenance program
14 MORTGAGE/M Mortgage amortization table
15 MULTMON Computes time needed for money to double, triple, etc.
16 SALVAGE Determines salvage value of an investment
17 RRESH Facility change in investment
18 RRCONST Rate of return on investment with variable inflows
19 EFFECT Effective interest rate of an loan
20 FVAL Future value of an investment (compound interest)
21 PVAL Present value of a future amount
22 LOANPAY Amount of payment on a loan
23 REGWITH Equal withdrawals from investment to leave 0 over
24 SIMDISK Simple discount analysis
25 DATEVAL Equated & non-equivalent dated values for oblig.
26 ANNDEF Present value of deferred annuities
27 MARKUP Markup for items
28 SINKFUNF Sinking fund amortization program
29 BONDVA Value of a bond
30 DEPRET Depletion analysis
31 BLACK Option pricing for American options
32 STOQL1 Value of a warrant
33 BONDL2 Value of a bond
34 ESTRET Estimate of future earnings per share for company
35 BETAALPHA Computes alpha and beta variables for stock
36 SHARE1 Portfolio selection model i.e. what stocks to hold
38 OPNUMTE Option using computations
39 RIVAL Value of a right
40 EXPVAL Expected value analysis
41 BAYES Bayesian decisions
42 VALPRIF Value of perfect information
43 VALADIF Value of additional information
44 UTILITY Derives utility function
45 SIMPLEX Linear programming solution by simplex method
46 TRANSPORT Transportation method for linear programming
47 EQG Economic order quantity inventory model
48 QUEUEA Single server queuing (waiting line) model
49 CVP Cost-volume-profit analysis
50 CONPROF Conditional profit tables
51 OPTLOSS Opportunity loss tables
52 FIXQOG Fixed quantity economic order quantity model

NAME DESCRIPTION
53 FQEQSHW As above but with shortages permitted
54 FQEQSB As above but with quantity price breaks
55 QUEUEB Cost-benefit waiting line analysis
56 NAVANAL Net cash flow analysis for airway 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 CMBPAL True rate on loan with compensating bal. required
61 DISBAL True rate on discounted loan
62 MERCAN Financial ratios for a firm
63 FNPV Net present value of project
64 LP Dues Index of an organization
65 LPNDIAS Laspeyres price index
66 PNDIRA Paasche price index
67 SEASON Seasonal index for a product
68 TIPMT Time series analysis linear trend
69 TIMAP Time series analysis moving average trend
70 FUPR Inflation future price estimation with inflation
71 MALLAP Mailing list management
72 LETER Letter writing system-links with MALLAP
73 SORT3 Sort list of names
74 LABEL1 Shipping label maker
75 LABEL2 Name label maker
76 BUSKWD DOWM business bookkeeping system
77 TIMECCLK Computes weekly total hours from timeclock info.
78 ACCPAY 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 usage analysis
83 ASSIGN Use of assignment algorithm for optimal job assign.
84 ACCSTOR In memory accounts receivable system-storage control
85 TERCPAY Computes 3 methods of repayment of loans
86 PAYNET Computes gross pay required for given net
87 SELLPR Computes selling price for given tax amount
88 ARCPAY Arbitrage computations
89 DEPRSF Sinking fund depreciation
90 GPSZONF Finds GPS zones from zip code
91 ENVOICE Types document including return address
92 AUTOPAY Automobile expense analysis
93 INSFLE Insurance policy file
94 PAYROLL In memory payroll system
95 DILAP Dilution analysis
96 LOANAPD Loan amount a borrower can afford
97 RECPAY Purchase price for rental property
98 SALELEAS Tax-loss deduction analysis
99 RRCRDYB Investor's rate of return on convertible bond
100 PORTVAL Stock market portfolio storage-value evaluation program

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FACTS ABOUT THE S.B.S.G. BUSINESS PACKAGES

1. S.B.S.G. is a sophisticated Business Software System designed for the serious businessman.
2. Each of the S.B.S.G. Business Modules may be purchased separately...or you may purchase the entire coordinated business system.
3. Modules purchased separately do not coordinate with the General Ledger (although for the standard S.B.S.G. fee, the user may upgrade his individual modules for the coordinated system).
4. Foolproof, Step-By-Step procedures are supplied, planned and documented for the First-Time Computer User. All programs are self-explanatory, telling the user what is required at every step.
5. Programs are written in BASIC and the source code listing is supplied for those users who decide to modify the original system.
6. A complete users manual is supplied with each module.
7. Demo Data diskettes are supplied with sample data.
8. S.B.S.G. has an In-House staff that can answer questions and problems related to the proper use of the S.B.S.G. Business System (on the telephone or through the mail).
9. First-Time Computer Owners Note-Instructions are provided for entering state payroll withholding tables. There is an additional charge if you prefer to have S.B.S.G. Programmers insert the correct data.
10. Minimum system requirement is 2-drives to run any single module.
11. Minimum system requirement is 3-drives to run the coordinated business system (AR-AP-GL) or (AR-AP-GL with PAYROLL).
12. Minimum system requirement is 4-drives to run the extended coordinated system (AR-AP/GL-PR and INVENTORY/INVOICING).
13. The A. OSBORNE & ASSOCIATES business manuals are provided FREE with each order (they may be purchased separately at $20 per manual).
14. The INVENTORY and INVOICING modules are original programs written by S.B.S.G.
15. Each module can be purchased as independent modules to run on a 2 or more drive system except INVOICING.
16. Memory requirement is 48K for the MODEL-I and 64K for the MODEL-II.
17. All S.B.S.G. BUSINESS SYSTEMS may be upgraded up to 4-disk drives. No data is ever lost during an upgrade. There is a standard S.B.S.G. charge for all upgrades.

ACCOUNTS PAYABLE

The accounts payable system receives data concerning purchases from suppliers and produces checks in payment of outstanding invoices. In addition, it produces cash management reports. This system aids in tight financial control over all cash disbursements of the business. Several reports are available and supply information needed for the analysis of payments, expenses, purchases and cash requirements. All A/P data feeds General Ledger so that data is entered into the system just once. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80* and is now well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding many larger systems).

CAPABILITIES:
- menu driven; easy to use, full screen prompting and cursor control
- invoice oriented; everything revolves around the invoice, handles new invoice or credit memo or debit memo
- invoice information recorded: invoice #, description, buyer, check register #, invoice date, age date, amount of invoice, discount (in %), freight, tax ($), total payable
- transaction print and file maintenance procedures insure accuracy
- flexible check calculation procedure; allows checks to be calculated for a set of vendors or for specific vendors
- program prints your checks; contiguous computer checks with your company letterhead can be purchased from SBSG
- reports include (samples on back):
  - open item listing/closed item listing - both detail and summary
  - debit memo listing/credit memo listing
  - aging
  - check register report (to give an audit trail of checks printed)
- vendor listing and vendor activity (activity of the whole year)
- fully linked to GENERAL LEDGER; each invoice can be distributed to as many as five (5) different GL accounts; system automatically posts to cash and A/P accounts

ACCOUNTS RECEIVABLE

The objective of a computerized A/R system is to prepare accurate and timely monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit sales while minimizing losses from bad debts. The programs composing this system were developed 5 years ago, especially for small businesses using the Wang Microcomputer. They have been tested in many environments since then. Each module can be used stand alone or can feed General Ledger for a fully integrated system.

CAPABILITIES:
- menu driven; easy to use; full screen prompting and cursor control
- invoice oriented; invoices can be entered before ready for billing, when ready for billing, after billing or after paid
- allows entry of new invoice, credit memo, debit memo, or change/delete invoice
- allows for progress payment
- transaction information includes:
  - type of A/R transaction
  - customer P.O. #
  - description of P.O.
  - shipping/transportation charges
  - tax charges
  - payment
  - progress payment information
- transaction print & file maintenance procedures insure accuracy
- customer statements printed; computer statements with your company letterhead can be purchased from SBSG
- reports include:
  - listing of invoices not yet billed
  - open items (unpaid invoices)
  - closed items (paid invoices)
  - aging
- fully linked to General Ledger; will post to applicable accounts; debit A/R, credits account you specify
PAYROLL
Payroll invoices many complex calculations and the production of reports and documents, many of which are required by government agencies. It is an ideal candidate for the TRS-80™. With this Payroll system in-house, you can promptly and accurately pay your employees and generate accurate documents/reports to management, employees, and appropriate government agencies concerning earnings, taxes, and other deductions. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive, micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:
* performs all necessary payroll tasks including:
  * file maintenance, pay data entry and verification
  * computation of pay and deduction amounts
  * printing of reports and checks
* can handle salaried and hourly employees
* employees can receive:
  * hourly or salary wage
  * vacation pay
  * year-end pay
  * piecework pay
  * overtime pay
* employees can be paid using any combination of pay types (except, hourly cannot receive salary and salary cannot receive hourly)
* special non-taxable or taxable lump sums can be paid regularly or at one time (bonus, reimbursements, etc)
* health and welfare deductions can be automatically calculated for each employee
* earnings-to-date are accumulated and added to permanent records; taxes are computed and deducted: US income tax, Social Security tax, state income tax, other deductions (regular or one time)
* paychecks are printed; computer checks with your company letterhead can be purchased from SBSS
* calculations are accumulated for: employee pay history, 941A report, W-2 report, insurance report, absentee report
* fully linked to General Ledger. Each employee's payroll information can be distributed to as many as (12) different GL accounts; system automatically posts to cash account

INVENTORY CONTROL/INVOICING
* ISAM (Indexed Sequential Access Method) eliminates the necessity for time consuming sort
* Pre-Allocated Files for IMMEDIATE update and inquiry capabilities.
* Fast Disk storage and retrieval.
* Inventory Master Record includes: class, SKU, Division, Retail, Cost, Beginning Balance, Period Sale Units, Period Receipts, On Order, On Hand, Minimum Reorder Point, Recommended Reorder Amount, Vendor Number, Period Sale Dollars, YTD Sale Dollars.
* Calculated and Displayed Formulas include: Gross Margin ($), Gross Margin (%), Gross Margin ROI (%), Average Inventory Retail ($), Average Inventory Cost ($), Loss Turnover (%)
* Reports Generated include: Master File Listing, Class Description Listing, Transaction Audit Trail, Minimum Reorder Point by Vendor, Retail Price List, Retail & Cost Price List, Period Sales Report, Year to Date Sales Report, Stock Status (Screen or printer output), Commission Report (for salesmen and buyers)
* Transaction Types include: Sales, Vendor Receipts, Vendor Orders, Customer Returns, Vendor Returns, Transfer Stock.

GENERAL LEDGER
The General Ledger accounting system consolidates financial data from other accounting subsystems (A/P, A/P, Payroll, direct posting) in an accurate and timely manner. Major reports include the Income Statement and Balance Sheet and the "special" report designed by management. The beauty of this General Ledger system is that it is completely user formatted. You "customize" the account numbers, descriptions, and report formats to suit particular business requirements. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:
* more than 200 chart of accounts can be handled
* account number structure is user defined and controlled
* more than 1,760 transactions may be entered via:
  * direct posting, done by hand, validated against the account file before acceptance
  * external posting, generated by A/P, P/A, Payroll or any other user source
* data is maintained and reported by:
  * month
  * quarter
  * year
  * previous three quarters
* reports (samples on back) include:
  * trial balances
  * income statement
  * balance sheet
  * special accounts reports and more...
* user formats reports with the following designated as you wish:
  * titles
  * headings
  * account numbers
  * descriptions
  * subtotals
  * totals
  * skip lines
  * skip pages
* up to eight levels of totals - full user designated
* menu driven; easy to use; full screen prompting and cursor control

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THE ORIGINAL MAGAZINE FOR
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Joysticks for the Model I

About six months ago I built a two joystick interface unit for my TRS-80.

Construction was simple and practically foolproof.

The entire system consists of two joysticks, each mounted in a plastic box. A push button is included as a Fire button. Another box has the interface board and connecting cables. It plugs into the expansion port in the rear of the computer. No modifications to the TRS-80 itself are necessary.

Power to operate the interface is supplied by a self-contained battery that is turned on when the edge connector is plugged into the expansion port.

The circuit uses two tri-state hex inverters (74LS368), that are turned off and on alternately with a 74LS73 dual JK flip-flop. The flip-flop toggles each time an INP (1) command is used. If any of the inverters' inputs are at ground potential when the 74LS368 is on, the corresponding data is sent to the CPU.

The joystick pots are used as on-off switches, to ground the inputs of the inverters. The push button switch (Fire), shorts all four inputs to ground simultaneously, through the four diodes.

A program line such as: 20 A = INP(1); B = INP(1) operates the interface by returning values for A and B to the CPU. It is important that two INP statements are used on the same line so the flip-flop operates twice when that part of the program executes. Otherwise the joysticks will be out of sync.

These parts were used because they were readily available.

Joysticks: substitutes must

---

**Parts List**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Part</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Tri State Hex Inverter</td>
<td>Radio Shack #276-1836</td>
</tr>
<tr>
<td>1</td>
<td>Dual JK Flip-Flop</td>
<td>Radio Shack #276-1918</td>
</tr>
<tr>
<td>3</td>
<td>Experimenter Box</td>
<td>Radio Shack #270-233</td>
</tr>
<tr>
<td>2</td>
<td>Terminal Strip</td>
<td>Radio Shack #274-668</td>
</tr>
<tr>
<td>2</td>
<td>Pushbutton Switch</td>
<td>Radio Shack #275-011</td>
</tr>
<tr>
<td>1</td>
<td>5 Conductor Cable</td>
<td>Radio Shack #42-2151</td>
</tr>
<tr>
<td>8</td>
<td>Diodes</td>
<td>Radio Shack #275-1101</td>
</tr>
<tr>
<td>8</td>
<td>4.7 kOhm Resistors</td>
<td>Radio Shack #271-1300</td>
</tr>
<tr>
<td>1</td>
<td>Circuit Board</td>
<td>Radio Shack #26-170</td>
</tr>
<tr>
<td>1</td>
<td>Battery Holder</td>
<td>Radio Shack #270-383</td>
</tr>
<tr>
<td>2</td>
<td>200 kOhm Joystick TM21K167</td>
<td>Herbent and Rademan, Philadelphia, PA</td>
</tr>
<tr>
<td>1</td>
<td>40 Conductor Cable 2037</td>
<td>Hobbyworld Electronics</td>
</tr>
<tr>
<td>2</td>
<td>16-Pin IC Sockets</td>
<td>Radio Shack #276-1998</td>
</tr>
<tr>
<td>1</td>
<td>14-Pin IC Socket</td>
<td>Radio Shack #276-1999</td>
</tr>
<tr>
<td>4</td>
<td>AA Batteries</td>
<td></td>
</tr>
</tbody>
</table>

---

*Fig. 1*
be able to go down to 0 Ohms resistance.

- Experimenters’ Box.
- Five-Conductor Cable: the plugs must be cut off, and the cable cut into two equal lengths. A second option is to leave the plugs on the cable and add two DIN sockets to the interface box. This will allow the joysticks to be unplugged and permit other input devices to control the interface unit.
- Circuit Board: this must be cut off at about the 30th row to fit into the experimenters’ box.
- 40-Conductor Ribbon Cable: check the wiring to see where they terminate on the edge connector. Most are wired 2, 1, 4, 3, 6, 5 etc. with respect to the TRS-80 edge plug. Also, be sure to mark the top of the connector, because it can be put upside-down.
- Broken lines in Fig. 2: indicate the wire jumpers that go on the underside of the PC board where the foil is.
- IC Sockets: some of the mounting pins have to be cut off the sockets to simplify wiring of the circuit board. The pins not needed on the 16 pin sockets are: 11, 12, 13, 14, and 15. The pins to remove on the 14 pin socket are: 1, 2, 3, 6, 7, 10, 12, 13, and 14. They can be bent up instead of cut.

### Assembling the Joysticks

Using Fig. 1 as a template, cut the mounting holes in the cover of one of the boxes. Mount the joystick, terminal strip, and push button switch to the underside of the cover. Connect a wire to the center tap of pot #2 and run it to the center tap of pot #1 then to terminal #3 on the terminal strip. (See Fig. 2). Solder a wire to the bottom tap of pot #1 to terminal #5 on strip. Fasten a wire to the top tap of pot #1 to terminal #4. Connect a wire to the top tap of pot #2 then to terminal #1. Run a wire from the bottom tap of pot #2 to terminal #2. Fasten a diode to each of the terminals (1, 2, 4, and 5) on the strip. The other ends, with the band around them, are soldered to one side of the push button switch. The other side of the switch is wired to terminal #3 on the terminal strip.

### Assembling the Interface Unit

Take both 16 pin IC sockets and cut off pins 11, 12, 13, 14, and 15. From the 14 pin socket remove pins 1, 2, 3, 6, 7, 10, 12, 13 and 14. Insert the IC sockets as shown in Fig. 3. This is the top side of the Radio Shack board (#276-170). Turn the board over and solder jump wires on the bottom as follows: E2 to F2, E4 to F4, E5 to F5, E8 to F8, E9 to F9, E11 to F11, E13 to F13, E15 to F15, E22 to F17, E23 to F22 and A23 to X23.

Turn the board over again and solder jumpers from A10 to A24, D8 to D17, D1 to D25. Run wires from G8 to G17, G10 to G23. Connect H1 to H10, H7 to H16. Attach jumpers from I3 to I12, I5 to I14. Install the 4.7 k Ohm resistors from X2 to B2, X4 to B4, X5 to B6, X7 to B7, X11 to B11, X13 to B13, X15 to B15, and X16 to B16. Connect the +5 volt battery lead to J22 and the -5 volt lead to Y22. Attach the 40 connector jumper cable to the board as follows:

- J1 to 19 on edge connector
- J3 to 30
- J5 to 22
- J7 to 32
- J8 to 37
- J9 to 26
- Y10 to 29

Connect the first joystick to the board as follows:

- Yellow wire to C2
- White wire to C4
- Red wire to C6
- Black wire to C7
- Bare copper wire to C22

The second joystick is wired as follows:

- Yellow to C11
- White to C13
- Red to C15
- Black to C16
- Bare wire to C22

File two grooves for the five-conductor cable in the edge of the bottom section of the experimenters’ box. Also, file a slot for the ribbon that goes to the 40 pin edge connector. Fasten the battery holder to the bottom side of the board with double-sided tape, insert batteries, ICs, then attach lid.

This completes the assembly.
of the entire system.

Testing the Joystick Controllers

Plug the 40 pin edge connector into the port in the rear of the TRS-80. The battery is automatically connected to the interface through the grounds of the TRS-80 bus when the connector is attached.

The system is now ready for testing. Type in the program listed below:

```
10 CLS
20 A = INP(1); B = INP(1)
30 PRINT "JOYSTICK A =" ; A;
40 PRINT "JOYSTICK B =" ; B
50 GOTO 20
```

Set the joystick handles to the center position and run the program. The values for A and B should be 240. Move the handles to different positions and the numbers will change values to:

UP = 244; DOWN = 241;
LEFT = 242; RIGHT = 248;
PUSHBUTTON = 255; UP and RIGHT = 252; DOWN
and LEFT = 248; RIGHT = 242; DOWN
and LEFT = 243; UP and

This program operates with joystick #1 and is similar to Etch-a-Sketch. The push button will erase the screen. The numbers at the corner of the screen are the values returned by the joysticks to the computer. They are for reference only.

Both joysticks can be used in a program by assigning the value returned by A to one player and the B value to a second player.

---

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Arrays give you a perspective on mazes in this 3-D game.

SUPERMAZE

Howard F. Batie
12002 Cheviot Drive
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Supermaze puts you inside a maze looking down a corridor. The corridor lies ahead of you in complete perspective, while halls lead off to the right and left. (See Fig. 1) It’s up to you to guess which way to go.

In the maze you can see a maximum distance of four units ahead. However, if there’s a wall three squares ahead, you can’t see beyond it.

Three Options
Each move offers three options: forward one, left or right.

After each move you get a new picture of what lies ahead. A counter keeps track of the number of forward moves, but is not incremented if you turn. The minimum number of forward moves to successfully exit is printed along with your score when you leave the maze.

If you get turned around and leave the maze at the entrance, you lose. And if you’re unfortunate enough to walk into an electric wall, you fry.

Listing 1 has six mazes of increasing difficulty and is written for a Level II TRS-80 with 16K.

Table 1 shows the logic flow

<table>
<thead>
<tr>
<th>Line</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>Clear Screen DIMENSION ARRAYS</td>
</tr>
<tr>
<td>200</td>
<td>Enter maze at A(100)</td>
</tr>
<tr>
<td>290</td>
<td>Start: GOSUB 830</td>
</tr>
<tr>
<td>830</td>
<td>Set Y for direction you are facing</td>
</tr>
<tr>
<td>870</td>
<td>Fetch Array A contents for your current location</td>
</tr>
<tr>
<td>880</td>
<td>Rotate Array A contents for your current direction: GOTO 300</td>
</tr>
<tr>
<td>300</td>
<td>Is there a wall to the right?</td>
</tr>
<tr>
<td>310</td>
<td>Yes: Draw wall: GOTO 360</td>
</tr>
<tr>
<td>350</td>
<td>No: Draw hall</td>
</tr>
<tr>
<td>360</td>
<td>Is there a wall to the left?</td>
</tr>
<tr>
<td>380</td>
<td>Yes: Draw wall: GOTO 420</td>
</tr>
<tr>
<td>410</td>
<td>No: Draw hall</td>
</tr>
<tr>
<td>420</td>
<td>Is there a wall ahead?</td>
</tr>
<tr>
<td>460</td>
<td>Yes: Draw wall: GOTO 500</td>
</tr>
<tr>
<td>470</td>
<td>No: E = E + 1: Is E=4?</td>
</tr>
<tr>
<td>470</td>
<td>Yes: GOTO 500</td>
</tr>
<tr>
<td>480</td>
<td>No: GOSUB 830 (Set Y for next location forward)</td>
</tr>
<tr>
<td>500</td>
<td>Move Forward or Turn (Type F, R or L)</td>
</tr>
<tr>
<td>550</td>
<td>Move Forward (Type F)</td>
</tr>
<tr>
<td>550</td>
<td>Did I exit at the entrance?</td>
</tr>
<tr>
<td>550</td>
<td>Yes: GOTO 700</td>
</tr>
<tr>
<td>550</td>
<td>No: Proceed</td>
</tr>
<tr>
<td>560</td>
<td>Did I leave at the exit?</td>
</tr>
<tr>
<td>560</td>
<td>Yes: GOTO 760</td>
</tr>
<tr>
<td>560</td>
<td>No: Proceed</td>
</tr>
<tr>
<td>560</td>
<td>Did I run into a wall?</td>
</tr>
<tr>
<td>560</td>
<td>Yes: GOTO 710</td>
</tr>
<tr>
<td>600</td>
<td>No: GOSUB 830</td>
</tr>
<tr>
<td>620</td>
<td>Turn Right (Type R)</td>
</tr>
<tr>
<td>620</td>
<td>D = D + 1: IF D&gt;4 THEN D = 1: GOSUB 830</td>
</tr>
<tr>
<td>960</td>
<td>Turn Left (Type L)</td>
</tr>
<tr>
<td>960</td>
<td>D = D - 1: IF D&lt;1 THEN D = 4: GOSUB 830</td>
</tr>
<tr>
<td>700</td>
<td>Clear Screen: Lose; Print Message: END</td>
</tr>
<tr>
<td>710</td>
<td>Clear Screen: Lose; Print Message: END</td>
</tr>
<tr>
<td>760</td>
<td>Clear Screen: Win; Print Message: END</td>
</tr>
</tbody>
</table>

Table 1. Supermaze Logic Flow Chart
in a form that is easier (for me, anyway) to understand than a flowchart. The logic flows downward unless there is a branching instruction.

The program's first array is called A and has the dimensions of 105 x 1. It uses the zero element. The first 100 elements (0-99) contain either a zero value or a five-digit decimal number which defines the shape of its maze location. Visualize the first 100 elements of the A array as a 10 x 10 matrix (which is the maximum size of the maze) shown in Fig. 2.

**Constructing the Maze**

The program statements 930-980 in Listing 1 construct the 8 x 7 maze of Fig. 3 with the entrance at location 60 and the exit at location 57. Other mazes shown in Figs. 4 through 8 are constructed by statements 990-1270. Note that all mazes must be entered from the left and exited on the right side because the initial direction (D) is equal to 2 in line 200.

The final five elements of the A array (100-104) specify the starting and ending locations, minimum number of moves to the exit, and the size of the maze. These can differ for each maze.

If any numbered matrix location in the grid is outside the maze, the contents of the corresponding element will be set to zero; otherwise the five-digit decimal defines the shape of the maze location. To prevent blanking of leading zeros in the last four digits, the first of the five digits is always one.

In each of the last four digits, one represents a wall and a zero represents a hall (no wall). The second, third, fourth and fifth digits correspond to the north, east, south and west sides. For example, the shape of block 60 in Fig. 3 is designated by 10000, and block 65 is designated by 10101.

**Change the Shape**

To change the shape of the maze, simply code the data statements to correspond with the particular maze you con-
Of course, nearly every program written can be refined, and this one is no exception. Two improvements that come to mind are a built-in random maze generator and machine language graphics with more speed.

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C. Young P. Johnson-p

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Sample Lineup
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W. Stargell H. Aaron
W. Mays L. Brock
P. Rose R. Carew
O. Cepeeda H. Killebrew
C. Yazstremski R. Allen
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Using the AY3-8910 with the TRS-80.

Polyphonic Sound Synthesis

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Photo 1. The complete sound generator board: At the upper left is the address selection switch, and at the lower right is the crystal and oscillator chip. Note the use of five bypass capacitors and one solid tantalum.

Being a fancier of game programs for the TRS-80, I recently became interested in complex sound generation, especially in the addition of exciting sound effects.

To produce the widest range of sound effects using the least amount of external circuitry, I narrowed my choice of sound chips to the General Instrument AY3-8910 Programmable Sound Generator (PSG). While this device is rather expensive ($15), its design and ease of use make it better than other chips.

The PSG is a bus oriented device and can be attached to almost any eight bit microprocessor bus. It is controlled by loading 14 registers on board the PSG. By selecting the correct combinations of registers under software control, any sound can be produced.

The PSG contains three independent tone generators with 16 levels of amplitude each; a variable noise generator; a set of mixers, and an envelope generator with eight selectable envelope shapes. In addition, the chip has two complete eight bit I/O ports which are addressable in a fashion similar to the 14 PSG registers. When using these ports, no other functions of the device are affected.

Sounds Good

Some combination of the 14 registers must be loaded with data in order to produce a sound. Each parameter must be analyzed into noise and/or tone components, envelope shape and speed. Once done, the registers can be loaded and the sound produced.

The first three register pairs are the tone period for each of the three channels. There is a coarse (four bit) and a fine (eight bit) register for each. Any tone frequency between about 111,500 Hz (000000000001) and 17.5 Hz (11111111111111) may be produced. Each channel is independently programmable.

Register R6 determines the frequency of the noise source in the PSG. Only the lower five bits are used. Noise frequencies between approximately 3,600 Hz (00011111) and 112,000 Hz (00000001) may be produced.

Register R7 controls the mixing of the three tone generators and the noise source. The two auxiliary I/O ports are controlled by R7. The table below shows the effect of each bit in R7:

<table>
<thead>
<tr>
<th>BIT</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I/O port B input</td>
</tr>
<tr>
<td>1</td>
<td>I/O port A input</td>
</tr>
<tr>
<td>2</td>
<td>Noise enable ch. C</td>
</tr>
<tr>
<td>3</td>
<td>Noise enable ch. B</td>
</tr>
<tr>
<td>4</td>
<td>Tone enable ch. C</td>
</tr>
<tr>
<td>5</td>
<td>Tone enable ch. A</td>
</tr>
<tr>
<td>6</td>
<td>Tone enable ch. B</td>
</tr>
</tbody>
</table>

Note that disabling noise and tone do not turn off a channel. This is done by writing zero to the channel's amplitude control register.

R8, R9, and R10 control the amplitude of channels A, B, and C. The lower four bits, B0–B3, allow 15 volume levels from mini-
maximum (0001) to maximum (1111). All zeros in the register turn off the corresponding channel. Bit B4 of each is the mode select. A one in this bit places the channel under control of the envelope generator. If bit B4 is one, no other bits have any effect.

The envelope period control is a 16 bit register made of registers R11 (fine period, lower eight bits) and R12 (coarse period, upper eight bits). The envelope period can be varied from approximately 0.11 Hz (0000000000000000) to 5000 Hz (1000111111111111) at 1000 Hz steps.

---

**Table 1. TRS-80 PSG Parts List.**

<table>
<thead>
<tr>
<th>CHIP TYPE</th>
<th>POWER GROUND</th>
<th>PIN</th>
<th>PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>I0</td>
<td>74LS06</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>I1</td>
<td>74LS06</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>I2</td>
<td>74LS04</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>I3</td>
<td>74LS04</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>I4</td>
<td>74LS00</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>I5</td>
<td>74LS148</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>I6</td>
<td>MC4024 VC01</td>
<td>14,1</td>
<td>5,7</td>
</tr>
<tr>
<td>I7</td>
<td>74LS74</td>
<td>14</td>
<td>7</td>
</tr>
</tbody>
</table>

PSG Board Power requirement: +5 volts at 1000amps

**Other Parts**

- C1 100 microfarad 15V electrolytic
- C2 470 pf 50V silver mica
- R1 1000 Ohm ½ watt

---

**Fig. 1. PSG Plan**

---

**Fig. 2. Internal Organization of AY3-8910 PSG**

---

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Table 2. Connections to TRS-80 Expansion Port

<table>
<thead>
<tr>
<th>SIGNAL</th>
<th>TRS-80 PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO</td>
<td>30</td>
</tr>
<tr>
<td>D1</td>
<td>22</td>
</tr>
<tr>
<td>D2</td>
<td>32</td>
</tr>
<tr>
<td>D3</td>
<td>26</td>
</tr>
<tr>
<td>D4</td>
<td>18</td>
</tr>
<tr>
<td>D5</td>
<td>28</td>
</tr>
<tr>
<td>D6</td>
<td>24</td>
</tr>
<tr>
<td>D7</td>
<td>20</td>
</tr>
<tr>
<td>A0</td>
<td>25</td>
</tr>
<tr>
<td>A1</td>
<td>27</td>
</tr>
<tr>
<td>A2</td>
<td>40</td>
</tr>
<tr>
<td>A3</td>
<td>34</td>
</tr>
<tr>
<td>A4</td>
<td>31</td>
</tr>
<tr>
<td>A5</td>
<td>35</td>
</tr>
<tr>
<td>A6</td>
<td>38</td>
</tr>
<tr>
<td>A7</td>
<td>36</td>
</tr>
<tr>
<td>IN</td>
<td>19</td>
</tr>
<tr>
<td>OUT</td>
<td>12</td>
</tr>
</tbody>
</table>

**SYSTANCES 2**

| Ground | B9, B9, 39 | (Connect TRS-80 grounds to PSG board grounds and power supply ground) |

**Table 3. Envelope Pattern**

<table>
<thead>
<tr>
<th>B7</th>
<th>B6</th>
<th>B5</th>
<th>B4</th>
<th>B3</th>
<th>B2</th>
<th>B1</th>
<th>B0</th>
</tr>
</thead>
<tbody>
<tr>
<td>8B</td>
<td>4B</td>
<td>4B</td>
<td>4B</td>
<td>4B</td>
<td>4B</td>
<td>4B</td>
<td>4B</td>
</tr>
</tbody>
</table>

**Fig. 3. Layout of registers: register numbers are in octal notation.**

**I/O Data Ports**

- Registers R14 and R15 are the auxiliary I/O ports. To output data from the bus to I/O port A, the following steps are required:
  - LATCH ADDRESS R7
  - WRITE a one to bit 6 of R7
  - LATCH ADDRESS R14
  - WRITE output data to port A

The output data to the port will not change until a reset or another output comes along. Similar steps are required to input from the port.

This has been a brief overview of the PSG registers because a detailed account would cover many pages. The reader is urged to read the data manual before attempting any programming of the PSG. The manual's one defect, however, is its use of octal notation for registers and their contents. The description above to maximum amplitude, then turn off.

1 0 0 0
Start at maximum amplitude and decay to zero, then repeat pattern.

1 0 1 0
Start at maximum amplitude, decay to zero, then attack to maximum. Repeat pattern.

1 0 1 1
Start at maximum amplitude, decay to zero, then hold at maximum amplitude.

1 1 0 0
Start at zero, attack to maximum amplitude, then turn off. Repeat pattern.

1 1 0 1
Start at zero, attack to maximum amplitude, then decay to zero. Repeat pattern.
is based on the decimal equivalents.

**TRS-80 Adaption**

On obtaining an AY3-8910, I found no data was available explaining how to interface the device to the TRS-80. A diagram was supplied for the S-100 bus. Using that and the detailed technical write up, I designed the following interface.

The circuitry required is simple and straightforward. Referring to the schematic, IC1 and IC2 select the lower of the two required consecutive address ports. The lower port address is the sum of the open switches. Some of this circuitry may be eliminated by hardwiring the port address and leaving out the switches and pullup resistors. Outputting to the first port causes the register address to be latched in the PSG. Outputting to the second port loads the selected register with data. An input from the second reads the data in the selected register. The priority encoder, IC5, in combination with the in and out signals from the TRS-80, simulates the bus control signals required to control the operation of the PSG. IC7 and IC8 provide the clock signal.

The choice of the MC4024 voltage controlled oscillator for IC7 was arbitrary; any TTL oscillator would work. The crystal frequency is not critical, but for correct tone frequencies, a TV color burst crystal is recommended.

My breadboard version worked perfectly with a 4.7 MHz crystal, although the tone frequencies were high.

The PSG IC6 has the three outputs tied together. The output is suitable for driving any standard audio amplifier. A stereo effect could be produced by using separate amplifiers in each output, but the R1, C1 network must be repeated at each output. Note that no bi-directional drivers are required on the data bus; the PSG has tri-state drivers built in for these lines.

The circuit was assembled on a Radio Shack kluge card using wirewrap. It was connected to the TRS-80 via three feet of twisted pair flat cable. Parts lay-

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out is not critical. The board should have the usual complement of bypass capacitors. Any power supply capable of +5 volts at 0.100 amp should be adequate. Be sure that the ground pins on the TRS-80, the ground on the PSG board, and the power supply ground are all tied together.

I had a problem in the breadboard version when using a prewired 40-conductor edge connector because of noise on the unterminated lines. I recommend that only the required signals be cabled from the TRS-80. A suitable edge connector can be made by hacking sawing the first 20 pins from the end of an S-100 edge connector.

The circuit was designed to plug into the screen printer port on the expansion interface. If the reader wishes to hook up directly to the TRS-80 keyboard, additional buffering of all lines, except of the data bus, may be required. This prevents overloading the signals.

Programming

When ordering an AY3-8910, the purchase of the complete data manual is recommended because the methods of calculating tone and noise frequencies are not included in the abbreviated data sheet.

While programming the PSG is beyond the scope of this article (the subject occupies about 10 pages in the manual), the following routines are presented. They show the structure of PSG programs. The address latch port is 16 and the read/write port is 17.

Routine 1: Gunshot

10 'RESET ALL PSG REGISTERS
20 FOR I = 1 TO 14: OUT 16,I: OUT 17,I: NEXT I
30 OUT 16,7: OUT 17,8: 'ENABLE TONE ON CHANNEL A
40 OUT 16,8: OUT 17,15: 'SELECT MAXIMUM AMPLITUDE ON CHANNEL A
50 OUT 16,0: SELECT CHANNEL A TONE REGISTER
60 FOR J = 1 TO 3: PRODUCE 3 CYCLES OF THE SIREN
70 OR I = 100 TO 200: 'DOWNWARD FREQUENCY SWEEP
80 OUT 17,J
90 NEXT J
100 FOR I = 200 TO 100 STEP -1: 'UPWARD FREQUENCY SWEEP
110 OUT 17,J
120 NEXT J
130 NEXT J
140 OUT 16,8: OUT 17,0: 'SET AMPLITUDE TO ZERO TO END EFFECT

Note: The tone is turned on at statement 40 and off at 140. Breaking will allow the tone at the selected frequency to remain constant. Once the register address is latched, the register can be read or written many times without reselecting the register.

These are only two of the audio programs that could be written for the PSG. In addition, the PSG could be used as a music synthesizer for the creation of two and three part harmony. This author has written a series of programs in BASIC, giving further examples of PSG usage, and a utility program which allows calculation of the contents of the registers. It also examines the current status of PSG registers.

Once the reader has built and installed the circuit, he should have hours of fun experimenting with myriad effects the device produces. I found the total cost to be about $30 using new parts. The entertainment value of the games and the challenge more than offsets the cost.

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Note: These programs are available from the author.
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80 Microcomputing, June 1981 • 173
A quick look at an alternative to BASIC.

The Pascal Dream

John Krutch
P.O. Box 761
Crescent City, CA 95531

Just three years ago, when the TRS-80 was introduced, the only language available was Level I BASIC. Not even T-BUG or the Microsoft editor/assembly had been released.

But things have changed in three short years. TRS-80 owners can now pick and choose from many languages. A few of them are supplied by Radio Shack, but many of them come from other vendors. Besides the BASIC interpreters and compilers, there’s BASEX (a structured language similar to BASIC), Pascal, FORTRAN, COBOL, Tiny C, FORTH, APL, LISP, PLILOT, and others. Most are available for both cassette and disk-based systems. And if you’re fortunate enough to have a modified TRS-80 that runs standard CP/M by Digital Research, your choice is even greater.

I want to discuss an interesting Pascal compiler, the Pipe Dream Pascal system (better known in the United States as People’s Pascal I). I want to demonstrate a feature of the Pipe Dream system that sets it apart from most other Pascal compilers on the market.

Pascal Compiler-Interpreter

What is a compiler, anyway? A compiler is a piece of software that takes a source program—that is, a program written in a high-level language—and translates it into a low-level object program equivalent to the source program.

Theoretically, then, if you have a compiler for language X running on your TRS-80, you ought to be able to type in a source program written in X; the compiler then compiles it into fast, compact Z-80 object code. Then, next time you want to run the program, you can just load the object file; the source code may be thrown away. David Bolke’s TINYCOMP (80 Microcomputing, May) takes a BASIC source file and compiles it into pure binary machine code.

Unfortunately, few compilers for microcomputers work this way. Instead, they write an intermediary file into the disk, then another program reads this file and compiles it into machine code. The Pipe Dream Pascal system is different.

The Pipe Dream Pascal system is an editor, compiler, and assembler in one neat little package. It will run in either CP/M or TRS-80 monitor. It is shareware and was written by the People’s Pascal’s John W. Lambert. Program Listing 1 is an example of the Pipe Dream Pascal system in action.

Program Listing 1

```
10 (* Peeker *)
20
30 VAR ADDRESS, BYTE: INTEGER;
40
50 BEGIN
60 REPEAT
70 WRITE('ADDRESS?');
80 READ.ADDRESS$;
90 BYTE := MEM.ADDRESS$;
100 WRITE('CONTENTS = ', BYTE$, 13, 13)
110 UNTIL 1 < 1
120 END.
```

Program continues
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straightforwardly. All compilers take a source file and translate it into an object file, however, the object code produced in this way isn’t necessarily code that can be read and executed by the host computer’s processor.

Let’s look at UCSD Pascal, which is available for many microcomputers (including the Model I and Model II TRS-80). UCSD Pascal consists of an interpreter and a compiler. When the UCSD system running on a TRS-80 compiles a Pascal source file into object code, what is produced is actually a form of intermediate code known as pseudocode or p-code. This p-code then goes to the interpreter which executes the p-code, causing the program to run. This is as far as you can go with UCSD Pascal.

Pascal Translator

Pipe Dream Pascal is a “Tiny” Pascal designed along the lines suggested by Kin-man Chung and Herbert Yuen in 1978. It was written by John Alexander of Berwick, Australia and is distributed in this country by Computer Information Exchange, Inc. as People’s Pascal. It is available on cassette for the 16K Level II TRS-80.

Pipe Dream Pascal includes a compiler which compiles Tiny Pascal source into p-code, and an interpreter which executes the p-code. Pipe Dream Pascal also supplies a translator, which does just what its name suggests—it takes the p-code generated by the compiler and translates it into pure binary Z-code.

Using the Pipe Dream system, therefore, can write your Tiny Pascal program, compile it, and execute the resulting p-codes with the interpreter. Once you’ve executed the program and verified that it is operating correctly, you can use the translator to generate Z-80 machine code from the p-code. The resulting Z-code program is fast and occupies very little memory. (However, you’ll probably need to load a run-time system along with the Z-code program to handle I/O operations and such. This system occupies only about 1K bytes.)

Program Listing 1 is a short program written in Pipe Dream’s subset of Pascal, which prompts the user to type in a memory address in decimal, and returns the byte at that location. For readers not familiar with Pascal, here a few words of explanation. Line 30 sets variables ADDRESS and BYTE to integer type.

Lines 60-110 set up a loop which repeats indefinitely, since the condition in line 110 (I<1) can never be met. Line 70 prompts the user for the address to be PEEKed at. Line 80 reads this address from the keyboard into variable ADDRESS. Line 90 gets the byte
out of memory and puts it into variable BYTE. Line 100 writes the byte on the display and prints two line feeds.

Program Listing 2 shows the same program and its compilation into p-code. Each group of p-codes is listed just underneath the line of source code. The number that precedes the code is the location number of the p-code. There are 42 p-codes numbered 0-41. The two numbers that follows each p-code, are operands.

As to what the p-codes do, look at p-code number 2, LIT 0 65, which causes the number 65 to be loaded on top of the stack. This number is the decimal ASCII code for A, which is the first letter of the word ADDRESS'. This will be printed on the display to prompt the user. P-code number 34, CSP 0 1, is a call to standard procedure 1. This causes a jump to subroutine 1 in the run-time system.

Program Listing 3 is the culmination of our work and is the output from the translator, which decodes the p-code into Z-code. Column one is the list of p-codes. Column two contains the decimal address at which the translated Z-80 codes begin for each p-code. Column three contains the same address in hexadecimal. Column four is the actual machine code. It is not an exact translation into machine language of the source program in Program Listing 1, because it depends on a run-time system which must be loaded when the machine code is.

The Pipe Dream Pascal system is cumbersome. First, you have to load the compiler, then the interpreter, then the translator, and finally the run-time system. Then you have to load T-BUG to run off a copy of the translated program and run-time system. However, in spite of all this cassette-swapping, using the Pipe Dream system is a fascinating experience. It is rewarding to watch a program written in a very high-level language turn into binary machine code right before your eyes.

Why sit around typing RUN and LIST all day?

The Disk Auto-Menu

Larry M. Hewin, Ed. D.
Volksmicro Computer Systems, Inc.
202 Packets Court
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While showing off my micro-computers to customers and clients, I've frequently found myself typing RUN WHATEVER/BAS and other file names again and again. To make it harder, my typing error rate goes up as I hurry to lessen the dead time during loading. As a result, "the hurrier I go, the behinder I get."

I've tried setting up demo disks in advance. The items that I desire to show vary, however, so preparing a set of demos doesn't satisfy my need.

Besides, all of us know the one thing a computer is supposed to do well is take away the need for humans to perform repetitious and dull tasks.

So why sit around typing RUN or LOAD such and such on a machine which is capable of doing it better? The two simple programs in this article reflect an approach to a solution.

Main Point

The main objective is to choose a program from a menu that tells which programs are residing on the diskette(s) in the drives, and to call the selection by entering the number of the choice. A second objective is to be able to return from the selection or called program to the disk menu, to call another. Easy.

Also, since I'm not always certain what some of my more cryptic file names represent, it would be nice to have the menus present descriptive titles. This would identify, while still allowing the use of, the actual file spec for calling.

It seems desirable to provide for a printed version of diskette screen menus, since the menu collection itself provides only a primitive directory of the program collection.

Finally, inherent in the collective points above is the need for a data base manager with the usual entry, edit and delete functions.

Two Programs

The system devised consists of two main programs: a menu maintenance program and a menu manager program. The menu maintenance program allows entry, editing and deletion of program descriptions, and calling file specs. Under the file name MENU/DAT, it writes data to the disk you have designated.

The menu manager program, when run, reads data from MENU/DAT for whichever disk you've designated and screens it in menu format (Table 1). You are then free to select a program by number from the menu and call it by entering its number. You may also call the following items from the menu: a different disk drive menu; the menu maintenance program; or a return to DOS. If you are in the menu maintenance program for any reason, the menu there permits you to call the menu manager program.

The two main programs are saved to a disk containing a DOS you normally have in drive 0. These two need to be in your drives on one disk only, so it may make sense to put them on the DOS disk. MENU/DAT will be on every disk used in the system and contains only the menu data for that diskette.

To start using this system, you load BASIC, and run MENU/MGR/BAS. You are then asked to enter the drive number on which the data is to be entered.

From the menu of menu maintenance functions as shown in Table 2, select New Menu by entering 1. You will then be given prompts for entering program data which you answer in the manner shown in Table 3. When the two fields are entered, the
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program automatically asks whether the entries are correct or not. If the answer is N for no, the program cycles you back through the entries. If a particular entry is correct, hit ENTER and the entry, as originally entered, will be preserved. If it isn’t correct, however, enter the correct one.

While BASIC programs are entered as shown in Table 3, command programs, usually summoned from DOS, need different treatment. In the program title field we can still name programs anything we desire, but in the field for filespec the procedure is as follows: Assume the program is a machine language program called Electric Stylus and has the filespec: STYLI$US/CMD. The proper entry to the prompt for filespec is &STYLI$US, i.e., an ampersand is put in front, and the / and file extension is left off.

Providing for an automatic return to DOS is similar. If you respond with RETURN TO DOS to the program title prompt, and respond to the filespec prompt with &DIR, the menu will show an item returning you to DOS, and call up a DIR command. Similar entries, &LIB and &FREE, will invoke those DOS commands.

Exit

When you are finished entering programs, the exit is accomplished by answering the program title prompt with END. The program then leads you to save your entries on disk. It specifies the disk drive number on which they are to be saved. It then returns to the menu of the menu maintenance program. You may then elect to run the menu manager program by making the appropriate selection, and when prompted, giving the disk drive number for the disk on which you have just saved your MENU/DAT. This brings up the menu you have established, and allows menu selection of programs. Note that the program has automatically added the selections necessary for calling a new drive menu, menu maintenance, and for a printed copy of the menu.

How to return from called programs to the menu? The answer to this problem depends on whether it is a BASIC program or machine language or other entry which calls for exiting the BASIC mode. The approach with BASIC programs is simple. I usually modify one line of the called program; where a program line might have been 900 END, I substitute 900 RUN MENUMGR/BAS. If the called program has a menu, I usually modify it to add on an item like RETURN TO DISK (or MAIN) MENU (9). I modify the program so that the (9) selection sends it to a line like the line 900 above.

With machine language programs, the problem is different. It is generally difficult to modify programs to call MENUMGR/BAS directly (particularly if you did not write them, or have not disassembled them). There are, however, possibilities in short machine language instructions, designed to bring the MENUMGR/BAS back in when the reset button is hit. This is accomplished by Autoing the machine language program.

The approach I have chosen was selected because it has been printed in 80 Microcomputing (May, 1980, page 27, in an excellent letter from Gary Alcorn.

---

**Table 3**

<table>
<thead>
<tr>
<th>MENU ENTRIES</th>
<th>FOR PROGRAM #1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>THE PROGRAM TITLE IS:</td>
<td>NAME FILE</td>
</tr>
<tr>
<td>THE FILESPEC IS:</td>
<td>NAMEFILE/BAS</td>
</tr>
<tr>
<td>ARE THESE CORRECT? Y/N</td>
<td>Y/N = &gt; Y</td>
</tr>
</tbody>
</table>

---

**Program Listing 1**

```
1 REM * COPYRIGHT DR. LARRY HENIN
2 REM * VOLKSMICRO COMPUTER SYSTEMS INC.
3 REM * 282 PACKETS COURT
4 REM * WILMINGTON, VA 23185
5 REM * DECEMBER 15, 1979
6 REM ***************************************************************************
7 REM * A DISK MENU SYSTEM -- PROGRAM # 3 *
8 REM * MENU MANAGER (FS=MENUGR/BAS) *
9 REM ***************************************************************************
11 GOTO40
12 INPUT"PRESS ENTER TO CONTINUE":S$:RETURN
13 FOR=1 TO 100:NEXT:RETURN
14 CLS:PRINT474."MENU MANAGER":PRINT8597."BY DR. LARRY HENIN"
15 PRINT670,"ENTER DRIVE NO. FROM WHICH MENU IS DESIRED"
16 IFD=I:
17 IFD=I:
18 IFD=I:
19 IFD=I:
20 IFD=I:
21 IFD=I:
22 IFD=I:
23 IFD=I:
24 IFD=I:
25 IFD=I:
26 IFD=I:
27 IFD=I:
28 IFD=I:
29 IFD=I:
30 IFD=I:
31 IFD=I:
32 IFD=I:
33 IFD=I:
34 IFD=I:
35 IFD=I:
36 IFD=I:
37 IFD=I:
38 IFD=I:
39 IFD=I:
40 IFD=I:
41 IFD=I:
42 IFD=I:
43 IFD=I:
44 IFD=I:
45 IFD=I:
46 IFD=I:
```

---

**Example 1**

1. Enter TRSDOS /DEBUG and type D8600.
2. Type M86000(space).
3. Enter machine code exactly as shown:
   -6800 21 6 6B 22 16 40 21 2C 6B 22 2A 6B C3 2D 40 E5
   -6B10 2A 2A 6B 7E 0E 0A CA 1F 6B 23 22 2A 6B E1 91 21
   -6B20 E3 02 2B 10 3E OD C3 1D 6B 20 20 1F 42 41 53
   -6B30 40 40 OD OD OD OD OD 56 56 4D 22 22 22 22 22 22 22
   -6B40 2F 42 41 53 22 0A
4. Press Enter.
5. Type 0402D then hit Enter.
6. In DOS mode type DEBUG (OFF).
7. Type TAPEDISK and hit Enter.
8. Save program with TAPEDISK by ?F(MENU/M0):D8600:6845 6800
   ?E (enter) to return to DOS READY.

---

**Fig. 1**

The System is comprised of three programs:
1. MENUMGR/BAS—the data manager for entry and maintenance of menu data for each of the user’s disks. Writes data to the disk under the filespec MENU/DAT.
2. MENUMGR/BAS—the program that calls MENU/DAT, writes the screen menu, and organizes program selection from the menu.
3. MENUCMD—a machine language program which, when AUTOed, allow return to MENUMGR/BAS anytime reset is hit.

---

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DOS TO BASIC."

Thus, anytime we hit the reset, we will go back to the disk menu. This system has solved one of my problems and I’ve been delighted with the ability to quickly throw a couple of diskettes in the drives, hit reset, and select from 20 to 30 programs. It may be just as useful to other TRS-80 users who have to use two diskettes full of programs used frequently.

The program is available from the authors on tape or diskette.

---

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The next 4 pages contain over 100 Model III compatible programs for your TRS-80. Whatever your interests, we have a software program for you. We list sections on Home/Personal, Business, Games, the Arts, Home Education, Utilities, Special Business, Flight Simulations, Electronics, Comp-U-Novels, and Popular Games. These programs can be purchased through your local Instant Software dealer, or you can call us directly using our toll free number. We ship our orders within 48 hours. Browse through these 4 pages, we're sure you'll enjoy your selections.

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> 80 Microcomputing, June 1981 • 185
A seagoing simulation of the action in the Bungoe Straits.

Subdestroy

When I go to a shopping mall the first place I head for is the games arcade. One day I discovered a new game that involved dropping depth charges from a destroyer onto submarines. I was fascinated and fastest with the game and wanted to play it longer but I ran out of change.

Since I enjoyed the game so much I decided to try to program my TRS-80 to simulate it. A couple of days later I emerged from my room after completing the programming for my version of the game, which I named SubDestroy.

The Program

SubDestroy is written for a 16 K Level II TRS-80. It doesn’t contain any special machine language subroutines so as to answer the Memory Size? prompt with Enter.

After you have loaded the program and typed Run you will be asked if you want instructions.

They will remain on the screen until you press Enter. After pressing Enter, the screen will clear and you will see your destroyer cruising on the ocean’s waterline with three submarines traveling underneath.

The object of the game is to score as many possible points as you can with only twenty depth charges. If you score well enough, you will receive bonus depth charges at the end of the game.

There are three different types of submarines; each varies in point value. The largest and fastest is worth thirty points, the medium size sub is worth ten points, and the smallest is worth five points.

When you drop a depth charge, you must set the level at which it is to explode with the up or down arrow. A line will then flash across the screen to indicate the depth at which the charge will explode.

When a depth charge is dropped all the ships will move faster and you will have to compensate for this. In addition, when a depth charge is dropped it will move forward in order to try and keep pace with the destroyer.

If you hit a ship, it will sink and your score and charges left will be updated.

At the end of the game, if you score above 35 points you will receive extra depth charges. Depending on your score, you will receive up to twenty extra charges or one replay.

I haven’t found any problems in the program. If you do have problems after typing it in, I suggest you check the number of spaces in the strings, for example, lines 350, 400, 530-550, etc.

Fig. 1. Variables

| B$ | B1S | B2S | submarine Chr$’s ES | depth indicator Chr$ | E1S | E2S | erase strings | J-score | J1-number of depth charges | Q-destroyers print@ position | X-explode depth | Z, S, A-submarine print@ positions | S$-destroyers Chr$ |

Program Listing

```
10 CLEAR400
20 DEFINTA-5
30 RAND
40 ONEDROWN:GOTO720
50 CLS
60 PRINTTAB(15)"-------- SUBDESTROY--------":PRINT:PR
INT:PRINT"DO YOU WANT INSTRUCTION (Y/N) ?"70 K=INKEY$:IFK=""THEN70"$FRS=""D"$THENCLS:GOTO999ELS70
90 O=1:J1=30
100 GOSUB110:GOTO550
110 E1S=STRING$(4,120)
120 E2S=STRING$(6,126)
130 A=RND(190):I=A+RND(156)
140 T=RND(1934):IFT=1824082:3847THEN138
150 IF$=A:1824082+A=3847THEN138
160 IF$=A:AROUND=2+A=3847THEN138
170 X=512
180 L$=STRING$(63,144)
190 BS=CHR$(176)+CHRS$(176)+CHR$(184)+CHR$(184)+CHR$(176)+CHR$(176)+CHR$(18)
41+CHR$(176)
200 ES$=STRING$(63,128)
210 BS=CHR$(176)+CHR$(187)+CHR$(182)+CHR$(180)+CHR$(176)
220 BS=CHR$(176)+CHR$(184)+CHR$(176)+CHR$(184)+CHR$(176)
230 SS=CHR$(176)+CHR$(184)+CHR$(176)+CHR$(184)+CHR$(176)+CHR$(18)
41+CHR$(176)
240 RETURN
250 GOSUB260:GOTO720
260 PRINT56,"PRINT56,STRING$"(64,45);RETURN
270 AS=INKEY$:IFAS=""THENGOSUB260:GOTO288
280 GOSUB750
290 IF$=CHR$(32)THENQ1=0:J1=1:GOSUB480
300 GOSUB350
310 GOTO720
320 END
330 GOSUB750
340 RETURN
350 IF$="THENQ1=1:PRINT$57,"
360 GOSUB780
```

Program continues

186 • 80 Microcomputing, June 1981
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More than 100 Interludes are included in the program. Most are described in detail in the accompanying manual, but several surprise Interludes are buried in the program awaiting that very special time when your interview says you’re ready. (When you learn secret Interlude #99, your love life may never again be the same!) Interlude can give you experiences you’ll never forget. Are you ready for it?

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**MATLIB** — This is a collection of 13 very powerful matrix-handling subroutines which can be used individually or can be linked together to form program modules to perform successive matrix operations. These subroutines all use Variable Array Dimensioning.

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CAPTRAN

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At one time or another every computer owner thinks about a word processing program for his or her machine. And often, as your hardware system grows, the uses for word processing also grow. At least that was true for me.

I began using a word processor with my 16K system and an ancient (but very functional!) Model 15 teletype machine. At that time there was little reason to worry about upper and lowercase since the printer had only uppercase characters. As I've become more experienced with word processing, I hope to obtain an ASCII printer with the full character set. Consequently, I am reworking the system to handle upper and lowercase.

This article describes a program I wrote to convert text files of only uppercase characters to files with upper and lowercase.

Unpredictable Text

It is impossible to write a program that will completely convert a text file, since the presence of all capitals in a text is not predictable. However, 99 percent of the work can be done automatically. This program was written to run with my word processor. It resides in high memory, out of the way of my word processing program.

The program first converts all uppercase ASCII characters to lowercase and then converts the first letter character following a period to an uppercase character. Here's how it works.

The variables BUFFER and BUFINS correspond to my word processor program and provide the location and size of the text buffer area in memory. This program begins at FF00H. Starting in line 180 things are set up to find ASCII uppercase letters; that is, characters with an ASCII value greater than 64. The CPI function takes care of the comparisons. If parity is odd after the CPI, then the entire buffer set has been scanned so we go to PASS 2. If the result of the compare was negative, indicating an ASCII character, go to TRAN; otherwise we loop back for another compare.

In TRAN we DEC HL back to the ASCII character (CPI increments HL after the compare is completed) and SET the fifth bit in the location pointed to by HL. This changes the value to that of a lowercase character. Next, increase HL back to its value on entering TRAN and then loop back to the compare. In this way COMP and TRAN take care of changing capital letters to lowercase letters.

Once this sequence is completed, the program will continue with PASS 2. Here, things are set up to look for the period (ASCII 46). After the CPIR, the ZERO flag will be set if the compare was true, that is if HL points to a period. Otherwise the CPIR would be complete when the entire buffer area had been scanned. In line 350, if the ZERO flag has not been set, we branch to 402D in order to reenter DOS. Otherwise when a period is identified we will be in TRAN1.

There, we put the value now pointed to by HL (this will be the next character after the period)
into the A register. We then check to see if this is a zero. (In my word processor, 0 is used as a blank space which is not to be printed.)

If we find a zero, we branch to BAK. If the character is not a zero, we check to see if it is a 13, which is a carriage return. If it is, we branch to BAK.

If not, we check to see if it is a space (20H) and if it is we go to BAK. If it is none of these, we assume that it is a letter. On occasion this will be a false assumption, but it's usually correct. An alternative is to change line 370 to CP 65 and line 380 to JP M, BAK and delete 390-420. This returns to BAK for any ASCII value below 65 and may work better for common text.

Since the letter after a period often starts a new sentence, RESET the fifth bit to restore the character to uppercase and then loop back to COM to continue the comparisons.

What Follows a Period

BAK is a routine which will help us avoid characters that follow a period, but are not letters. We increase HL, decrease BC and then check to see if BC has hit zero. (No zero flag is set when BC is decremented to zero, so we put C in A and then OR B, which will set the zero flag if both B and C are zero.) If it hasn't hit zero, we loop back to TRA1 to check the next character. If BC is zero, then the task is done and we go to DOS.

When I use the program, first I enter my word processor which loads the text file into memory. Next, I exit that program and go to DOS to run CAPTRAN. When that has run I am back in DOS and can reenter the word processor. As an alternative, this program could be put into the word processor as a function to be called within the program. It's also possible to add a bit to this program to distinguish other marks of punctuation. It depends on what your data file contains. For me, this simple version does a reasonable job.

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# The Level II Index

Barbara Mercer, Mercer Systems, Inc., 87 Scooter Lane, Hicksville, NY 11801

**Editor's Note:** Having spent the last 17 years in data processing where he developed applications on everything from the 1401 to the 3033, Stephen Hughes, President of Mercer Systems, Inc., was embarrassed one day as he flipped through the Level II Basic Reference Manual and found no index! Barbara Mercer authored the following, supplemental index for their own reference. Feeling that more people could benefit from it, the author decided to share it with 90 readers.

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194 • 80 Microcomputing, June 1981
Poor Man's Floppy

Now the widely acclaimed JPC Cassette System is available for your TRS-80* computer.
The price is only $90.00

TC-8 Cassette System
JPC Products
Albuquerque, NM
Kit: $90
Assembled: $120

by Carl A. Kollar

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16k machine, "you ain't got nothin left" for even one disk drive at 500 bucks apiece. So you suffer.
A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it.

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of Microcomputing had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products, acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly $90 bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free.

I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board.

There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of 8½ × 11 paper stapled together. It is written in the nicest format I've seen in a while. Each command and/or subject is covered on its own sheet, in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.
LOAD: Reads the next BASIC program from the cassette.
LOAD*"filename": Searches for and loads the specified file from cassette.
LOAD?: and LOAD??"filename": Reads file from cassette, and compares contents to memory.
LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.
LOADN"filename": Same as above except the tape will stop at the end of the program named.
KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.
RESET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.
RUN"filename": TC-8 searches for a specified program and runs it immediately.
PUT"filename": Same as SAVE "filename", except it is for use with system tapes.
GET: Same as LOAD, except it is for use with system tapes.
GET"filename": Same as LOAD "filename", except it is for use with system tapes.
GET? and GET??"filename": Same as LOAD? and LOAD??"filename", except it is for use with system tapes.
GETN and GETN"filename": Same as LOADN and LOADN"filename", except it is for use with system tapes.

OPEN: Required before cassette input or output of a data file can be attempted.
CLOSE: Required to end a cassette data file.
PRINT#: Allows numerical or string data to be output to a cassette file.
INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button.

ORDER NOW
To order your TC-8 kit, send your check or money order for $90.00 plus $3.50 postage and handling to JPC PRODUCTS CO., 12021 Paisano Ct., Albuquerque, NM 87112 (New Mexico residents add 4% sales tax). Credit card orders accepted by phone or mail. Personal checks will delay shipment. We will otherwise immediately ship you the TC-8 kit, the cabinet, the ribbon cable, the power adapter, an instruction manual, and a cassette containing the software.

JPC PRODUCTS CO.
Phone (505) 294-4623
12021 Paisano Ct.
Albuquerque, N.M. 87112

See List of Advertisers on page 306

80 Microcomputing, June 1981 • 195
MULTI-USER OASIS HAS THE FEATURES PROS DEMAND. READ WHY.

(THEN COMPARE.)

Without this control, unauthorized users could access your programs and data and do what they like. A frightening prospect isn’t it?

And multi-users can multiply the problem. But with the Logon, Password and Privilege Level features of Multi-User OASIS, a system manager can specify for each user which programs and files may be accessed — and for what purpose.

Security is further enhanced by User Accounting — a feature that lets you keep a history of which user has been logged on, when and for how long.

Pros insist on these security features. OASIS has them.

EFFICIENCY: RE-ENTRANT BASIC

A multi-user system is often not even practical on computers limited to 64K memory. OASIS Re-entrant BASIC makes it practical.

How?

Because all users use a single run-time BASIC module, to execute their compiled programs, less memory is needed. Even if you have more than 64K, your pay-off is cost saving and more efficient use of all the memory you have available — because it services more users.

Sound like a pro feature? It is. And OASIS has it.

AND LOTS MORE...

Multi-User OASIS supports as many as 16 terminals and can run in its little as 56K memory. Or, without bank switching, as much as 784K.

Multi-Tasking lets each user run more than one job at the same time.

And there’s our BASIC — a compiler, interpreter and debugger all in one. An OASIS exclusive.

Still more: Editor; Hard & Floppy Disk Support; Keyed (ISAM), Direct & Sequential Files; Mail-Box; Scheduler, Spoiler; all from OASIS.

Our documentation is recognized as some of the best, most extensive, in the industry. And, of course, there’s plenty of application software.

Put it all together and it’s easy to see why the real pros like OASIS. Join them.

Send your order today.

The biggest challenge for any multi-user system is co-ordinating requests from several users to change the same record at the same time.

Without proper co-ordination, the confusion and problems of inaccurate or even destroyed data can be staggering.

Our File and Automatic Record Locking features solve these problems. For example: normally all users can view a particular record at the same time. But, if that record is being updated by one user, automatic record locking will deny all other users access to the record until the up-date is completed. So records are always accurate, up-to-date and integrity is assured.

Pros demand file & automatic record locking. OASIS has it.

SYSTEM SECURITY: LOGON, PASSWORD & USER ACCOUNTING

Controlling who gets on your system and what they do once they’re on is the essence of system security.

MAKES MICROs RUN LIKE MINIS
I often receive letters and calls from distraught Model II owners, most of whom are having some difficulty moving up from the Model I.

Here’s some of their more frequent questions, with my solutions:

Q: I miss my Model I graphics. Is there any way I can draw with my new computer?

A: Not as well as on the Model I. The grid on the Model II is only 80 horizontal by 24 vertical, about half the size of its predecessor. The best you can do is use the BASIC statements in Fig. 1 in place of SET and RESET.

Q: My disk isn’t operating properly. My computer works with other disks, but there’s one or two it just refuses to allow me to use.

A: This could be caused by several things, but there are three which I have found most common. First, the disk area where the information you’re trying to access is stored could be flawed. Flaws include disks affected by humidity, heat, cold, static electricity, rough handling, and other environmental hazards. If the problem is a foreign object, such as dust or cigarette ash, a few attempts to use the disk might cause the obstruction to fall off, or at least move out of the way. If the problem is environmental (heat, humidity, etc.), disks will sometimes recover when left in a cool (not cold), dry place for a while.

Overall prevention: Treat disks with more care—the fragility of magnetic media is underrated. Use the protective jacket wherever the disk is not in the machine. Don’t lay a disk on top of the video display or near a line printer; these produce magnetic fields which could play havoc with your disks.

Second, simple but devastating: you’ve changed disks and forgotten to use the I command to initialize it. This needs to be done because much of the disk directory is stored in RAM. The directory is more important than it looks; it contains vital infor-

Note: Row signifies vertical (Y) position and column horizontal (X)

For normal video (white on black) the code is as follows:

SET: PRINT @ (row.column),CHR$(26);CHR$(32);CHR$(25);
RESET: PRINT @ (row.column),CHR$(32);

For reverse video, use this code:

SET: PRINT @ (row.column),CHR$(25);CHR$(32);CHR$(26);
RESET: PRINT @ (row.column),CHR$(32);

Fig. 1. BASIC Code for SET and RESET

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Fig. 2. Directory of Uninitialized Diskette
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LEVEL III BASIC
26-1062

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information about the location of each file, and what locations are available. If you change disks and don’t initialize, the operating system tries reading and writing to the new disk, using the directory from the old one. This results in areas on the disk being destroyed, and blank file names often show up in a directory as a signal of this (Fig. 2). If the directory looks like this, try typing E (or SYSTEM ??“E” from BASIO). This will work if you haven’t written to the disk (SAVE, PRINT#, PUT, etc.). But if a directory taken after initialization reveals blank file names, it’s too late. Prevention: make it a habit to use the I command before your disk write operations. It doesn’t take long, and SYSTEM ??“E”: SAVE?“FILE/TXT” is pretty easy to use. SYSTEM ??“E” also makes a good first program line, if your program uses disk I/O.

Third, a disk is left in the drive after the power is shut off. The heads may release some stored energy at this time, and guess where it ends up? On your disk. The only solution is prevention —don’t leave a disk in any drive when you power down (or up, just to be on the safe side). This is an unstable state for any electronic device.

Q: I have a BASIO program from my old Model I that uses PEEK and POKE, and I want to put it on my new Model II. Can it?
A: Yes, in most cases. Before
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<td>LEEDEX 100 12” B/W MONITOR</td>
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<td>LYNX Telecommunication system for the TRS-80 and PMC-80</td>
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<tr>
<td>Includes terminal software and connections for instant hookup! Can be connected to the TRS-80 or PMC-80 with or without an expansion interface!</td>
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<tr>
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<tr>
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you upgrade, though, you have to find out why PEEK and/or POKE are used, and see if there is really a need. If, for instance, POKE graphics are used to write to screen memory, you’d better stick with PRINT @ statements, as screen memory is only accessible through a supervisor call on Model II. If, however, you find that you must use PEEK or POKE, use the code in Figs. 3 and 4 (see Fig. 5 for information on entering machine language programs). Use the accompanying BASIC program in Fig. 6.

Q: I just jumped from BASIC to DOS using System. Is there any way to go back to BASIC without losing my program?

A: Enter the program in Fig. 7 (again, following the guidelines in Fig. 5 for entry and storage). As long as you returned from BASIC and didn’t use any DOS commands that dump or zero memory, the return will always be successful.

To load the code into memory:
From TRS DOS READY, type
DEBUG ON (enter)
DEBUG (enter)
When the ? appears on the screen, reply with "M" followed by the starting address of the code. Tap the F1 key to position the cursor for entry of the code. Enter the code as it appears, in hex. When entry is complete, tap the F2 key to store it in memory, then "S" to return you to TRS DOS READY mode.

To store the program, type
DUMP name = START = address1, END = address2, RORT = X (enter) where "name," "address1," "address2," and "X" are replaced with the values given for each program. So, to save the J2800 program, type
DUMP J2800 = START = F100, END = F102, RORT = T (enter)
To call the program from TRS DOS READY, type name (enter) where name is the program name used in DUMP. From BASIC, use SYSTEM "name".

Fig. 5. Loading and Saving a Machine Language Program

The following BASIC code will make PEEK and POKE easier to use in your programs:

To load PEEK and POKE into memory and set up theUSR routines:
60000: SYSTEM = "PEEK/END = 10000: DEFUSR1 = &HF000;
DEFUSR2 = &HF000"

To convert a memory address into integer format (which must be done before each PEEK or POKE call) where address is contained in X and returned as an integer in A:
65000: IF X = 32768 THEN A = (-32768 + X) + 2 &= 1; ELSE A = X
65010 RETURN

To perform a PEEK (read from memory address X):
65100: ASCSUB 65000: Address is already in X Convert to integer A%
65110 A = MK(A/S)/Prepare address
65120 A = USR(A/$Call PEEK
65130 B% = ASC(A/$)B% now contains value of memory address X

To perform a POKE (place value V% at memory location X):
65200 ASCSUB 65000: Convert X to integer A%
65210 A = MK(A/S)/Prepare address
65220 A = A + CHR(V%/4)/Tack on value to store at X
65230 NOTE: Value (V%) must be between 0 and 255, inclusive
65240 A = USR(A/$Call POKE E + V% is now stored at memory location X

Fig. 6. BASIC Code for use with PEEK and POKE

61692 F200 C3(0028) JP (N/ D > 2800) TO: 2800
61695 F203 00 NOP
61696 F204 00 NOP
61697 F205 00 NOP

To save, type DUMP J2800: START = F200, END = F202, RORT = T

Fig. 7. Code for J2800 user routine.

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Q: I have a machine language program from the Model I which contains various calls to ROM routines, for routines such as keyboard input and disk I/O—Is there an equivalent on the Model II?
A: Yes, there is. The routines are named Supervisor Calls (SVCs). They are called by loading the arguments into the proper registers and executing an RST 8 instruction.

A list of commonly used routines is in Fig. 8, and the DOS manual covers them nicely in pages 4/13 to 4/84.

Q: I have a program in BASIC which must be secured from Break. Can I disable the Break key temporarily?
A: Yes. The codes in Figs. 9 and 10 will permit you to disable, or enable, the Break key. Be careful to use them only inside BASIC code. Remember to enable the Break key before program execution is over.

<table>
<thead>
<tr>
<th>SVC CODE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Read the disk ID from any drive</td>
</tr>
<tr>
<td>25</td>
<td>Set a timer to generate an interrupt after n seconds</td>
</tr>
<tr>
<td>36</td>
<td>Jump to TRSOS READY mode</td>
</tr>
<tr>
<td>38</td>
<td>Execute a DOS command</td>
</tr>
<tr>
<td>4</td>
<td>Fetch a character from the keyboard</td>
</tr>
<tr>
<td>5</td>
<td>Fetch a line from the keyboard</td>
</tr>
<tr>
<td>7</td>
<td>Clear the screen with normal/reverse video</td>
</tr>
<tr>
<td>8</td>
<td>Output a character to the display</td>
</tr>
<tr>
<td>9</td>
<td>Output a line to the display</td>
</tr>
<tr>
<td>11</td>
<td>Read video memory</td>
</tr>
<tr>
<td>18</td>
<td>Send a character to the printer</td>
</tr>
<tr>
<td>19</td>
<td>Send a line to the printer</td>
</tr>
<tr>
<td>20</td>
<td>Open a disk file</td>
</tr>
<tr>
<td>35</td>
<td>Read from a disk file</td>
</tr>
<tr>
<td>44</td>
<td>Write to a disk file</td>
</tr>
<tr>
<td>42</td>
<td>Close a disk file</td>
</tr>
<tr>
<td>41</td>
<td>Delete a disk file</td>
</tr>
<tr>
<td>21</td>
<td>Generate a random number</td>
</tr>
<tr>
<td>23</td>
<td>Perform binary-decimal/decimal-binary conversions</td>
</tr>
<tr>
<td>24</td>
<td>Perform binary-hex/hex-binary conversions</td>
</tr>
</tbody>
</table>

Fig. 8. Sample supervisor calls.

61584 F090 3E<00> LD A,<CN> *<03>
61586 F092 21<0000> LD HL,<NN> *<0000>
61589 F095 CF RST 8
61590 F096 3E<00> LD A,<CN> *<03>
61592 F098 21<0000> LD HL,<NN> *<0000>
61595 F09B CF RST 8
61596 F09C C9 RET
61597 F09D 00 NOP
61598 F09E 00 NOP
61599 F09F 00 NOP

To save, type DUMP DISABLE/BRK START = F090, END = F09C, RORT = T

Fig. 9. Code for DISABLE/BRK user routine.

61584 F090 3E<00> LD A,<CN> *<03>
61586 F092 21<0000> LD HL,<NN> *<0000>
61589 F095 CF RST 8
61590 F096 3E<00> LD A,<CN> *<03>
61592 F098 21<0200> LD HL,<NN> *<0002>
61595 F09B CF RST 8
61596 F09C C9 RET
61597 F09D 00 NOP
61598 F09E 00 NOP
61599 F09F 00 NOP
61600 F0A0 00 NOP

To save, type DUMP ENABLE/BRK START = F090, END = F09C, RORT = T

Fig. 10. Code for ENABLE/BRK user routine.

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The Color Computer

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So—your friendly Radio Shack store is selling color computers; and high-resolution color at that. No more 48 by 128 white blocks, but as many as eight colors (nine if you count black) in five modes ranging from 32 x 64 to 192 x 256.

Why would anyone want to buy a color computer from Radio Shack when you can get an Apple for only $1195 or an Atari for about $1079? The most convincing sales pitch is the price—$399! That gets you a 4K computer with low-level Color BASIC. You can move up to 16K for another $119 (plus installation). The total 16K computer with extended BASIC costs only $599.

What Comes with It?

For the initial $399, you get the following:

- 4K Color BASIC computer with built-in RS-232 I/O port and real-time clock
- TV switch box
- 12 foot cable to connect computer to switch box
- Operation Manual
- Color BASIC instruction manual
- Card listing statements, functions, operators, etc.

Phil’s system arrived minus the TV switch box and card. Included with the system is a form to return, stating that more information will be made available in the future. You will also be placed on the Radio Shack computer newsletter mailing list.

You must supply your own color (or black and white) television set and tape recorder.

The TRS-80 Color Video Receiver (#26-3010) is a 13 inch TV set that sells for $399. The CTR-80A Cassette Recorder (#26-1206) costs $59.95. Floppy disks are supposed to be available in the future. In the meantime, don’t despair; the cassette interface operates at 1500 baud—three times the speed of Level II BASIC and six times faster than Level II.

The computer uses a 6809E Motorola eight-bit microprocessor chip with a clock speed of 0.894 MHz. There are DIN connections at the back of the computer for a tape recorder, serial printer or modem, and dual joystick controllers (#26-3006, $24.95). There is also a switch to select channel three or four for computer operation.

Hooking It Up

The operation manual clearly describes how to hook the TV switch box to your set. After plugging the computer into the wall and connecting the computer to the switch box with the cable provided, flip the switch from the TV setting to the computer setting. Now turn on your television to channel three or four, whichever proves to be clearest, and press the on/off button on the computer.

You should now have a green screen framed in black with the Tandy message in the upper left corner. The operation manual includes a color adjustment test and a video centering test to help you balance your set for computer use.

The clarity and color quality of your screen will depend upon the condition of your television set. We are using a ten-year-old Zenith with one and a new Samsung with the other. We have also seen the Shack’s video monitor working. While all three sets provide easily readable text, some of the colors are not very sharp. The worst cases are red, yellow and orange. Red lines particularly appear to be different shades, depending upon whether the line is horizontal, vertical or diagonal. The resolution is poor on the old Zenith, better on the new Samsung and better yet on the Shack’s monitor.

At this point, you should have 2343 bytes of available memory with a 4K machine and 14631 bytes with 16K. Two hundred additional bytes have been automatically set aside for strings.

If you have one of the old Radio Shack cables for a tape recorder, be advised that the color computer requires a metal DIN plug. The plastic ones won’t fit in the slot provided.

Color BASIC and the Manual

Color BASIC has more power than Level I BASIC, but less than Level II. A complete list of commands is given in Table 1. In addition, there are the usual symbols for addition, subtraction, multiplication and division. You cannot use exponents. The relational tests of <, >, =, =<, >= and <> exist, as do the logical operators NOT, AND, and OR.

Permitted abbreviations are the apostrophe for REM and question mark for PRINT. Multiple lines are supported using the colon as a separator. The comma and semicolon are used with PRINT to control spacing. A comma provides 16-column zones. The video display is 16 lines of 32 characters each. Shift @ haunts listing or program flow, as on the Model I.

Variables may be one or two characters long. (They may actually be longer, but only the first two are significant.) Numeric and string variables, as well as arrays, may be used. The LET command has been completely obliterated. If you enter LET A = 25 and then ask for the value of A, you will get a zero. However, the variable LETA has a value of 25.

Some of the commands are different from any in either Level I or II. The CLEAR command allows you to clear string space
and set memory size at the same time. (There is no more memory size question.) For instance, CLEAR500,12000 would reserve 500 bytes of string storage and set memory size at 12000.

CLS does what it used to do—sort of! It now clears the screen to its usual green color. You can change this by specifying a number from 0 to 8. CLS4 clears the video screen to red. Color numbers are:

0 black 3 blue 6 cyan
1 green 4 red 7 magenta
2 yellow 5 white 8 orange

Entering CLS9 gives a green screen with Microsoft written in the upper left corner. This is true of all numbers from 9 to 255.

There is no CLOAD?, which means you cannot verify programs saved to tape. To make up for it, there's Audio. Entering AUDIO before a CLOAD or CSAVE will project your program over your TV speaker. AUDIO OFF turns the sound off. You can also save programs to tape in ASCII format. Example: CSAVE"MEMORY": A.

Machine language programs load with the CLOAD command rather than SYSTEM. EXEC is used to transfer control to the machine language program. You can specify an address, such as EXEC15348. (You also have USR for transferring control to machine language routines.)

You can OPEN sequential files to the screen or keyboard (0), cassette (-1) or line printer (-2). PRINT# and INPUT# are used for transferring information to and from the file. There is also an EOF (end of file) feature.

You can LLIST an entire program or any part thereof. LPRINT, however, has been replaced by PRINT# – 2. We have experienced some problems with LLIST. It seems to scramble lines once in a while. (If you have a copy of 80 Programs for the TRS-80 from 80 Microcomputing, you can modify the print program on page 194 and list and format your program saved on tape in ASCII format.)

A motor feature has been added that turns the recorder on or off from the keyboard without pulling plugs. (Hint: Rather than typing MOTOR OFF, enter anything which would be an error—it's faster. Example: Type H and then enter.)

Programs can be saved to tape with names up to eight characters in length. SKIPF allows you to move to the end of the next file. SKIPF"MEMORY" would search for the file named MEMORY and stop at the end of it.

The SET command includes a color element. SET(13,24,4) would light up block (13,24) with the color four (red). RESET does not need a color indicator.

JOYSTK finds the horizontal and vertical screen positions of the dual joysticks. Use memory location 65280 to determine if a joystick button has been depressed.

Sound fanatics; we now have SOUND. You can send a frequency from 1 (lowest pitch) to 255 (highest) through your TV speaker for a duration of 1 to 255, making sound much easier.

Twenty-five error messages are given in two or three character codes.

The BASIC manual covers most commands. It assumes you know nothing about programming and uses the tongue-in-cheek humorous approach of the original Level I manual. No mention is made of file handling. The basics of numbers, strings, graphics, color, joysticks and sound are covered adequately. The manual refers the user to other computer programming books available from Radio Shack for "more complete instructions on how to program."

The appendices provide a table of values for musical tones with SOUND, a PRINT@ screen location table and a table for SET locations. There are also a few sample programs.

Table 2

Table 2 is a memory map of the Color Computer. It is similar to the memory map in Appendix D of Radio Shack's Level II manual.

Unlike the Model I, the Color Computer has its user RAM (Random Access Memory) in low memory and its ROM (Read Only Memory) higher up. This is because of the different ways the Z-80 chip and the 6809 chip behave on power up and restart.

The Z-80 starts executing code at address 0, so ROM must be in low memory. The 6809 starts looking at the two locations at top of memory to determine the starting location. This means that some ROM must be in the top of memory.

The Color Computer has a 32 byte ROM in locations FE00 to FFFF hexadecimal. This ROM can be disabled by inserting a ROM cartridge in the slot located on the side of the computer. This approach allows the ROM cartridge programs to use some of

<table>
<thead>
<tr>
<th>Hexadecimal</th>
<th>Decimal</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000-3FFF</td>
<td>0 - 16383</td>
<td>User RAM (16K)</td>
</tr>
<tr>
<td>4000-7FFF</td>
<td>16384 - 32767</td>
<td>Empty (RAM expansion)</td>
</tr>
<tr>
<td>8000-9FFF</td>
<td>32768 - 40959</td>
<td>Who knows what evil lurks?</td>
</tr>
<tr>
<td>A000-BFFF</td>
<td>40960 - 49151</td>
<td>8K Color BASIC ROM</td>
</tr>
<tr>
<td>C00-C7FF</td>
<td>49152 - 57343</td>
<td>Memory location for program pack ROMs</td>
</tr>
<tr>
<td>E000-FFFF</td>
<td>57344 - 65535</td>
<td>Who knows what evil lurks?</td>
</tr>
<tr>
<td>FF00-FF1F</td>
<td>65536 - 65711</td>
<td>Keyboard and joystick button PIA (input/output)</td>
</tr>
<tr>
<td>FF20-FF3F</td>
<td>65712 - 65843</td>
<td>Cassette, joystick and video PIA (input/output)</td>
</tr>
<tr>
<td>FF40-FFDF</td>
<td>65844 - 66003</td>
<td>Part of this looks like control for high resolution</td>
</tr>
<tr>
<td>FFED-FFFF</td>
<td>66004 - 66553</td>
<td>Transfer vector ROM</td>
</tr>
</tbody>
</table>

Table 2. Overall Memory Map
"The BASIC manual... assumes you know nothing about programming and uses the tongue-in-cheek humorous approach...."

```
<table>
<thead>
<tr>
<th>BASIC Keyword</th>
<th>Stored Value</th>
<th>Value</th>
<th>ROM Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>128</td>
<td>80</td>
<td>44359</td>
</tr>
<tr>
<td>GO</td>
<td>129</td>
<td>81</td>
<td>44678</td>
</tr>
<tr>
<td>REM</td>
<td>130</td>
<td>82</td>
<td>44711</td>
</tr>
<tr>
<td>ELSE</td>
<td>131</td>
<td>83</td>
<td>44711</td>
</tr>
<tr>
<td>IF</td>
<td>132</td>
<td>84</td>
<td>44820</td>
</tr>
<tr>
<td>DATA</td>
<td>133</td>
<td>85</td>
<td>44768</td>
</tr>
<tr>
<td>PRINT</td>
<td>134</td>
<td>86</td>
<td>44751</td>
</tr>
<tr>
<td>ON</td>
<td>135</td>
<td>87</td>
<td>44866</td>
</tr>
<tr>
<td>INPUT</td>
<td>136</td>
<td>88</td>
<td>45045</td>
</tr>
<tr>
<td>END</td>
<td>137</td>
<td>89</td>
<td>45456</td>
</tr>
<tr>
<td>NEXT</td>
<td>138</td>
<td>90</td>
<td>45304</td>
</tr>
<tr>
<td>DIM</td>
<td>139</td>
<td>91</td>
<td>45902</td>
</tr>
<tr>
<td>READ</td>
<td>140</td>
<td>92</td>
<td>45126</td>
</tr>
<tr>
<td>RUN</td>
<td>141</td>
<td>93</td>
<td>44661</td>
</tr>
<tr>
<td>RESTORE</td>
<td>142</td>
<td>94</td>
<td>44516</td>
</tr>
<tr>
<td>RETURN</td>
<td>143</td>
<td>95</td>
<td>44736</td>
</tr>
<tr>
<td>STOP</td>
<td>144</td>
<td>96</td>
<td>44899</td>
</tr>
<tr>
<td>POKE</td>
<td>145</td>
<td>97</td>
<td>46935</td>
</tr>
<tr>
<td>CONT</td>
<td>146</td>
<td>98</td>
<td>46952</td>
</tr>
<tr>
<td>CLEAR</td>
<td>147</td>
<td>99</td>
<td>46952</td>
</tr>
<tr>
<td>NEW</td>
<td>148</td>
<td>100</td>
<td>46952</td>
</tr>
<tr>
<td>CLOAD</td>
<td>149</td>
<td>101</td>
<td>46952</td>
</tr>
<tr>
<td>CSAVE</td>
<td>150</td>
<td>102</td>
<td>46952</td>
</tr>
<tr>
<td>OPEN</td>
<td>151</td>
<td>103</td>
<td>46952</td>
</tr>
<tr>
<td>CLOSE</td>
<td>152</td>
<td>104</td>
<td>46952</td>
</tr>
<tr>
<td>LLIST</td>
<td>153</td>
<td>105</td>
<td>46952</td>
</tr>
<tr>
<td>SET</td>
<td>154</td>
<td>106</td>
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</tr>
<tr>
<td>RESET</td>
<td>155</td>
<td>107</td>
<td>46952</td>
</tr>
<tr>
<td>CLS</td>
<td>156</td>
<td>108</td>
<td>46952</td>
</tr>
<tr>
<td>MOTOR</td>
<td>157</td>
<td>109</td>
<td>46952</td>
</tr>
<tr>
<td>SOUND</td>
<td>158</td>
<td>110</td>
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<td>AUDIO</td>
<td>159</td>
<td>111</td>
<td>46952</td>
</tr>
<tr>
<td>EXE</td>
<td>160</td>
<td>112</td>
<td>46952</td>
</tr>
<tr>
<td>SKIPF</td>
<td>161</td>
<td>113</td>
<td>46952</td>
</tr>
<tr>
<td>TAB</td>
<td>162</td>
<td>114</td>
<td>46952</td>
</tr>
<tr>
<td>TO</td>
<td>163</td>
<td>115</td>
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<td>SUB</td>
<td>164</td>
<td>116</td>
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<tr>
<td>THEN</td>
<td>165</td>
<td>117</td>
<td>46952</td>
</tr>
<tr>
<td>NOT</td>
<td>166</td>
<td>118</td>
<td>46952</td>
</tr>
<tr>
<td>STEP</td>
<td>167</td>
<td>119</td>
<td>46952</td>
</tr>
<tr>
<td>OFF</td>
<td>168</td>
<td>120</td>
<td>46952</td>
</tr>
<tr>
<td>+</td>
<td>169</td>
<td>121</td>
<td>46952</td>
</tr>
<tr>
<td>=</td>
<td>170</td>
<td>122</td>
<td>46952</td>
</tr>
<tr>
<td>&gt;</td>
<td>171</td>
<td>123</td>
<td>46952</td>
</tr>
<tr>
<td>&lt;</td>
<td>172</td>
<td>124</td>
<td>46952</td>
</tr>
<tr>
<td>OR</td>
<td>173</td>
<td>125</td>
<td>46952</td>
</tr>
<tr>
<td>;</td>
<td>174</td>
<td>126</td>
<td>46952</td>
</tr>
<tr>
<td>&quot;</td>
<td>175</td>
<td>127</td>
<td>46952</td>
</tr>
<tr>
<td>,</td>
<td>176</td>
<td>128</td>
<td>46952</td>
</tr>
</tbody>
</table>
```

Table 3. One-byte BASIC Keyword Codes and Addresses

```
<table>
<thead>
<tr>
<th>BASIC Keyword</th>
<th>Stored Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGN</td>
<td>128</td>
<td>80</td>
</tr>
<tr>
<td>INT</td>
<td>129</td>
<td>81</td>
</tr>
<tr>
<td>ABS</td>
<td>130</td>
<td>82</td>
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<tr>
<td>USR</td>
<td>131</td>
<td>83</td>
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<tr>
<td>RND</td>
<td>132</td>
<td>84</td>
</tr>
<tr>
<td>SIN</td>
<td>133</td>
<td>85</td>
</tr>
<tr>
<td>PEEK</td>
<td>134</td>
<td>86</td>
</tr>
<tr>
<td>LEN</td>
<td>135</td>
<td>87</td>
</tr>
<tr>
<td>STRS</td>
<td>136</td>
<td>88</td>
</tr>
<tr>
<td>VAL</td>
<td>137</td>
<td>89</td>
</tr>
<tr>
<td>ASC</td>
<td>138</td>
<td>90</td>
</tr>
<tr>
<td>CHRS</td>
<td>139</td>
<td>91</td>
</tr>
<tr>
<td>EOF</td>
<td>140</td>
<td>92</td>
</tr>
<tr>
<td>JOYSTK</td>
<td>141</td>
<td>93</td>
</tr>
<tr>
<td>LEFTS</td>
<td>142</td>
<td>94</td>
</tr>
<tr>
<td>RIGHT$</td>
<td>143</td>
<td>95</td>
</tr>
<tr>
<td>MID$</td>
<td>144</td>
<td>96</td>
</tr>
<tr>
<td>POINT</td>
<td>145</td>
<td>97</td>
</tr>
<tr>
<td>INKEYS</td>
<td>146</td>
<td>98</td>
</tr>
<tr>
<td>MEM</td>
<td>147</td>
<td>99</td>
</tr>
</tbody>
</table>

NOTE: Each of these keywords actually uses two bytes. The first byte is 255 (or FF hexadecimal), the second byte is as indicated above.

Table 4. Two-byte BASIC Keyword Codes

```
```

Table 4 lists these keywords which are preceded by 255 (FF hexadecimal) in the BASIC program memory. In ROM this table follows the other keyword table. It starts at 48802 through the BASIC ROM's subroutines.

The sections of memory space marked as empty have the value 255 (hexadecimal FF) in them. The sections of memory space (Table 2) marked "Who knows what evil lurks?" have the value 126 (hexadecimal 7E) in them, as does the section of memory space marked for high resolution. What goes on in this space is unknown to us at this time.

The two sections of memory described as PRAs in the table are I/O (input/output) devices. There are I/O ports built into the Z-80. The 6809 lacks these ports and does all its I/O through the memory. The concept of memory mapped I/O is described in the TRS-80 Microcomputer Technical Reference Handbook (R.S. Cat. No. 26-2103). These locations control all the keyboard, cassette, and joystick interactions and some of the video generator controls.

The joystick buttons are brought in through the keyboard port. In addition to PEEKing location 95280, these buttons may be detected by an INKEYS statement.

Table 3 contains a list of the BASIC words stored in the program as one byte. This data is available in ROM starting at location 43622 (AA66 hexadecimal). If you examine the ROM, you will notice the last letter of the word is garbled. In fact the last letter has had 128 (80 hexadecimal) added to it as an end of word indicator.

The stored value is the actual code stored in the BASIC program's memory space. It corresponds to the value 128 plus the position of the BASIC keyword in the table. The instructions FOR to SKIFF (with the exception of ELSE) may start a line of the BASIC program.

A table in ROM, starting at location 43879 (AB87 hexadecimal), contains the starting addresses of the routines that perform the keywords. Table 3 lists these values in the fourth and fifth columns. We haven't been able to locate the addresses for those keywords from TAB (down).

A word is in order about ELSE. In the BASIC program, ELSE is stored as a 132 (84 hexadecimal), as indicated. However, a colon (58 decimal, 3A hexadecimal) is always stored in front of it. (This colon is stored in memory. It doesn't appear in the program listing.) If you remove the colon by POKING the location which contains it with another value, you can get a program which looks correct but which gives a syntax error when the THEN branch of the IF...THEN...ELSE statement is run.
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<table>
<thead>
<tr>
<th>Memory Location</th>
<th>191</th>
<th>223</th>
<th>239</th>
<th>247</th>
<th>251</th>
<th>253</th>
<th>254</th>
</tr>
</thead>
<tbody>
<tr>
<td>338</td>
<td>ENTER</td>
<td>8</td>
<td>0</td>
<td>X</td>
<td>P</td>
<td>H</td>
<td>@</td>
</tr>
<tr>
<td>339</td>
<td>CLEAR</td>
<td>9</td>
<td>1</td>
<td>Y</td>
<td>Q</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>340</td>
<td></td>
<td>2</td>
<td>Z</td>
<td>R</td>
<td>J</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>341</td>
<td></td>
<td>3</td>
<td>T</td>
<td>S</td>
<td>K</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>342</td>
<td></td>
<td>4</td>
<td>I</td>
<td>T</td>
<td>L</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>343</td>
<td></td>
<td>5</td>
<td>U</td>
<td>M</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>344</td>
<td></td>
<td>6</td>
<td>V</td>
<td>N</td>
<td>F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>345</td>
<td></td>
<td>7</td>
<td>SPACE</td>
<td></td>
<td>W</td>
<td>O</td>
<td>G</td>
</tr>
</tbody>
</table>

Note: Normal value at these locations is 255. When a key has been pressed, the value changes accordingly. Shifted keys produce the same values. Note also that the values above are the 255 complements of 64, 32, 16, 8, 4, 2 and 1.

Table 5. TRS-80 Color Computer Keyboard Map

(AB1A hexadecimal) and runs to 43878 (AB66 hexadecimal). The table of starting addresses displayed in Table 3 comes after this table of keywords. Again, we have not yet been able to find the ROM start addresses for these keywords.

Table 7 lists the locations of functions in RAM that we have found. In the 6809, the memory may be considered to be divided into 256 pages of 256 bytes each. An internal register, the DPR (direct page register), points to one of these pages. This allows quick access to a page. In much, if not all, of Color BASIC the DPR points to page 00, which holds quite a few of the pointers and storage variables used by BASIC.

One potentially useful section of page 01 is found in Table 5, containing a memory map of the keyboard (338 to 345 decimal). All keys except the Break and Shift keys can be accessed from this map. Through careful programming you can determine if a particular key is being depressed. For instance, if PEEK(344) equals 247 then the right arrow key is being held down. When you release the key, memory location 344 will revert to 255.

Another handy location is 135 (87 hexadecimal), which normally contains a zero, and holds the ASCII value of the last key pressed. It will continue to hold that value until you press another key or until either an INKEY$ or INPUT statement is encountered.

The beginning of page 01 (around address 256) holds the starting locations for interrupt routines (SW13, SW12, SW1, NM1, IRQ and FIRQ). These addresses are specified by the transfer vector ROM at the high end of memory. There are three addresses between these locations; normal procedure is to put a jump instruction to the body of the interrupt routine in these locations.

Locations 1024 to 1535 (400 to SFF hexadecimal) contain the memory normally associated with video display. Unlike the Model I, the Color Computer does not have a physically separate RAM for the video storage. The position and amount of RAM displayed on the screen can be changed by POKEing certain locations in high memory. This process has to be used for some of the higher graphics resolution modes.

Locations 1024 to 1535 (0400 to 05FF hexadecimal) are your video screen. If you want to POKE the screen or PEEK at it, do it here. According to Table 8, it can make a difference whether you print the CHR$ of a number or POKE that number to the screen. From 0 to 127 you will get control codes, letters, numbers, arrows and the rest of the keyboard symbols. (There is no way to produce the right arrow or the down arrow.) Table 6 shows the lowest resolution graphics codes from 128 to 255. Notice that these blocks repeat in groups of sixteen for each of the eight colors.

Fig. 2 shows how RAM is divided for use by BASIC. The system RAM is used internally by BASIC. The video display RAM is where the screen data is stored. The first address of video RAM can possibly be moved, but we're not certain how to do it. This move involves some POKEing into high memory in the area indicated in Table 2.

The addresses for the rest of the start points are surrounded by parentheses, which indicates that the desired address is stored there. (Actually, it is in that address and the following one. In the 6809, the most significant byte of an address is stored first, while in the Z-80 the least significant byte comes first.) You can modify these pointers by POKEing the pointer locations. Modifying the pointers is dangerous because you may destroy your program or cause the Color Computer to hang up in a state which it can’t get out of without being powered down. However, if you have saved a copy of your program and power down, all will be well. You can’t damage the system by typing on the keyboard, so experiment!

And Now, The Programs

The first program is titled Memory. It allows you to search through RAM and ROM to see what’s there. You may enter the starting address in decimal or hexadecimal. Your screen will be filled with a block of thirty-two bytes of memory at a time, showing the RAM/ROM location, the number (0-255, OH-FBH) stored there and the CHR$ of that number (if greater than 32). These values can be shown in either decimal or hexadecimal. To switch from decimal to hex, press the H. To return to decimal mode press D. To scroll forward a block of thirty-two bytes press ; and to scroll backwards press -. When you finish looking through one section of code and wish to switch to another, press CLEAR and select a new starting address.

Refer to Table 2 and Table 7 as guides while PEEKing through memory. Note that at 466 RAM (1D2 hex) you will see the name of the program last CSAVeD, CLOAdeD or SKIPFed, and that the last file encountered on tape will be found to start at 474 (1DA hex). Within the last two hundred bytes of your computer's memory (3895 for 4K and 16183 for 16K), you should begin to see the keys you are pressing while running Mem-
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<table>
<thead>
<tr>
<th>0</th>
<th>0000</th>
<th>..................................................</th>
</tr>
</thead>
<tbody>
<tr>
<td>1024</td>
<td>0400</td>
<td>SYSTEM RAM</td>
</tr>
<tr>
<td>(25)</td>
<td>(0010)</td>
<td>VIDEO DISPLAY RAM</td>
</tr>
<tr>
<td>(27)</td>
<td>(0011)</td>
<td>BASIC PROGRAM</td>
</tr>
<tr>
<td>(29)</td>
<td>(0012)</td>
<td>SIMPLE VARIABLE STORAGE</td>
</tr>
<tr>
<td>(31)</td>
<td>(0013)</td>
<td>ARRAY VARIABLE STORAGE</td>
</tr>
<tr>
<td>(23)</td>
<td>(0017)</td>
<td>FREE SPACE</td>
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<tr>
<td>(33)</td>
<td>(0021)</td>
<td>STRING STORAGE</td>
</tr>
<tr>
<td>(39)</td>
<td>(0027)</td>
<td>STACK AREA</td>
</tr>
<tr>
<td>(116)</td>
<td>(0074)</td>
<td>PROTECTED MEMORY</td>
</tr>
</tbody>
</table>

Fig. 2. Map of BASIC Storage Area

Memory (D, H, ..., Z). The list of BASIC keywords runs from 43622 to 43879 (A66--AB66 hex). The ROM starting addresses for these routines can be found from 43679 to 43950 (AB67--ABAE hex). The twenty-five error messages of Color BASIC can be found from 43951 to 44000 (ABAF--ABEO hex).

The second program is called Windows. It is a low-resolution graphics program. Format one creates sixteen identical windows on your video screen and format two simultaneously draws four identical Kaleido-

ory (D, H, ...).

The ignoring the order of points being used, press the CLEAR key after you hear the tone and you'll be returned to the beginning of the program to start anew.

Experiment with both formats, the number of points displayed and the color combinations and see what you come up with. Fewer points will give a light airy design, whereas many points will produce more complex and crowded figures.

A Musical Program

The third program listing is Music-Music-Music.

```plaintext
0 A=INT(J/4896)
1 REM MEMORY PEEK ROUTINE
2 HS='0123456789ABCDEF'
3 PRINT"" VALUES IN DECIMAL OR HEX"
4 DATA 1,16,256,4896
5 GOSUB3500
6 IF (LNS,,1) THEN LNS=VAL(LNS):GOTO12
7 EXIT=RIGHT$(LNS,LE-NS)=1
8 FORM=PT01
9 LS=MEAS(LNS,LE+1-X,1)
10 FOR P=PT02 TO PT05
11 NEXT: GOTO100
12 QE=4: P+1: P+2
13 NEXT
14 IFQ=65536 THEN 1098
15 PRINT@1;"P"+P*32,""; IFHEX=1"HEX=0:GOSUB36500: GOSUB3500:
16 J=3-4896:A
17 PRINT@P*16+7+P*32,""
18 IFINS="H" THENH = "H": RETURN
19 IFINS="D" THENH = "D": RETURN
20 IFHEX=1: GOSUB36500: GOSUB36500:
21 IP(INS)=12: THENCLS: GOTO118
22 PRINT@P*16+12+P*32,"","", A=INT(J/126): GOSUB3500
23 PRINT" OR THE '-' KEY TO SCROLL BACK-
24 PRINT" WARDS."
25 PRINT" PRESS 'H' TO CHANGE TO HEX OR 'D' TO SWITCH TO DECIMAL."
26 J=J-256*A
27 PRINT" TO CHANGE START ADDRESS","; PRINT"PRESS 'CLEAR'."
28 A=INT(J/16): GOSUB3500
29 A=J-16:A: GOSUB3500
30 RETURN
31 GOSUB2000: CLS
32 IFINS="H": THENP=P+32: GOTO1158
33 IFINS=0: ORINS="D": GOTO1158
34 IFINS="": THENP=P-32: ELSCLS: GOTO110
35 IFP08 THEN P=0
36 IFP05335 THENP=0:65525
37 GOTO1012
38 END
39 PRINTMIDS(HS,A-1,1);: RETURN
```

Program Listing 1

change formats or the number of points being used, press the CLEAR key after you hear the tone and you'll be returned to the beginning of the program to start anew.

Experiment with both formats, the number of points displayed and the color combinations and see what you come up with. Fewer points will give a light airy design, whereas many points will produce more complex and crowded figures.

A Musical Program

The third program listing is Music-Music-Musicaassist you visually.

To enter a note, type in its number (1-48), or zero (0) for a rest. (See Fig. 3.) To cancel the last note entered, type the letter C. To end entering music press the up arrow and hit Enter. (All of this information appears on the screen while you are working.)

Once you've selected the number of the note (or rest), the orange block will appear on that note on the keyboard. Type in the duration for that note (1-32). (See Fig. 4.) If you want to cancel that note, type a zero (0).

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<td>2</td>
</tr>
</tbody>
</table>
```

Fig. 3. Notes for Music-Music-Music.
Mini-Disk Storage Systems for TRS-80* Computers

Access... Offers More. Charges less.

from $295

Check this line-by-line comparison of Access 5-inch mini-disk systems for Model I and Model III computers. Nobody offers more benefits, better service or lower prices.

TOLL-FREE ORDER NO.
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(order and literature only)

Free trial offer

Use your brand new AFD drive system for up to 15 days. If you're not completely satisfied, pack it in the original shipping container and send it back to Access. We'll refund the price of the system (less shipping charges) no questions asked. (No refund for misuse or improper handling.)

Operating burn-in test — too

Every drive that leaves Access is not only 100% electrically tested and double-checked for mechanical alignment, but it is also given a full 48-hour operating burn-in test. You'll find a test list — checked and signed by one of our competent technicians — in the drive carton. If a drive has latent defects, the burn-in life test will weed them out. The drives we ship just keep on running. And running. And running.

About our warranty

Venus de Milo has about the right number of fingers to count our warranty returns. Nevertheless, your new drive system is covered by our comprehensive 90-day limited warranty. The details are spelled out in the illustrated users manual included with each AFD drive system.

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Games. Business programs. System software. We sell many of the best TRS-80* Model I and Model III programs, and at competitive prices. Make Access Unlimited your one-stop shopping center for all of your TRS-80* software, hardware and accessories. Save big! Call our toll-free order number, 1-800-527-4196† for free descriptive literature.

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the DOUBLER™

Percom's new plug-in adapter for your Expansion Interface stores almost twice the data on a diskette track as a single-density system. You can store up to four times more data — depending on the type of drive — on one side of a diskette than you can store using a standard Model I mini-disk drive. Other features: Reads, writes and formats either single or double density minidiskettes; Runs TRSDOS™, NEWDOS™ or other single-density software with no changes. Switch to double-density when convenient. Includes DDLBOS™, a TRSDOS™ compatible, double-density operating system. Includes on-card, high-performance data separator circuit; Installs without rewiring or trace cutting; Introductory pricing, including DDLBOS and format conversion utility, only $99.50. Permits Model III software to be read on Model I computers.

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Order by calling Access Unlimited toll-free on 1-800-527-4196†. Mail orders also accepted. Orders may be charged to a VISA or MasterCard account or paid by a cashier's check, certified check or money order. We accept COD orders with 25% deposit. Sorry, we cannot accept personal checks. We pay shipping and insurance charges on orders over $1,000. Add approximate insurance and shipping charges for under $1,000. If in doubt about these charges, ask when you call in your order. Texas residents add 5% sales tax. Minimum order $20.00. Allow 2 to 4 weeks for delivery. **Texas residents call (214) 494-0206.

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1. Call 1-800-527-4196†.
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4. Drive your order to the drop-ship address within 15 days for a full refund. (If you don't return the drive within 15 days, we'll charge you the full price of the drive.)
5. If you're not satisfied with the drive, return it within 15 days for a full refund. (If you return the drive within 15 days, we'll charge you the full price of the drive.)
6. If you're not satisfied with the service, return the drive within 15 days for a full refund. (If you return the drive within 15 days, we'll charge you the full price of the drive.)

DATA SEPARATOR™

This PC board plug-in adapter for the TRS-80* virtually eliminates data read errors (CRC error — Track locked out!) which occur on high-density inner disk tracks, a problem that has plagued TRS-80* systems. The Percem Data Separator™ is installed in the Expansion Interface without modifying the host system. Caution: Opening the TRS-80* Expansion Interface may void the limited 90-day warranty: $29.95.©

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Improvement over RS cable design places drive 0, which includes the cable termination, at the end of the cable to eliminate the reflected noise of an unterminated cable. Better data integrity. Prices:

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$24.95

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115/250V, 50-600 Hz. Instructions included for easy installation in standard mini-box chassis. $19.95.

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10 Disks in a convenient plastic organizer box . $34.90

Single Disk . 3.49

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1 x 1/4" self-adhering plastic drive identification tabs. Compatible with engraved black drive number. Two tabs (Nos. 0, 1): $2.50; three tabs (Nos. 0, 1, 2): $3.25; four tabs (0, 1, 2, 3): $4.50

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(214) 494-0206

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"Machine language programs load with the CLOADM command rather than SYSTEM."

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<th>Content</th>
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<td>0017-0018</td>
<td>BASIC stack pointer</td>
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<td>25-26</td>
<td>0019-001A</td>
<td>Start of BASIC pointer (normally 1537)</td>
</tr>
<tr>
<td>27-28</td>
<td>001B-001C</td>
<td>Start of simple variables pointer</td>
</tr>
<tr>
<td>29-30</td>
<td>001D-001E</td>
<td>Start of arrays pointer</td>
</tr>
<tr>
<td>31-32</td>
<td>001F-0020</td>
<td>Start of free space pointer</td>
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<tr>
<td>33-34</td>
<td>0021-0022</td>
<td>Pointer to next available byte in string space</td>
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<td>0023-0024</td>
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<td>002F-0030</td>
<td>Pointer to byte following last data element read</td>
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<td>0033-0034</td>
<td>Pointer to next byte in keyboard buffer</td>
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<td>Pointer to top of available memory (minus one)</td>
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<td>ASCII value of key last pressed (Returns to zero after INPUT or INKEY$)</td>
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<td>136-137</td>
<td>008B-008C</td>
<td>Location of cursor in memory</td>
</tr>
<tr>
<td>141-142</td>
<td>008D-008E</td>
<td>Stores pitch for SOUND command</td>
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<tr>
<td>157-158</td>
<td>009D-009E</td>
<td>Stores pitch duration for SOUND command</td>
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<td>00A6-00A7</td>
<td>Used by EXEC command to store jump location</td>
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<td>Pointer to what part of BASIC program is being executed</td>
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<td>Keyboard map</td>
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<td>Stores name specified by CSAVE, CLOAD or SKIPF</td>
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Table 7. TRS-80 Color Computer RAM Map
"To whet your appetite a little further, look at... the list of features Radio Shack is claiming..."

Extended BASIC to Come

Even with only the low level BASIC to work with, the sound and color graphics features of the Color Computer are enormous fun. If you are looking for an inexpensive color computer which can be expanded to do some moderately sophisticated programming, the TRS-80 Color looks like a good buy.


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<tr>
<td>30</td>
<td>!</td>
<td>62</td>
<td></td>
<td></td>
<td>94</td>
<td>!</td>
<td>126</td>
<td>!</td>
</tr>
<tr>
<td>31</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
<td>95</td>
<td></td>
<td>127</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** "bg" means black print on green screen
"gb" means green print on black screen

Table 8. CHR$ and POKE Values 0 to 127.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Note</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Note</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Note</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Note</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Note</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Note</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Note</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Whole Rest</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Whole Rest</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>1/2 Rest</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>1/4 Rest</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>1/8 Rest</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1/16 Rest</td>
<td>2</td>
</tr>
</tbody>
</table>

Fig. 4. Note Durations

Program Listing 2

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 ^ WINDOWS</td>
<td></td>
</tr>
<tr>
<td>20 ^ EOG NICKOLAS</td>
<td></td>
</tr>
<tr>
<td>30 ^ 1-89/80</td>
<td></td>
</tr>
<tr>
<td>48 CLS</td>
<td></td>
</tr>
<tr>
<td>159 INPUT&quot;ENTER FORMAT (1-2)&quot;;FMS</td>
<td></td>
</tr>
<tr>
<td>165 IF FMS=&quot;THENCLS:GOTO100ELSEFMS=VAL(FMS)</td>
<td></td>
</tr>
<tr>
<td>170 IF FMS&lt;1 OR FMS&gt;2 THEN CLS:GOTO100</td>
<td></td>
</tr>
<tr>
<td>172 PRINT</td>
<td></td>
</tr>
<tr>
<td>175 INPUT&quot;HOW MANY POINTS [10-180]&quot;;PS</td>
<td></td>
</tr>
<tr>
<td>179 IF PS=10 OR PS&gt;180 THEN CLS:GOTO125</td>
<td></td>
</tr>
<tr>
<td>180 CLE</td>
<td></td>
</tr>
<tr>
<td>182 FOR X=1 TO 180</td>
<td></td>
</tr>
</tbody>
</table>

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BASF "LEXYDISK"... Superior Quality, data storage medium. Certified and guaranteed 100% error free.

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Program Listing 3

139 PRINTX$=32+26*X;
140 FORA=TO:ST:SET(A,X*2);X;
142 NEXTA,X
144 PRINT$=84,CHR$(11)+PRINT$=84,"");
145 INPUT "WHICH COLORS FOR POINTS";CS
146 IFCS="" THEN 135
150 CALL=88,50
160 ON FM GOTO188,300
170 ' FORMAT ONE - 16 WINDOWS
180 X=RND(14)-15=RND(7)-1
190 C=VAL(MIDS(CS,RND(LEN(CS)),1))
192 IF(C<0 OR C>8 THEN 190
195 N=N+1;INF=N THEN 500
200 FORA=TO:ST
210 FORB=TO:ST
220 SET(A+18*X,B+8,Y,C)
230 NEXTA,B
235 SOUND258-2*N,1
240 GOTO300
290 ' FORMAT TWO - FOUR KALEIDO SCPE WINDOWS
300 X=RND(15);Y=RND(7)
310 C=VAL(MIDS(CS,RND(LLEN(CS)),1))
315 IF(C<0 ORC>8 THEN 310
320 N=N+1;INF=N THEN 500
330 FORA=TO:ST
340 FORB=TO:ST
350 A=12;ION 360 SET(A+X,B+Y,C)
370 SET(A+31,X,B+Y,C)
380 SET(A+15+X,B+15+Y,C)
390 SET(A+31-X,B+15-Y,C)
400 NEXTA,B
405 SOUND258-NP 1,1
410 GOTO300
500 INF=""
505 SOUND158,38
510 FORM=1 TO 750
520 INF=INKEYS 1;INF="";THEN 550
530 IFASC(CAS)"=";THEN 550
550 NEXT GOTO358

Program continues
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and chassis.
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- Help you perform WATS feasibility studies

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phone system.

<table>
<thead>
<tr>
<th>Model</th>
<th>Cassette</th>
<th>TRSDOS* disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>$95</td>
<td>$135</td>
</tr>
<tr>
<td>II</td>
<td>N/A</td>
<td>$155</td>
</tr>
<tr>
<td>III</td>
<td>$95</td>
<td>$155</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>AEROCOMP</th>
<th>YES</th>
<th>Srs.</th>
<th>YES</th>
<th>YES</th>
<th>250K bytes (both sides)</th>
<th>YES</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RADIO SHACK</td>
<td>NO</td>
<td>40s</td>
<td>NO</td>
<td>NO</td>
<td>109K bytes</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>PERCOM</td>
<td>YES</td>
<td>25s</td>
<td>NO</td>
<td>NO</td>
<td>250K bytes (both sides)</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>MPI</td>
<td>NO</td>
<td>5s</td>
<td>YES</td>
<td>YES</td>
<td>125K bytes</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>SHUGART</td>
<td>NO</td>
<td>40s</td>
<td>NO</td>
<td>NO</td>
<td>109K bytes</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>TANDON</td>
<td>NO</td>
<td>5s</td>
<td>NO</td>
<td>NO</td>
<td>125K bytes</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

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Purge

Have you ever sat at your TRS-80 typing KILL FILENAME over and over to clear a diskette of unwanted files? If you've wanted a faster way of clearing a diskette, Purge Utility will fill the bill.

Purge Utility will operate with either TRSDOS or NEWDOS operating systems with only one difference. Under TRSDOS the Purge Utility will not delete a password protected file. Since NEWDOS ignores password protection, Purge Utility will delete them.

Program Operation

Purge Utility is presented here in two forms, an assembly language listing and a BASIC program which POKEs the decimal values into memory and allows the program to be dumped onto disk. It operates simply.

Initially the program prompts the operator for a drive number (0-3) to indicate which diskette is to be purged. This beginning drive number prompt also allows loading the Purge Utility from one diskette, then loading a second diskette that you wish to purge. You can purge any disk without having to actually store the utility on all your disks (useful for single drive systems).

Once the drive prompt is answered, the program displays each file in the directory (system files excluded), and prompts for a Y or N to indicate if the file is to be deleted or not. All your entries are single keystrokes. You don't need to press Enter after your responses. The program can be aborted at any point by hitting an X instead of a Y or N.

The files are displayed in order within the directory; invisible attribute files are also displayed. When all the files have been displayed, the screen clears and the program displays each file as it deletes it, then returns to DOS Ready.

Program Composition

The program uses two DOS routines, Open and Kill. Although BASIC requires a file to be closed before it can be killed, in actuality the file is opened and then deleted from the directory. Three ROM routines are also utilized in the program. CRT (033AH) displays a single character (passed in the accumulator) on the screen and handles all screen positioning. CLS (01C9H) is the clear screen routine in ROM. KBD (0049H) is a keyboard scan routine. This routine scans the keyboard, waits for an entry and returns with the character in the accumulator. The program aborts itself if a drive-not-ready condition occurs, or if an error is encountered when reading the directory.

An internal-sector read routine is used to read the directory rather than a DOS based directory read routine. This helps ensure compatibility on future DOS releases and allows a drive-not-ready check routine.

The directory is located on track 11H (17 decimal) and the actual directory entries reside in sectors two through nine of the directory track. Sectors zero and one contain a granule allocation table and a hash index table. These two sectors are not accessed by the program, but are accessed and updated by the DOS Open and Kill routines called by the program.

The program resides at memory locations 7400H to 7666H. The location was chosen to make the program compatible with the DUMP command when the program is entered with the BASIC program. Once the BASIC program is executed, enter CMD "S" to return to DOS Ready. Enter the following DUMP command:

```
DUMP PURGE/CMD (START=X7400, END=X7666, TRA=X7400)
```

This will store the program on disk and allow it to be executed.
by simply entering Purge from DOS Ready. If you are using an editor/assembler, be sure to use a file name with /CMD as an extension to achieve immediate execution from DOS.

Although this program's usefulness is somewhat limited, I hope that the assembly language listing will be of some educational value to beginning programmers.

```basic
1 ** BASIC PROGRAM TO POKE PURGE PROGRAM INTO MEMORY
2 ** RETURN TO 'DOS READY' AND DUMP THE PROGRAM ONTO
3 ** DISK. THE COMMENTS WITHIN THIS PROGRAM SHOULD
4 ** BE **
5 ** DELETED TO ALLOW THE PROGRAM TO FIT IN MEMORY.
6 **
7 ** SET MEMORY SIZE FROM BASIC PROGRAM **
8 POKE16561,258;POKE16562,115;CLEAR18;CLS
9 ** SET START OF PROGRAM (7400H) AND ZERO CHECKS
10 UM **
11 S=7H7400C;CH=8
12 ** LOOP TO READ A BYTE (DECIMAL) AND POKE TO MEM
13 ORY **
14 FOR I = 8 TO 7H7666
15 READ X : POKE I,X
16 PRINT@256, "STORING ":X; INTO MEMORY LOCATION ";
17 I;CHR$(30)
18 C=C+X
19 NEXT
20 ** CHECK THE CHECKSUM **
21 IF C < 57478 THEN PRINT "CHECKSUM ERROR" : END
22 PRINT "RETURN TO DOS" : PRINT
23 PRINT "DUMP PURGE/CMO (START=X'7400', END=X'7666',TRAP="X'7400'"
24 **
25 DATA 243,205,281,1,33,191,117,285,201,116,33,84,11
26,205
27 7010 DATA 281,116,285,73,0,254,52,48,249,254,48,56,245,
28,285
29 7020 DATA 58,3,214,48,68,58,183,118,285,98,117,285,213,
30,116,6
31 7030 DATA 64,33,8,100,205,62,117,197,229,283,118,32,37,
32,283,102
33 7040 DATA 48,3,17,5,0,25,205,22,117,33,236,117,285,201,
34 5,32,3
35 7050 DATA 244,116,254,69,245,205,58,3,285,62,117,241,22,
36 5,32,3
37 7060 DATA 62,255,119,229,255,17,32,0,25,193,16,285,205,
38 281,1,6
39 7070 DATA 64,33,8,100,197,229,62,255,198,32,71,285,60,1,
40 17,17
41 7080 DATA 5,8,25,17,0,99,6,8,126,254,32,40,2,18,19,35,1,
42,246
43 7090 DATA 62,47,18,19,6,3,126,254,32,48,5,18,35,19,16,2
44 46,62
45 7100 DATA 13,10,33,253,117,285,201,116,225,229,17,5,0,2
46 5,285
47 7110 DATA 22,117,205,62,117,33,0,126,17,8,99,285,36,68,
48 285,44
49 7120 DATA 68,225,17,32,8,25,193,16,170,285,201,1,195,45,
50 .64
51 7130 DATA 126,254,8,280,229,205,58,3,225,35,24,62,61,
52 7,58
53 7140 DATA 184,116,62,2,58,105,118,1,8,100,205,110,117,2
54 21
55 7150 DATA 33,105,116,221,52,0,62,18,221,190,8,32,239,20
56 1,285,73
57 7160 DATA 0,254,69,200,254,78,200,254,88,282,195,116,24
58 ,240,126
59 7170 DATA 254,32,48,3,285,16,117,35,16,245,281,221,119,
60 8,221,35
61 7180 DATA 281,6,12,221,33,221,17,205,7,117,221,33,223,
62 .117
63 7190 DATA 6,8,205,4,117,62,32,190,40,18,62,47,205,16,11
64
65 7200 DATA 6,3,205,4,117,33,223,117,205,201,116,201,62,1
66 3
67 7210 DATA 285,58,3,201,6,32,221,33,0,99,221,54,0,32,221
68 7220 DATA 35,16,245,281,197,58,183,118,71,62,228,17,16,2
69 53
70 7230 DATA 58,225,55,193,281,205,83,117,33,0,8,43,124,10
71 1
72 7240 DATA 32,251,281,205,83,117,58,184,116,58,239,55,58
73 ,185
74 7250 DATA 118,50,238,55,33,236,55,62,38,119,197,193,197
75 ,193
76 7260 DATA 126,7,48,3,195,186,113,15,55,245,54,136,17
77 139
78 7270 DATA 55,197,193,197,193,24,3,15,48,10,126,283,79,4
78
```

Program Listing continues
HI-RESOLUTION GRAPHICS FOR TRS-80*

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E/RAM is fast. "E/RAM" is an acronym for Extended Random Access Memory, a very short description of the Patent-Pending method of I/O employed by this device, which gives it memory-mapped speed without interfering with the memory space used by the TRS-80.

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E/RAM software package is compact (less than 1000 bytes), fast, easy to use, and very flexible. A relocating loader is provided. The user can delete unused routines if more memory space is required. Lines can be drawn as fast as 13 per second using BASIC USR calls, and as fast as 200 per second using assembly language programs.

Utilities usable through USR of BASIC, and of course an assembler CALL are:

INT - Sets up display
PLT - Plots a point
READ - Reads a point from the screen
BLACK - Sets drawing mode to black (off)
WHITE - Sets drawing mode to on
CLEAR - Clears the high-resolution graphics screen
LINE - Draws a line

As an example, the utilities package is loaded and you desire to draw a line, the following sequence of BASIC instructions could be executed:

U-USR(0) - Return the communications area
POKE U+1,X0 - Provide the beginning X coordinate
POKE U+3,Y0 - Provide the beginning Y coordinate
POKE U+5,X1 - Provide the ending X coordinate
POKE U+7,Y1 - Provide the ending Y coordinate
USR(4) - Draw the line (Current speed is approximately 13 vectors/second)

The complete E/RAM package is available for only $349.95, and includes case, power supply, cables, software cassette, and complete documentation.

To order, or for further details, write or call:

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222 • 80 Microcomputing, June 1981
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- HI RES CHARACTER GENERATOR: Sixty-four definable characters, Save and Load Characters set to and from tape, Define Characters, and Place on screen in any color and in any position.

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Copykill

Copykill will selectively copy or kill dozens of programs with one command, zap new names on your diskettes and sort and LPRINT alphabetical listings of all your diskette directories. All this is done without entering program names or data manually.

The tricks and patches I used writing Copykill are detailed and explained for use in other programs.

This is the type of program that just about everybody thinks of writing, but no one ever finds the time to do.

These programs won't balance your checkbook or destroy any Klingons, but you'll find a few in almost every program library. Utility programs—programs that really don't do anything practical or useful by themselves—provide an easier way to accomplish what you wanted to do in the first place. If you're like me, you know what it's like to sit down at the computer ready to write the world's greatest, universal, do-all program, only to end up spending hours trying to work around the shortcomings of the computer.

Utility programs can help by turning the computer into a better, more capable tool. If you spend all your time writing utilities, however, you'll never have time for the program you first set out to write. What's worse is that most of your time will be spent reinventing the wheel—writing utilities that already exist and trying out ideas that have already been tried.

Throughout my experience with microcomputers I have developed ideas and tricks to make things run easier, or faster, or maybe just better. Some of these would prove helpful to anyone writing programs for their TRS-80. Copykill presents some of these ideas, demonstrating its implementation, as well as its use. The program containing these routines is a very handy utility as well. The more wheels you don't have to reinvent, the better, right?

Table 1

<table>
<thead>
<tr>
<th>COPYKILL MENU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = COPY - COPY ANY OR ALL DISK FILES</td>
</tr>
<tr>
<td>2 = PURGE - KILL ANY OR ALL DISK FILES</td>
</tr>
<tr>
<td>3 = LPRINT DISK DIRECTORIES</td>
</tr>
<tr>
<td>4 = SORT &amp; LIST DISK DIRECTORIES</td>
</tr>
<tr>
<td>5 = EDIT DISK ID'S</td>
</tr>
<tr>
<td>6 = DOS COMMAND</td>
</tr>
<tr>
<td>7 = LPRINT FORM FEED</td>
</tr>
<tr>
<td>WHICH ONE ? _</td>
</tr>
</tbody>
</table>

Table 2. Sample print-out of LPRINT DIRECTORY command.
Tricks and Ideas

How many times have you attempted to copy all your programs onto disks in an organized manner, and create a catalog so they would be easy to find later? How many times have you succeeded? Answer A minus answer B will yield the approximate Excedrin headache number.

Each time I tried, I would get about halfway through, get bored, and stop. This only compounded my problems by leaving the original programs in random order on the same number of disks, adding a few organized but unlabeled disks to the pile, and all with no list. I finally got fed up not being able to find anything, and decided to write a utility program to copy programs from disk to disk and kill duplicate programs without having to enter their names or even the words copy or kill. More functions were added later.

Operation

The copy function (see menu in Table 1) will read the directory of the source drive and prompt a Y or N (yes or no) input for each entry. Completing this, Copykill copies all selected programs to the destination drive. If the source and destination drives are the same, temporary files are opened on drive zero to contain all files to be copied. Then only one disk swap is necessary regardless of the number of programs being copied.

Copykill's purge function is almost as useful as Copy in saving time and work. After you copy 23 games from your financial disk to your amusement disk with a single command, you still must go back and kill them to free the space. Purge reads the source drive's directory and prompts Y or N for each entry just as copy does. Then as an extra precaution, it lists all the files to be killed on the screen and asks if you are sure. If you are, each selected file is displayed and killed. The Copykill program uses this routine to kill all temporary files after a one drive copy.

Finally, all my disks are organized. Now how about that list I needed?

The LPrint Directory routine was originally written for that. It LPRINTs each disk's directory in neat columns along with the disk's ID and free space (see Table 2). It does so as fast as you can feed the disks into the drive to be read. This enables you to see what's on a disk and is certainly faster than doing directory reads of 25 disks to find the program you want. If you're looking for a particular program, you still have to search a bunch of random lists; that's why I added the Sort and List function. It lets you feed in as many disks as you want; sorts the list into alphabetical order; and yields a printout, shown in Table 3. Notice that the entries are in order vertically, so column one contains entries from A to G, column two contains H to N, etc. I find this format easier to

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>DISK ID</th>
<th>PROGRAM</th>
<th>DISK ID</th>
<th>PROGRAM</th>
<th>DISK ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIRAIDCMD</td>
<td>DATA 3B</td>
<td>DISKEDIT</td>
<td>DATA 3B</td>
<td>SAILOR1</td>
<td>DATA 5A</td>
</tr>
<tr>
<td>BAGGAMN</td>
<td>DATA 5A</td>
<td>ENDZONE</td>
<td>DATA 3B</td>
<td>SAILOR2</td>
<td>DATA 5A</td>
</tr>
<tr>
<td>BACKUPCMD</td>
<td>NDOS 21A</td>
<td>EXPTEST</td>
<td>NDOS 5A</td>
<td>SARONICMD</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>BANNER</td>
<td>NDOS 21A</td>
<td>FORMATICMD</td>
<td>NDOS 21A</td>
<td>SARONICOM</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>BASICCMD</td>
<td>NDOS 21A</td>
<td>HARRY2</td>
<td>NDOS 5A</td>
<td>SLOTS</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>BLACKY</td>
<td>NDOS 21A</td>
<td>HEXAZSC</td>
<td>NDOS 5A</td>
<td>SMARTAC</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>BRIDGE</td>
<td>DATA 3B</td>
<td>INTR</td>
<td>NDOS 3B</td>
<td>SPACEGUARD</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>CHKBOOK</td>
<td>DATA 2B</td>
<td>KNOX</td>
<td>DATA 3B</td>
<td>STARMIKE</td>
<td>NDOS 5A</td>
</tr>
<tr>
<td>COMPOSER</td>
<td>DATA 3B</td>
<td>LANDER</td>
<td>DATA 3B</td>
<td>SUPERGET</td>
<td>NDOS 21A</td>
</tr>
<tr>
<td>COPYCMD</td>
<td>NDOS 21A</td>
<td>LEVEL1CMD</td>
<td>NDOS 21A</td>
<td>SUPERZAP</td>
<td>NDOS 21A</td>
</tr>
<tr>
<td>COPYKILL</td>
<td>NDOS 21A</td>
<td>LMOFFSETCMD</td>
<td>NDOS 21A</td>
<td>SUPERZAPICOM</td>
<td>NDOS 21A</td>
</tr>
<tr>
<td>DAY2BOOK</td>
<td>NDOS 21A</td>
<td>LPSICMD</td>
<td>NDOS 21A</td>
<td>SUPERNEED</td>
<td>NDOS 5A</td>
</tr>
<tr>
<td>DATES</td>
<td>NDOS 21A</td>
<td>TANKWAR</td>
<td>DATA 3B</td>
<td>SUSPTREK</td>
<td>NDOS 5A</td>
</tr>
<tr>
<td>DIAPOS</td>
<td>DATA 5A</td>
<td>UARTC5D</td>
<td>DATA 3B</td>
<td>TANDWORM</td>
<td>DATA 5A</td>
</tr>
<tr>
<td>DIALP</td>
<td>DATA 5A</td>
<td>UARTD</td>
<td>DATA 3B</td>
<td>TANKWAR</td>
<td>DATA 5A</td>
</tr>
<tr>
<td>DIETPLAN</td>
<td>DATA 5A</td>
<td>VCONVCMD</td>
<td>DATA 3B</td>
<td>TESTD</td>
<td>NDOS 21A</td>
</tr>
<tr>
<td>DIETST/TXT</td>
<td>DATA 5A</td>
<td>PENCILCMD</td>
<td>NDOS 21A</td>
<td>TICTACTO</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>DIRCHECKCMD</td>
<td>NDOS 21A</td>
<td>PINNACLE</td>
<td>DATA 5A</td>
<td>TICTACTO</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>DISASSEMCM</td>
<td>NDOS 21A</td>
<td>PICTURE</td>
<td>DATA 5A</td>
<td>TICTACTO</td>
<td>NDOS 3B</td>
</tr>
<tr>
<td>DISKOUNPNEW</td>
<td>NDOS 21A</td>
<td>PILBOX</td>
<td>DATA 5A</td>
<td>UARTCMD</td>
<td>DATA 5A</td>
</tr>
<tr>
<td>DISKOUNPNEW</td>
<td>NDOS 21A</td>
<td>REMOBDJ</td>
<td>NDOS 21A</td>
<td>UARTCBD</td>
<td>DATA 5A</td>
</tr>
</tbody>
</table>

Table 3. Sample print-out of SORT and LIST command.

Program Listing

```
10 10   *** COPYKILL ***
20 CLS
30 DEF P$=ZDEFSTR A=ALP:DEFDBL M
40 DEF PNA(1)=MIDS:(STR$(X),2,10)
50 50   *** CHECK FOR DATA STATEMENT ERRORS ***
60 60   *** (TO BE REMOVED AFTER INITIAL RUN) ***
70 70   M=8:FOR Z=1 TO 175:READ X1:M=M+1:NEXT 2:RESTORE
80 IF XM>364956 THEN PRINT"DATA STATEMENT ERROR 1";
90 90   *** PRINT "DATA STATEMENT ERROR 1";
100 100 *** PATCH FOR FAST CMD "DO1 COMMAND" **
110 110 FOR Z=0 TO 6:READ W1(W):W2(W)=PEEK(W1(W)):NEXT 2
120 120 DATA 21698,21691,21692,21729,21730,21731,21732
130 130 *** PATCH FOR READING DIR & FREE ***
140 140
150 150
```

Program continues
search quickly, and therefore worth the extra programming effort.
You may have noticed the unique disk IDs in the printout; where an ID would usually read simply
NEWDOS or DATA, instead they read NDOS 21A or
DATA 3B, for example. Having every disk with the same ID
seemed like a dumb idea, so I zapped my own IDs in their
place. At first I used Superzap by Aparat to do this, but later I
added the Edit Disk ID function to Copykill. I wouldn't then have
to think in hex while working in ASCII. The letters DOS within
the ID, of course, indicate that the disk will work in drive zero as
opposed to data disks, which will not. The A and B in the ID
number refer to sides A and B of the same disk, since I punch
the external sector hole and use both sides of each diskette. Now
whenever a DISK is done, a unique disk name appears on the
screen for visual indication and for Copykill to use in print-
outs.
I later added the remaining items to the menu for more func-
tions. I indicated with REM statements where to add to the
program and make the next functions appear on the menu.
Some areas for improvement in the Copykill program might be

to store the cumulative index on disk, and, maybe, add a com-
ment field with some editing features to the alphabetized
printout routine for program description.
You may wish to change the LPRINT"" statements to
LPRINT CHR$(138), simply LPRINT depending on the type
of printer you have. These will do a linefeed alone, instead of
printing a space, carriage return, and linefeed, and speed up
the printer operation.
If you have only one drive, or you're not using NEWDOS by
Aparat, the copy function will not work. Without NEWDOS you
will have to change the DISK statements to your DOS format.
Bear in mind that if your DOS
is different, the POKEs in lines
60,140 and 260 will not work.
You will have to change the DIM and Clear statements if you do not have 48K of memory, be-
cause they were set as large as possible for the Sort & List func-
tion of Copykill. Each program name stored requires one array
element and 21 bytes of string space.

Obstacles
Here are some of the problems I had writing Copykill.
The following tricks led to their solution. First I wanted to
copy programs from disk to disk without having to enter a COPY
command for every program. That was easy enough to do,
with Copykill using COPY etc. It took longer than I felt was neces-
sary, though.
I needed a patch of some kind to get rid of the familiar delay
when using WHATEVER, entering and leaving DOS from
BASIC. After a lot of disassembly and searching, I found the
answer. The POKEs in line 630 remove that delay, allowing in-
stant access to DOS commands (Program Listing 1). This patch
remains in effect until the system is rebooted, or, as I have
chosen to do, the original code is POKEd back into place in line
500. This happens immediately on return from the DOS routine.
This original code was PEElked and stored for future reference
in line 120.
For the technically minded, these POKEs nullify two calls to
a routine which generates a checksum of the BASIC inter-
preter before jumping to DOS. Then it regenerated the checksum
upon return to BASIC to make sure it remains intact.
If it's different, the system reboots. Besides the annoying
delay, this also prevents you from making intentional
changes to BASIC should you ever desire to do so.
If you would like to remove these delays permanently, you
can use SUPERZAP to modify BASIC/CMD on the disk. The
areas to be changed are in BASIC/CMD, relative sector 3.
That's the third sector from the beginning of BASIC/CMD (the
first sector being zero). The first change is at MOD BA. What you
should find is 41CD A453 which should be changed to 41000000.
The second change is in the same sector, MOD E2. CDAE
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53C2 should be changed to 0000 0000. Please note that these changes are for NEWDOS and will not work with TRSDOS!
I also wanted to be able to read the disk directory into strings that a BASIC program could use for sorting or prompting.
At first I displayed the directory on the video screen with DIR, then PEEKed at the screen where I knew the entries would be until I found an entry of all spaces.

The same applied for FREE. This produced the desired results, but again it seemed very slow. After some thought, I decided that a faster way would be to point the appropriate number of string pointers (found using VARPTR) at the screen. From then on, anything appearing on the screen in those locations would also be in the corresponding string. Fortunately, it's not as hard as it is to explain.

Line 160 sets up an array of strings called H, and lines 170—200 find the string pointers and POKE them to point to their respective screen locations. From there it's easy. Anything on the screen where the pointers point is also in that string. When the directory is displayed, the first entry on the screen is also in H(0), the second in H(1), etc. When FREE is entered, H(36) points to the free space on drive 0, H(37) to drive 1, etc. As soon as the information appears on the screen, these strings are transferred to another string array. The reason for this is that when the information disappears from the screen, it disappears from the H strings.

Finally, I wanted a faster sort than was available in BASIC, however, to have to protect memory and load a machine language file, or any of the other nuisances associated with machine language links to BASIC.
I tried all kinds of ways to avoid this "one program for the price of two" problem.
I tried POKEing the code into strings, which worked for small routines although there were problems passing arguments.
I then realized if I were to use an integer array, I could load the routine directly from data statements and pass arguments to it and from it just by knowing which array element that part of the code was in. The array could be DIMed to any size, too. The bubble sort itself is written in BASIC for simplicity, but the actual string manipulation is done in machine language. The code for the language part is loaded into the S integer array with the READ loop in line 340. Each string swap is called with USRO, with the location (VARPTR) of the appropriate strings in S(1) and S(2).

The speed advantages of the machine language routine are twofold. First, only the string pointers are swapped, so the strings themselves never have to be moved; second, since the strings are never moved, no temporary buffer strings are created by BASIC. BASIC's garbage collection routine, therefore, is never invoked. When sorting strings in a relatively full string space, this overhead time can account for more than 95 percent of sorting time.
I also wanted to change disk IDs. This involves writing a machine language routine to read and write disk sectors. It is not really a trick, but it is interesting and useful. The BASIC part of the routine is in lines 1930 to 2010, and the machine language routine is loaded into integer array P. It is done in the same manner as the sort routine. Although Copykill must access only one location on the disk (track 17, sector 0, MOD DO, eight bytes), I deliberately added the necessary code to the GOSUB statements (lines 1740 and 1900) to select track and sector. This is to illustrate how it is done. RW is zero for reading and one for writing.

This is a skeletal routine and the only error recovery is to display the error number on the screen. The error codes can be found in the DOS manual, pages 6–12.
The DOS Command function simply does a CMD whatever you enter and the Print Form feed does just that. These are all the functions I've installed, the rest is up to you!

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A disk rotational speed display program.

Soft Tach

After a few unexplainable errors while using a disk system, you may begin to wonder if all that expensive hardware is shooting craps. Of course, not everyone has the equipment or the desire to electronically test and set all the operating parameters of a disk system, but there is at least one thing that can be done easily with software. Only a short BASIC program is needed to test and set the disk rotational speed.

Since all operations carried out by the TRS-80 are timed precisely by a crystal clock, the execution time for any series of operations can be calculated exactly. The program presented here uses a machine language program which counts. It starts when the index hole in the disk is sensed and stops when it passes it again. The loop which tests for a hole and increments the counter takes 16.911 microseconds with the TRS-80 clock. A disk operating at 300 RPM makes one revolution in 0.2 seconds. By dividing, it can be seen that the timing can be checked to one part in 11827 or .025 RPM. Running the program shows that disk speed will vary more than this between consecutive revolutions so it is plenty accurate.

The program consists of two parts: one in machine language and the other in BASIC. The machine language portion is accessed from BASIC by the USR0 statement. It turns on the disk drive, waits one second for the speed to stabilize, and then counts for ten consecutive revolutions of the disk. The ten counts are stored in a buffer area set aside in memory. The BASIC part of the program PEEKs into the locations where the machine language program stored the counts. Then BASIC is used to convert the counts into 10 RPM values. These values are averaged. The 10 RPM val-
ues and the average are printed on the screen.

Since the machine language portion of this program is so short I have simply POKE'd it into memory from a series of data statements. However, the assembly listing from which the data statements were generated is included.

To assemble programs which use disk it is necessary to get hold of the data sheet for the Western Digital FD1771 (the disk controller chip) or preferably the Radio Shack Expansion Interface Service Manual. The manual contains the Western Digital data sheet and other useful information. The FD1771 floppy disk controller is a complex IC with an instruction set comparable to that of the Z-80.

Without knowing how the instructions work it is impossible to make sense out of any assembly listing which uses the disk.

There are two parts to the timing loop. The first part is the quick loop which looks for the hole and increments the counter. At the speed of the counter that little hole in the disk represents quite a gap. Therefore, after the hole has been sensed there is a test to see if this is the eleventh revolution. After that a loop kills time for about one tenth of a revolution to ensure that the hold has been completely passed. This second part of the loop takes a constant amount of time that must be added to the time taken by the counter. Execution of this part at 4 MHz would take 13022.5 microseconds and is the number used in the BASIC program. The reason for using the 4 MHz value is explained below.

To determine how much time is taken by a Z-80 instruction it is necessary to use the RS Editor/Assembler Manual. With each instruction in the manual there is a line that says "4 MHz E.T."

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ed to execute that instruction using a 4 MHz clock. The TRS-80 uses a clock of 1.774 MHz. It would be possible to convert the times for each instruction by multiplying by 4/1.774 or about 2.2548. However, it is easier to add up all the times as if the clock were 4 MHz and then multiply by the conversion factor. For instance, the timing loop that the program uses is:

LP2 BIT D1,(HL) ; time 3.00
INC DE           ; time 1.50
JR z,LP2         ; time 3.00 or 1.75

There are two times given for the last instruction because it consumes 3.00 microseconds when it loops back to LP2 and only 1.75 when it fails through. One complete loop at 4 MHz will take 7.50 µs and on the TRS-80 it will take 7.50*(4/1.774) or 16.911. The other times are calculated in the same manner.

Examination of the assembly listing shows that the program actually uses 12 revolutions of the disk rather than 10. The count shown for the first revolution will almost certainly be in error because the first count gives only the amount of time between when the program started and when it first encountered the hole. The second count will be in error if; when the program was started, the hole just happened to be passing the sensor. These two bogy values are saved but ignored by the BASIC program.

Running the program is straightforward. Memory size is set to 32000 and the program is run. It will repeat each time Enter is pressed. I have an MPI drive, and adjusting the speed is a simple matter of removing the cover and adjusting resistor R38. The manufacturer claims accuracy to 1.5 percent so I assume that any speed between 295.5 and 304.5 is acceptable. If you have another type of drive it will be necessary to consult the manufacturer’s literature to determine the allowable speed range and adjustment procedure.

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The Mileage Manager

A. L. Frink
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Back when gasoline was around 60 cents a gallon, I convinced my wife Peggy that our household needed a TRS-80, if for no other reason, for the kids to enjoy it. It wasn't long before she found out who the real kid was. At any rate, I went through the Level I Manual in record time and I just had to have a Level II. The Level II Manual was a little more challenging and about the time I felt comfortable with it, gas prices were climbing so I began spending my evenings writing a program to keep tabs on our gas expenses.

At that time we owned two cars: a full size 1973 Ford station wagon loaded with a 400 cubic inch engine and a 1966 Mustang with a modest 302. Even though the station wagon was a gas hog it was used more often because of its air conditioning, comfort, automatic transmission, etc.

As we started to accumulate data, it was quite a jolt to see the difference in operating costs between our two cars. As gas prices went up the differential also went up.

Not only does the program calculate miles per gallon each time the tank is filled but it calculates a summary of total miles driven, total gallons, total cost, average miles per gallon and average cost per mile. With this information available it was quite easy to compare the performance of the two vehicles.

We started sacrificing comfort for cost. (Stuffing the kids into the two-door Mustang was never popular with them, but what Dad says goes.) I was sure we were saving money, so I set

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<td>1979 Cost Per Month</td>
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<td>1980 Operating Cost Using 1979 Driving Habits</td>
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<tr>
<td>Monthly Saving</td>
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Fig. 1. Analysis of Average Monthly Operating Cost

Program Listing 1

10 DEFINT I, K, N, R, X, Y, Z
20 CLEAR$=DIMS$(38), O(38), G(38), C(38), I$(38), M$(38), S$(38), E$(38)
30 CLS=N=1: CS=""
40 ON ERROR: GOTO 4580
70 PRINT: PRINTTAB(3) "THE MILEAGE MANAGER"
75 PRINT: PRINTTAB(6) "* * DO YOU WANT TO * *"
80 PRINTTAB(18): "-------------------------"
90 PRINT: PRINT "(1) LOAD IN AN EXISTING DATA TAPE"
100 PRINT: PRINT "(2) ADD NEW INFORMATION TO THE EXISTING FILE"
110 PRINT: PRINT "(3) PRINT A TABLE OF INFORMATION"
120 PRINT: PRINT "(4) DRAW A GRAPH OF MPG VS TRIPS"
130 PRINT: PRINT "(5) PRINT A SUMMARIZATION OF ALL DATA"
140 PRINT: PRINT "(6) CORRECT ANY INFORMATION ON FILE"
150 PRINT: PRINT "(7) SAVE THE UPDATED DATA FILE"
160 PRINT: PRINT "(8) ESTABLISH YOUR FIRST DATA FILE"
170 PRINT: INPUT "ENTER A NUMBER FROM 1 TO 8": R
180 ON GOTO 4580, 1800, 1800, 2800, 2800, 3800, 3800, 4800
500 'LOAD DATA TAPE'<
510 IF: IF INKEY$="Y": GOTO 780 ELSE: GOTO 510: PRINT "PREPARE THE RECOR DER TO LOAD THE DATA TAPE"
520 PRINT: GOSUB 8000
540 INPUT "L": O$(N): PRINT
550 CLS: PRINT: PRINT
560 PRINT: "THE INFORMATION IS BEING ENTERED FOR ": O$(N): PRINT"
570 INPUTTAB(1) D$(N), O$(N), G$(N), C$(N), I$(N)
580 PRINTTAB(3) D$(N): N=N+1: GOTO 570
610 PRINT "THE DATA HAS BEEN ENTERED"
620 FOR G=1 TO 15: NEXT: CLS: GOTO 70
1000 'ADD TO EXISTING FILE'
1010 IF N=1: GOTO 4600
1020 N=N+1: GOTO 80: CLS
1840 PRINT: PRINTTAB(18): CS: PRINT
1850 INPUT: ENTER THE DATE (NO COMMAS): D$(N)
1860 PRINTTAB(18): CS
1870 INPUT: ENTER THE COST OF THE TANKFULL (NO $ SIGN): C$(N)
1880 PRINTTAB(18): CS
1890 INPUT: ENTER THE NUMBER OF GALLONS TO FILL THE TANK :G$(N)
1100 PRINTTAB(18): CS
1110 INPUT: ENTER THE ODOMETER READING: O$(N)
1120 PRINTTAB(18): CS
1130 PRINT: "ENTER ANY PERTINANT INFORMATION SUCH AS DRIV ING CONDITIONS."
1140 PRINT: "GRADE OF GAS, SPECIAL TRIPS, ETC. IF NONE PRESS ENTER."
1150 IF: IF INKEY"="": INPUT I$(N)
1160 INPUT(N)="": INPUT I$(N): CS
1240 CLS: GOTO 70
1500 'TABLE OF DATA'
1510 IF: IF INKEY$="": GOTO 180: CLS
1538 PRINTTAB(17): "* * *": M$(N): * PRINT"

Program continues
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SPEED-UP UNIT - an easy to install electronic device that enables programs to run 2 to 3 times faster. It's the fastest and finest quality speed-up unit on the market.

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out to analyze all the impressive data that I had been collecting.

Back in 1979 we were averaging 773 miles per month on the gas hog and 642 on the Mustang. Today the pendulum has swung the other way. The station wagon is only averaging 387 miles per month and the Mustang is being used about 839 miles per month (see Fig. 1).

Looking at costs, I discovered that last year we were spending about $93 per month on gas. Today it is around $96. That's no savings. But it didn't take long for me to realize that the gas costs have gone up more than 50 percent and my expenses have remained almost constant.

I calculated the gasoline cost at today's prices using last year's driving habits. This told me that I was saving $35 a month.

Besides making me feel good, I now had documentation to show Peggy. Not only were we patriotic energy savers, but our computer was saving money. After coming off my high horse, I realized that the program wasn't responsible for all the savings. I am sure that some change in our driving patterns would have evolved anyway. I am confident however, that the program had an influence on us.

Running the Program

Before running the program, your gas tank should be full and the mileage recorded. The tank should then be filled at least two more times. Mileage, total cost and gallons should be recorded each time the tank is filled. Also, note any pertinent information you want kept in the file (such as highway driving, special trips, or

**Example 1. Average Monthly Cost Analysis**

<table>
<thead>
<tr>
<th>DATE</th>
<th>CALLS</th>
<th>CDRMTR</th>
<th>COST</th>
<th>COST/GAL</th>
<th>MILES</th>
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<tr>
<td>JAN 07 80</td>
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<td>17130</td>
<td>$15.60</td>
<td>1.080</td>
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<td>JAN 21 80</td>
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<td>$16.50</td>
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<td>JAN 26 80</td>
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<td>$12.10</td>
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</table>

**Example 2. Graph Report**

**Example 3. Option Five**
even maintenance information. Once this information is available, the program can be run.

The program can be run on a 16K TRS-80 with or without a printer. After loading the program, a menu is displayed on the CRT with eight possible selections. Until you establish a data tape, option eight must be selected. A short introduction will give you instructions to set up the recorder with a new tape. It will ask for the name of the car and the starting odometer reading. It will next ask for information about each of the following fill-ups.

After entering the information for at least two sets of readings, the data tape can be rewound and loaded using option one. The program will ask you to load a data tape. As the tape is being loaded, the vehicle's name and the date of each entry will be displayed on the CRT, returning to the menu when complete.

Subsequent information is added to the file using option two, which can be selected anytime after the data tape has been loaded. The program will ask for the date, the total cost of the full tank, the number of gallons, odometer and other pertinent information. When complete, the program returns to the menu.

Options three, four and five are set up for a CRT and/or a printer. If you do not have a printer, I'll explain later how to modify the program.

Option three prints a table of information. First you have the opportunity to request a printed report and to position the paper while automatically setting the line counter back to zero. A tabulation of cost per gallon, miles per gallon, miles driven, etc. will be printed (see Example 1).

Option four draws a graph of miles per gallon on specific trips. This selection draws a bar graph presenting the various dates on the Y axis and the miles per gallon on the X axis. The scale automatically adjusts dates on the matically adjusts up to either 25 MPH or 50 MPH. If there are more than 11 dates in the file, the older ones will not appear. Pressing any key will return the menu.

The graph will highlight trends in gas usage. It helped me show my 18-year-old daughter what her lead foot did to gas mileage. She wouldn't listen to me, but for some reason the computer made a believer out of her.

The graph was designed primarily for my Line Printer II, using a screen print routine. (See Example 2.) If you don't have a

<table>
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**Table 2. Summary of Line Functions**

<table>
<thead>
<tr>
<th>10-40</th>
<th>Initialize</th>
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<tr>
<td>50-180</td>
<td>Menu Selection</td>
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<tr>
<td>500-620</td>
<td>Load Existing Data Tape</td>
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<tr>
<td>1000-1240</td>
<td>Add New Information To File</td>
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<tr>
<td>1500-1620</td>
<td>Print A Table Of Information</td>
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<tr>
<td>2000-2200</td>
<td>Graph Of MPG vs Trips</td>
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<td>2400-2580</td>
<td>Print A Summation Of Data</td>
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<td>3000-3070</td>
<td>Correct Information In File</td>
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<td>3500-3650</td>
<td>Save The Up-Dated File</td>
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<td>Establish First Data File</td>
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<td>4500-4600</td>
<td>Error Trap</td>
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<td>4800-4826</td>
<td>Report Heading</td>
</tr>
<tr>
<td>4840-4860</td>
<td>Printer Report</td>
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<tr>
<td>5000-5100</td>
<td>Print Option And Paper Positioner</td>
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<tr>
<td>6000-6080</td>
<td>Screen Print Routine</td>
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<tr>
<td>7000-7010</td>
<td>Form Feed</td>
</tr>
<tr>
<td>8000</td>
<td>Return To Menu</td>
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**Table 1. List Of Variables**

---

The table below shows the BASIC subset translated by ACCEL and ACCEL2 to machine code. Figures represent the minimum expected ratio of execution times, compiler to interpreter. All other BASIC statements and functions run at interpreter speed after compilation.

**ACCEL/ACCEL2 SPEEDUUPS**

TRS-80 Model I BASIC Compilers

<table>
<thead>
<tr>
<th>INTEGER</th>
<th>SINGLE</th>
<th>DOUBLE</th>
<th>STRING</th>
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</tbody>
</table>

**ACCEL**: For 16K TRS-80 Model I. Compiles bootstrap subset in INTEGER variable type. Compile-time size 2816 bytes, run-time size 234 bytes. Trade up later to ACCEL2 for the price difference.

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The < (<) and > (>) keys fire the lateral jets. Either may be pressed at any time, even when the main engine is firing. These two keys may also be pressed for continuous firing, but do use up fuel. Don't overshoot the base, or you'll burn up more fuel getting back.

When fire flickers from your ship's tail, the main engine is firing. The computer will also make comments on your landing.

Oh yes, the more you play, the harder the game becomes, as the computer will give you less starting fuel after a few good landings.

Happy landing!

Program Listing

```
100 REM BUILD TERRAIN


Program continues
```
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80 Microcomputing, June 1981 • 245
Hold that printout! Here's a software patch that Tandy neglected.

Underscoring Scripsit

Carl Iseli
2108 Kingshouse Road
Silver Spring, MD 20904

If you are already using Radio Shack's Scripsit word processing system, you know it's one of the best available. Its unlimited formatting capabilities within the text is probably the closest thing to guaranteeing freedom of expression since the First Amendment.

For all of Scripsit's attributes, it does have several weaknesses. The greatest of these are its inability to underline text (or even print the underscore character, for that matter) and to halt printing (in order to change type fonts, etc.). Fortunately, this and other print-related shortcomings can be easily corrected—without hard modifications.

The root of the underscore and special character problem is in the hardware of the TRS-80. Specifically, the TRS-80 keyboard has neither dedicated special character keys nor programmable keys. We'll have to invent some special keys with software.

First the Bad News

In order to dedicate a special key in Scripsit, you will have to give up one that is normally used for other purposes. I chose to give up the "at" character, which is generated in Scripsit by hitting the shift key, followed by the number 0. I chose the "at" character because in any situation I could always type the word "at" instead of using the character. If you use Scripsit to type and edit your BASIC programs, you will still have the use of the "at" character; it will LIST, LLIST and run properly under BASIC, but you will have to give up the ability to print the program using Scripsit.

The other bad news is perhaps a blessing in disguise. After modifying Scripsit, you will use various combinations of the "at" character with other characters to perform text underlining and to cause printer pauses.

While the characters used this way will be completely invisible to the printer, the Scripsit program will still see them as printable characters. The program will, therefore, count these characters in its calculation of the line length. The consequence of this is that you will not be able to print underlined text in justified (flush right and left) format.

I say this may really be a blessing because text that is justified by inserting extra spaces between words, rather than proportionally spacing the letters within each word, generally looks strange and is difficult to read.

Now the Good News!

Other than the changes above, Scripsit will operate normally. Once the modifications are made, you can form lines of underscore characters simply by typing a string of "at" characters. You can underline words or phrases of text by preceding the first letter of the text to be underlined with an "at" character and typing another "at" character immediately following the last letter of the text to be underlined. Finally, you can cause your printer to pause by embedding an "at!" character in your text followed immediately by a greater than sign (>).

In addition to the Scripsit program itself, you will need a minimum of 32K RAM, at
"Once the modifications are made, you can form lines of underscore characters simply by typing a string of 'at' characters."

least one disk drive and a parallel printer with backspacing (e.g. Radio Shack WP50, NEC Spinwriter 5530, Diablos and Qumes). Radio Shack's Editor/Assembler, or its equivalent, is helpful in entering the machine code; but it is not entirely necessary. I have included listings that can be entered by DOS Debug for those who do not have an assembler available.

If you shrink in terror at the mention of machine code or assembly language, don't drop out; I'll go through the modification steps one by one.

Getting Started
Prepare a disk with a copy of unmodified Scrispit on it, and make sure that you have a minimum of 20 granules of free space available. You will be placing two small programs on it, plus a core image of the interim modifications and the final, fully modified Scrispit program itself.

The first step relocates Scrispit to a high RAM address. This must be done because Scrispit normally resides in RAM at addresses starting at 5200H, and thus overlays the area used for DOS commands. By relocating Scrispit, we can work on it to our heart's content, then put it back in its resident RAM position just before execution.

Using your editor/assembler, type in the relocator program given in Program Listing 1. Make a tape of the object code, then return to DOS and type TAPEDISK. When the prompt appears, type C to load the object file. When the prompt returns, type E to return to DOS.

If you don't have an editor/assembler available, you can use the Debug M command: Type DEBUG and enter, then push the Break key to enter the Debug routine. Type DBF00 (enter), then MBF00 and press the space bar. Your display should now have the hex number located at BFOOH bracketed, and the lower left portion of the screen should read BFOO.

Now type the following sequence of hex numbers, pressing the space bar after each pair of digits:

F3 21 00 52 11 00 82 01 A4 28 EB B7 ED 52 E1 ED 50 C3 00 00

Return to DOS by entering 4042D.

Whichever way you produced your relocator program, you'll want to make a disk file of it. Enter TAPEDISK, type F REL0/ CIMO BF00 BF13 BF00 and enter it. Then return to DOS by typing E.

Load, but do not run, Scrispit by typing LOAD SCRISPI/T/LC. When the load is complete, type BASIC2 (enter). This will put you in Level II BASIC and the screen will ask for Memory Size?, to which you reply Enter.

Now type SYSTEM and execute the relocation program by answering the prompt with 48896 (enter). The relocation program will instantly zap Scrispit to high memory and return you to DOS. This is done in the wink of an eye, so don't worry that nothing could have happened before you returned to DOS—it did.

Just to make sure everything done so far has been correct, type DEBUG, enter it, then press Break. After the Debug format appears on the screen, type DB200 and enter it. If all is well, the fourth line from the bottom of your screen should now read:

8200 18 3D 43 4F 50...

Return to DOS by entering 4042D.

Now, let's save the relocated Scrispit for future use. Type DUMP SCRISPI/T/CIM (START = 'X8200', END = 'X83A3'), then press ENTER. You will now have a non-executing file that you can use for these and other Scrispit modifications.

For the next phase of the modification, you have two choices: If you own an editor/assembler, utilize the following section, "Using an Editor/Assembler." If not, skip the next section completely and follow the instructions in the section labeled "Doing it the Hard Way." O.K., let's go our separate ways; then meet again in the section titled "Everybody, Altogether Now."

Using an Editor/Assembler
If you have an editor/assembler available, use it to type in the assembly language modification exactly as it appears in Program Listing 2. If your assembler will write

---

Table 1

| FE 40 | 28 08 | CD CD | 7A 32 | EB 37 | C2 74 | 5F 08 | 3A 26 | 7B B7 |
| 28 66 | 7E FE | 3E 2B | 66 FE | 40 28 | 28 FE | 21 38 | 24 FE | 80 30 |
| 20 3E | 00 32 | 26 7B | 32 2B | 7B 06 | C9 06 | 3A 26 | 7B B7 | 20 00 |
| 08 FE | 08 3E | 14 08 | 3B 08 | 7B 3C | 32 2B | 7B 08 | C9 3E | FF 32 |
| 26 7B | 08 3E | 0F 18 | 3B 0B | 7B 0B | C9 0E | 3B 0D | 01 7B | 08 5F | CD 01 |
| 7B 3E | FF 32 | 26 7B | C1 08 | C9 3A | 28 7B | 47 7B | 32 EB | 37 CD |
| 10 7B | 05 20 | F6 C9 | 3A EB | 37 CB | 7F 20 | F9 C9 | 08 CD | ED 7A |
| 0C 23 | 3A 40 | 3B 28 | FA 0B | C9 21 | E3 22 | 16 40 | F3 21 |
| 00 82 | 11 00 | 52 01 | 27 29 | ED 80 | 3E FF | 32 26 | 7B C3 | 00 52 |

Table 2

| 4D 4F | 44 20 | 55 4C | 50 20 | 28 43 | 29 20 | 43 41 | 52 4C |
| 20 49 | 53 45 | 4C 49 | 2C 20 | 31 39 | 38 30 | 20 20 | 41 4C |
| 4C 20 | 52 49 | 47 48 | 54 53 | 20 52 | 45 53 | 45 52 | 56 45 |

Program Listing 1

```
00100 ; PROGRAM 1, REL0/CIM
00110 ; RELOATES SCRISPI/T FROM
00120 ; 5200-7AA4 TO
00130 ; 8200-AAA4
00140 ;
00150 ; LOADS AT BF00H (48896)
00160 ;
BF00 00170 ; ORG BF00H
BF00 F3 00180 ; STOP THE CLOCK
BF01 210052 00190 ; START ADDRESS
BF04 110082 00200 ; DE, 8200H
BF07 014A28 00210 ; # OF BYTES TO MOVE
BF0A 5 00220 ; SAVE START ADDR
BF0B 87 00230 ; CLEAR CARRY FLAG
BF0C ED 00240 ; WHICH DIRECTION?
BF0E EF 00250 ; RESTORE START ADDR
BF0F EB0 00260 ; MOVE IT!
BF11 C30000 00270 ; BOOT THE SYSTEM
C000 00280 ;
C0000 TOTAL ERRORS
```

80 Microcomputing, June 1981 • 247
“Without an editor/assembler, you may want to rest your fingertips while going on...”

the object code directly to disk, so; or save it on tape and use the DOS Tapedisk utility to put it on disk. In any case, use the filespec MODUL/PICM.

In DOS mode, enter LOAD SCRIPST/CIM; then enter LOAD MODUL/PICM. Now type DUMP SCRIPST/CIM (START = X’8200’, END = X’AB40’), and enter it. That’s it. You can skip the next section unless you’re a masochist.

Doing It the Hard Way

Without an editor/assembler, you may want to rest your fingertips before going on—you’ve got some serious typing to do. It will be worth it in the long run, though.

In the DOS mode, enter LOAD SCRIPST/CIM; Next enter DEBUG and press Break. Your screen should soon be filled with all the register contents. When it is, type DAA00 (enter); then type S and enter it to get a full screen of characters starting at A00H.

Now type MAA9E and press the space bar. At the bottom left of your screen you should see 32—, and the hex number 32 at location A99EH should be bracketed by graphics bars. If everything is O.K. so far, enter the sequence of hex numbers shown in Table 1. Be sure to press the space bar after each two-digit number is entered.

If you entered all the numbers in Table 1, the bottom left corner of your screen should now indicate the address AB40. (This doesn’t prove that you entered them all correctly, just that you entered them all.)

Press X, followed by G402D (enter), and not only will you be returned to DOS but the worst part will be over! Type DUMP SCRIPST/CIM (START = X’8200’, END = X’AB40’), and enter it. You are now ready for the final step in your modification.

Everybody, Altogether Now

There is only one last step between us and our completed Scripsit modification. We’ll do it by hand-assembly just so all you editor/assembler owners will remember the good old days. In the DOS mode, enter LOAD SCRIPST/CIM; Now enter DEBUG and press Break.

Your screen should soon be filled with all the register contents. When it is, type D8800 and enter it. Now type M8800 and press the space bar. At the bottom left of your screen you should see 20 —, and the numbers 20 at location 8800H should be bracketed by graphics bars. Enter the sequence of hex numbers in Table 2, again pressing the space bar after typing each two-digit number.

The bottom left corner of your screen should now give the address AB40 followed by 13 —, Press X, followed by G402D (enter), and you will be returned to DOS. Now type

DUMP SCRIPST/CIM (START = X’8200’, END = X’AB40’, TRA = X’AB26’) and enter it.

If you have followed the above instructions without error, you will now have a full copy of underline and pause-modified Scripsit! You can call the program from DOS at any time by simply typing SCRIPST/CIM (enter).

Theory of Operation

Scripsit’s actual line printer routine, as far as our interests are concerned, starts at location 7A99EH, which we have relocated to AA99EH. Here we would normally find: LD (37E8H)A, which outputs the character in the A register to the printer, and JP 5F74H, which jumps to a part of Scripsit to perform all sorts of housekeeping and get the next printable character.

Fortunately for our purposes, these locations coincide with the end of Scripsit, and are followed by a relatively large unused area of RAM (do the Radio Shack programmers have some future plans up their collective sleeves?). It is here that we interrupt the normal flow of Scripsit, inserted our modification, then plugged back into the program.

Referring to the assembly language Program Listing 2, you may find the address areas of the CALLs and DEFs a bit unusual. They were coded this way to save time during the many program revisions I had to make.

This form of addressing makes the code totally relocatable. When changing the ORG statement, or whenever program material is inserted or deleted, all the calls are automatically updated. I could have replaced them with the actual hex addresses of the final program, but I thought it was a neat trick worth passing along.

Lines 140–150: FLAG and CNTR are assigned to indicate the RAM locations to be used for a flag and a counter.

Lines 170–180: The next character about to be sent to the printer is checked to see if it is an "at" character (40H). If it is, control is transferred to line 220.

Line 190 calls a subroutine at line 400 that checks the flag status.

Line 200 sends the character in the A register to the printer.

Line 210 returns program flow to the main body of Scripsit.

Lines 220–390: Here, the flag status is checked. If it is set (00 in location 7B26H), control is passed to the underline routine beginning at line 810. If not, the routine looks at the next text character. If the next character is a greater than symbol, program flow reverts to the printer pause routine at lines 840–890. If it is another “at” symbol, a space (coded or uncoded), a linefeed or a carriage return, the original char-
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"While this may seem like a long and complicated routine, you won't actually notice any slow-up in your printing. This is because any word processing printer is almost infinitely slower in accepting characters..."

derescore control character (shift 0) immediately before and immediately following the word or phrase to be underlined. To have your text print "Atlas Shrugged is a book by Ayn Rand," you would type: (shift 0) Atlas Shrugged (shift 0) is a book...

There are several important limitations of the underlining mode:

- The first character following the initial "at" symbol must be a printable character. It must not be a space, a line terminator or a control character.
- The text to be underlined must not be formatted as justified or flush right.
- If the phrase to be underlined extends to more than one line of printed text, each line must have the underlining terminated and the next line must restart the underlining anew. Be especially careful when reformating or adding text to underlined areas; you may inadvertently change your line structure.
- If your printer has a text buffer that is limited to one line of type, the phrase length of underlined text may be limited. Remember: the actual line length is equal to the number of characters plus the number of backspace characters plus the number of underscore characters. What happens after the buffer overflows is dependent on your particular printer.

Pausing the Printer
When you want the printing operation to pause in the text, type an "at" character followed immediately by a greater than symbol (>). No message will be printed on the screen; the printer will simply halt. To resume printing, press Enter or the space bar.

A few caveats are in order: most printers that use a print buffer will not print to the middle of a line before pausing. They will hold the contents of the buffer until printing is resumed. Consequently, it will usually be necessary to plan your type font change to coincide with a new print line.

Because the program is now looking for the new control character combination to halt printing, phrases to be underlined must not begin with the greater than symbol.

Some printers (Anadex is the only one I know of) dump their print buffer after approximately 10 seconds of not receiving new characters. (Don't ask me why!) Obviously, this modification cannot be used with such printers.

A Few Last Words
By taking on the somewhat tedious task of trying to follow the program flow of this Scripsit modification, you will no doubt learn quite a bit about assembly/machine language programming. You will have an increased appreciation for how Scripsit actually works, and thus be able to make some of your own modifications.

Any questions or comments regarding the modifications are most welcome. For a fee I will also alter your Scripsit disk for you.

Using Scripsmod
Your newly modified Scripsit program will now give you total control over the following areas:
1) Printing lines (underscore characters)
2) Underlining text
3) Pausing the printer (to change type fonts, etc.)

Using these controls requires certain modifications to the original text and involves certain limitations.

Printing Underscore Characters
To print a line of underscore (5F hex) characters, simply type a series of "at" characters (shift 0). The only limitations are that the line must be at least two characters long and the last character must be followed by a space or a line terminator (see Scripsit instruction manual for the definition of a line terminator).

Underlining
Underlining text requires placing the un-

<table>
<thead>
<tr>
<th>Program Listing 2</th>
<th>00090 ;</th>
<th>PROGRAM 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>00100 ;</td>
<td>MUDUL/CIN - UNDERLINING SCRIPSET</td>
<td></td>
</tr>
<tr>
<td>00110 ;</td>
<td>(MUST MOVE SCRIPSET TO 8200H BASE ADDR FIRST)</td>
<td></td>
</tr>
<tr>
<td>00120 ;</td>
<td>START=8200 END=AB40 TRA=AB26</td>
<td></td>
</tr>
<tr>
<td>7E26</td>
<td>00140 FLAG DFL RELO-3000H</td>
<td></td>
</tr>
<tr>
<td>7E28</td>
<td>00150 CNTR DFL FLAG+2</td>
<td></td>
</tr>
<tr>
<td>A9E</td>
<td>00160 GBC OAA9EH</td>
<td></td>
</tr>
<tr>
<td>A9F FE40</td>
<td>00170 CP 40H</td>
<td></td>
</tr>
<tr>
<td>A9A 2809</td>
<td>00180 JR Z,USCR</td>
<td></td>
</tr>
<tr>
<td>A9B CDDCA7</td>
<td>00190 CALL FLGST-3000H</td>
<td></td>
</tr>
<tr>
<td>A9C 32837</td>
<td>00200 FRT LD (37EH),A</td>
<td></td>
</tr>
<tr>
<td>A9B C3745F</td>
<td>00210 JP 5F74H</td>
<td></td>
</tr>
<tr>
<td>A9B 08</td>
<td>00220 USCR EX AF,AFz</td>
<td></td>
</tr>
<tr>
<td>A9C 3A267B</td>
<td>00230 LD A,(FLAG)</td>
<td></td>
</tr>
<tr>
<td>A9F 87</td>
<td>00240 OR A</td>
<td></td>
</tr>
<tr>
<td>A80 2666</td>
<td>00250 JR Z,STPUL</td>
<td></td>
</tr>
<tr>
<td>A82 7E</td>
<td>00260 LD A,(HL)</td>
<td></td>
</tr>
<tr>
<td>A83 69</td>
<td>00270 CP 3EH</td>
<td></td>
</tr>
<tr>
<td>A85 2666</td>
<td>00280 JR Z,PSTUP</td>
<td></td>
</tr>
<tr>
<td>A87 FE40</td>
<td>00290 CP 40H</td>
<td></td>
</tr>
<tr>
<td>A89 2828</td>
<td>00300 JR Z,FRUL</td>
<td></td>
</tr>
<tr>
<td>A8B FE21</td>
<td>00310 CP 21H</td>
<td></td>
</tr>
<tr>
<td>A8D 3B24</td>
<td>00320 JR C,FRUL</td>
<td></td>
</tr>
</tbody>
</table>

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AA8F FE80 00330 CP SOH ;CHAR = CODED SP?
AA8C 3020 00340 JR NC, PRUL
AA8D 30D0 00350 LD A, OSH
AA8E 32267B 00360 LD (FLAG), A
AA8F 32287B 00370 LD (CNTR), A
AA90 08 00380 GYCHR EX AF, AF'
AA91 C9 00390 RET
AA92 08 00400 FLGST EX AF, AF'
AA93 3A267B 00410 LD A, (FLAG)
AA94 B7 00420 OR A
AA95 200D 00430 JR NZ, NTST
AA96 08 00440 EX AF, AF'
AA97 FD3E 00450 CP OEH
AA98 3814 00460 JR C, ULRTN
AA99 08 00470 EX AF, AF'
AA9A 3A267B 00480 LD A, (CNTR)
AA9B 0C 00490 INC A
AA9C 32267B 00500 LD (CNTR), A
AA9D 08 00510 NTST EX AF, AF'
AA9E C5 00520 RET
AA9F 32FF 00530 PRUL LD A, OFFH
AA9G 32560 00540 LD (FLAG), A
AA9H 08 00550 EX AF, AF'
AA9I 385F 00560 LD A, 5FH ;CHANGE TO UNDERSCORE
AA9J 16B6 00570 JR PRT
AA9K 08 00580 ULRTN EX AF, AF'
AA9L C5 00590 PUSH BC
AA9M 08D8 00600 LD C, OSH ;BACKSPACE CHAR
AA9N 3D017B 00610 CALL CHTDN-3000H ;BACK UP TO WORD START
AA9P 05F 00620 LD C, 5FH ;UNDERSCORE CHAR
AA9Q 0630 00630 CALL CHTDN-3000H ;UNDERLINE WORD
AA9R 3EFF 00640 LD A, OFFH ;RESET FLAG
AA9S 32267B 00650 LD (FLAG), A
AA9T 08 00660 POP BC
AA9U 08 00670 EX AF,A F'
AA9V C9 00680 RET
AA9W 32267B 00690 CHTDN LD A, (CNTR) ;GET COUNT
AA9X 04 00700 LD B, A
AA9Y 79 00710 PRCHR LD A, C ;GET CHAR
AA9Z 06 00720 LD (37EH), A
AA9A 3D017B 00730 CALL PRSTAT-3000H ;CHECK PRINTER STATUS
AA9B 05 00740 DEC B ;REDUCE COUNT
AA9C 06 00750 JR NZ, PRCHR ;LOOP IF NOT ZERO
AA9D 0F 00760 RET
AA9E 3A267B 00770 PRSTAT LD A, (37EH) ;GET STATUS CHAR
AA9F C7F 00780 BIT 7, A ;TEST IT
AA9G 20F9 00790 JR NZ, PRSTAT ;LOOP IF NOT READY
AA9H C7 007A0 RET
AA9I 08 007B0 STPUL EX AF, AF'
AA9J A8 007C0 ULRTN 3000H ;GO TO UNDERLINE
AA9K C9 007D0 RET
AA9L 23 007E0 00840 PSTOP INC HL ;ADVANCE CHARACTERS
AA9M 3A4033 00850 PLOOP LD A, (3840H) ;CR ON KEYBOARD?
AA9N 87 00860 OR A
AA9O 2F5A 00870 JR 2, PLOOP ;LOOP IF NOT
AA9P 08 00880 EX AF, AF'
AA9Q C9 00890 RET
AA9R 0900 ; END OF UNDERSOIRE ROUTINE
AA9S 0910 ; RELOCATOR CODE FOLLOWS
AA9T 21E303 00920 REL0 LD HL, 03EH
AA9U 221640 00930 LD (4016H), HL
AA9V FC 00940 DI
AA9W 210082 00950 LD HL, 8200H ;START ADDR
AA9X 3A00 00960 LD DE, 5200H ;DEST ADDR
AA9Y 333 02279 00970 LD BC, REL0-81FFH ;BYTE COUNT
AA9Z E800 00980 LDIR
AA9A 3EFF 00990 LD A, OFFH ;RESET FLAG
AA9B 32267B 001000 LD (FLAG), A
AA9C 3C005 001010 JP 5200H
AA9D 00 001020 FINIS MOP ;JUST TO QUICKLY FIND PROGRAM END
AA9E 00 001030 END
AA9F 000 001040 TOTAL ERRORS
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Program Chaining and Local Variable Definitions in BASIC

Hai Brown
643 W. Valley Forge Road
King of Prussia, PA 19406

Chaining, in computerese, refers to loading and running a series of programs, with each picking up data where it is left by the previous program. After doing its thing, one program leaves updated values for the next program. The programs themselves normally overlay in memory—if they didn't there would be little point in chaining; the functions of the different programs could all be provided in one large program.

Pointers

Unfortunately, chaining normally is impossible in TRS-80 Level II or Disk BASIC. Execution of a LOAD (or CLOAD) or RUN command initializes some pointers in scratch memory. In particular, three pointers are involved. The pointer to the start of simple variable storage area in memory is at 40F9H. 40FBH points to the beginning of array variable storage and 40FDOH points to the lowest byte in free memory.

At initialization the three pointers are loaded with the address of the first byte past the end of the BASIC program in memory. With the top and bottom of variable storage indicated as the same address by the pointers, the BASIC interpreter assumes that no variables are stored. Requests for variable values immediately after initialization return zeros (nulls for strings), so values developed during execution of one program are lost when another is loaded and run.

It is possible to transport variables from one program to another by saving them on tape or disk at the end of the first execution and reading them back at the beginning of the next, but that can be time-consuming if a lot of data is involved.

If all you want to do is rerun the same program or a different segment of the same program without zeroing the variables, this is easy. The secret is to use GOTO instead of Run. For example, assuming line 10 is the first in the program, GOTO 10 has the same effect as Run except that variables defined in a previous run are preserved.

Variable Preservation

It is not as easy to preserve variables between loads and runs of different programs, but it can be done with the help of a few additional instructions. The method I'm about to describe takes BASIC into storing the variables in a different area from that indicated by the pointers during initialization.

Conceptually the technique is simple. Near the beginning of a program run, new addresses are POKE'd into the three pointers described above. BASIC will store variables defined after that at the new place in memory. At the end of the program, the updated pointers are preserved in a safe place in memory and the original pointers restored.

Each program in the chaining set can retrieve the addresses left by the previous program and POKE them into the 40FnH pointer locations, thereby recovering the variables for further use and processing.

There are pitfalls to avoid in implementing this method. Remember that as soon as the pointer addresses are changed, BASIC will be unable to find variables defined before the change. To illustrate how this can be a problem, consider the way the block move of the three addresses (six bytes) from memory to the pointers might be accomplished. Since the pointers are adjacent in scratch memory, the first inclination is to use a FOR-NEXT loop. It won't work! Somewhere in the middle of the instruction, BASIC will be unable to find the operand (the "I" in a FOR I = n TO m instruction) and execution will abort.

The pointer moves could be accomplished with a small machine language routine called by aUSR instruction. I tried that first. The routine was packed into a string so no memory had to be reserved and it worked well. However, I finally opted for the approach used in Program Listing 1. It may not be as sophisticated as the use of string-packed machine language routines, but it works.

Variable Storage

Implementing transportable variables as discussed here requires preselection of an area in memory where the variables will be stored. Some care is required in the selection. If it is too low in memory, the longest program in the chaining set (or perhaps a longer one yet to be written) could overwrite it. If too high in memory, the string literals or stack may do the same.

It may seem that a location in reserved memory, above memory size, would be a good choice. Just set a relatively low memory size when entering BASIC, then load the variable storage pointers with a higher address. Unfortunately this won't work. Whenever a new variable is to be stored, BASIC checks the free-space pointer. If it points to an address in reserved memory, an out-of-memory message results.

A location just a little above the longest program to be chained would be ideal, but usually there will be no problem allowing generous space above the longest program for future expansion.

For the demonstration program, I selected addresses in middle memory—well above the end of the program—so those who want to experiment with the concept can do so without changing the locations. Longer segments can be written to replace the five line routines that currently represent the processing portions of the program.

String Storage

In addition to relocating the variable storage area pointers, attention must be given to one
other detail if string variables are to be transported from one program to another. It is related to the way strings are stored. In the case of numeric variables the values along with their attributes (type and name) are saved in the variable storage area. This is not true for strings. Only the attributes plus a pointer to the string literal (the actual string text) are saved in the variable storage area. If completely delimited by quotes within the program, string literals are left there; but all others are stored in high memory starting just below reserved memory and expanding downward.

A pointer at 40D6H directs data to the next string literal storage space, i.e., to the address just below the most recently stored string. (40D6H has been incorrectly identified as the storage space for memory size in some memory maps. It points to the address just below memory size only until the first string literal is stored there.) To prevent writing over existing strings in high memory with strings saved after a program change, it is necessary to save and rePOKE this pointer value since it will also be reinitialized during the load and run.

While discussing transportable string variables, note one limitation. If the string is completely defined in the program in a statement such as "$ = "THIS IS THE STRING LITERAL", it will not be stored in high memory. Instead the pointer in the variable storage area points to the string in the program area.

Strings so defined will be destroyed when another program is loaded. Thus the restriction: strings to be transported between programs must not be wholly defined in a simple assignment statement in the program. To circumvent this limitation, the string above could be defined as "$ = "THIS IS + "+ THE STRING LITERAL". The two parts will be concatenated by BASIC and the result stored in upper memory where it can be protected.

I noted earlier that the original variable storage pointer is saved and restored at the end of a program run. The need for this may not be obvious. Only the pointer at 40F9H need be restored, but failure to restore it can produce strange effects. Once I was developing the demonstration program, this pointer was not replaced. It remained pointing to an address in high memory. Since the program seemed to be working, I saved it on disk. Subsequently, after noting peculiar repeatable conditions in middle memory following a program load, I determined that the save had recorded everything from the first line of the program to the high address pointed to by 40F9H. The Save (and CSave) routine uses the 40F9H pointer address as the end-of-file pointer.

One other point: even if there is no other reason to set memory size, TRSDOS 2.2/2.3 users should protect some space. During Disk BASIC loading, the system uses the top 64 bytes of RAM. Setting memory size at least 64 bytes below top-of-memory will prevent loss of some strings if it is necessary to reload Disk BASIC following DOS reboot.

**Initialization**

Special initialization is required for the transportable variables system to work. Since addresses will be recovered from designated memory locations and POKE'd into pointers, addresses must be available for recovery. They will be available following the first execution of a program in the chaining set, but not before that. Consequently an initialization routine must be executed at the beginning of each chaining session. The routine loads initial pointer addresses into the designated memory locations for recovery by the first program execution.

To review briefly, the following steps must be taken during execution of a program to recover previously defined variables, process them and save the updated values for use by the next program:

1) Store the pointer value at 40F9H in a safe place in memory.
2) Retrieve the string pointer address from memory and POKE into 40D6H.
3) Retrieve three other pointer addresses and POKE into 40F9H, 40FBH and 40FDH.
4) Now use and process the variables as desired.
5) Before terminating the run, store the updated pointers in memory.
6) Store the updated string pointer.
7) Retrieve and replace the original value in 40F9H.

An initialization routine is appended to the end of the demonstration program starting at line 1000. In a practical application, this routine could be appended to every program in the set so any one of them could be loaded and run first, or it might be incorporated in a special program that is executed at the beginning of each chaining session.

Once the ability to arbitrarily select variable storage locations in memory has been developed, there is nothing in principle to prevent defining a second, third, or more, each for use in a different segment of the program. Within each segment BASIC will be unaware of variables defined in another segment. Consequently, variables in different segments of the program can be given the same names even though they are completely independent.

You may recognize this as the much heralded capability to define local (as opposed to global) variables. This is one of the important features of structured high level languages. (Move over Pascal!)

The problem with this method of providing local variables is that only local variables are available—none are global. As

```
10 * TRANSPORTABLE and LOCAL-GLOBAL VARIABLES
20 * DEMONSTRATION PROGRAM
30 * by Hal Brown
40 * 643 W. Valley Forge Rd.
50 * King of Prussia, PA 19406
60 * CLEAR200:DEFINTO
70 C=32258:POKE=1,PEEK(16634):POKE=0,PEEK(16633)
80 POKE16599,PEEK(Q-3):POKE16598,PEEK(Q-4)
90 COSUB 300
100 B=B:QV=VARPTR (B):Q=32580:GOSUB580
110 GS=**QV=VARPTR (GS):GOSUB580
120 PRINTA;TAB(6);TAB(15);S=TAB(33);GS
130 A=+A:1+B=2+R=4+S=F*;G=G+*+G
140 PRITA;TAB(6);TAB(15);S=TAB(33);GS
150 Q=32258;GOSUB480=32580;GOSUB380
160 B=8:QV=VARPTR (B):Q=32528;GOSUB580
170 GS=**QV=VARPTR (GS):GOSUB580
180 PRINTA;TAB(6);TAB(15);S=TAB(33);GS
190 Q=32528;GOSUB480
200 Q=32258;POKE=3,PEEK(16599):POKE=4,PEEK(16598)
210 POKE16634,PEEK(32249):POKE16633,PEEK(32248)
220 END
230 POKE16621,((QAND=256)-2*QAND=32768))/256
240 POKE16628,QAAND=55
250 POKE16633,PEEK(Q)
260 POKE16634,PEEK(PEEK(16628)+256*PEEK(16621)-512*PEEK(16621)+AND128)+1)
270 POKE16635,PEEK(PEEK(16628)+256*PEEK(16621)-512*PEEK(16621)+AND128)+2
280 POKE16636,PEEK(PEEK(16628)+256*PEEK(16621)-512*PEEK(16621)+AND128)+4
290 POKE16637,PEEK(PEEK(16628)+256*PEEK(16621)-512*PEEK(16621)+AND128)+8
300 POKE16638,PEEK(PEEK(16628)+256*PEEK(16621)-512*PEEK(16621)+AND128)+5
310 RETURN
320 FORO=1:TO=655:POKEO=O:PEEK(1663344)+1:RETURN
330 RETURN
340 IF(QA=2*QAND=32768)=QA=2*(QAND=32768):THENRET
350 ENDRETURN
360 FORO=1:TO=655:POKEO=O:PEEK(1663444)+1:RETURN
370 RETURN
380 FORO=1:TO=655:POKEO=O:PEEK(1663444)+1:RETURN
390 FORO=1:TO=655:POKEO=O:PEEK(1663444)+1:RETURN
400 RETURN
```

**Program Listing**

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soon as a new segment of the program is entered by changing the variable storage pointers, all variables defined in the previous segment are effectively non-existent.

Global Variables

Ability to define local variables is of little value without an accompanying ability to define global variables, so a means of providing the latter is needed. The program demonstrates the technique devised.

Any non-array variable can be made global using the routines in the current program. Array variables are stored in different format, but could be made global using the same general technique.

The means used in one segment of the program to obtain a variable from another is illustrated in line 180 of the demonstration program. B is the variable to be made global. First it is defined with a default value. If the variable exists in the program segment to be interrogated, the default value becomes a dummy and could be anything, but it will be the value assigned if the specified variable is not found in the other segment. In the default assignment a variable must be the same type—integer, single precision, double precision or string—and have the same name as the variable in the other segment; otherwise it will not be found.

Following the default value assignment a VARPTR statement assigns the address of the variable to QV. Q is then assigned the address of the other segment's variable storage area and a GOSUB 500 completes the recovery.

Subroutine 500 compares the first three bytes of each variable storage assignment in the other segment's storage area with the first three bytes for the variable in the current segment storage space. These bytes specify the type and name. If a match is found, the contents of the remaining bytes in the variable's assignment space are loaded from the other segment space into the current space. The variable now exists in the new segment with the same value it last had in the previous segment. If no match is found before reaching the address of the start of array storage space, execution returns to the subroutine calling point and the default value remains assigned to the variable.

This procedure can be repeated for as many variables as desired. For a subsequent run of the program, the updated value of the global variable is used in the first segment of the program, and there must also be a variable transfer sequence included in that segment. This was done in the demonstration program.

If this explanation of the global-variable definition has confounded you, welcome to the club. I'm confused and I wrote it! A study of the statements in the program will hopefully clarify it.

The current program is a compromise designed for non-disk owners and for disk system owners. To demonstrate both the ability to transport variables from program to program and the local/global variable capability, I had to identify two variable storage areas. To keep the demonstration within the limits of a 16K system, available memory for the purpose is limited, especially for disk users. DOS occupies most of memory up to 7000H, and by the time space is allowed for the BASIC program, there isn't room for large variable storage areas. However, large areas aren't needed for the demonstration.

The addresses selected are nominally at 32250 (7DFAH) and 32500 (7EF4H). If more extensive experimentation is to be done or a practical application made of the concept, Level II users with 16K may want to use lower addresses and Disk BASIC users with added memory can specify higher addresses.

Address Changing

Address changing is relatively easy. Note all the places in the program where Q is assigned a value. It will be either 32250 or 32500. To change one of these, change each occurrence of the number to the new address. Remember to use the negative form for addresses above 32767.
(FFFH). In addition, if 32250 is the address being changed, the two related addresses in line 250 and two in line 1140 must be changed to their equivalents relative to the new address. Variable expressions Q-1, Q-2, Q-3 and Q-4 could not be used at these points because the variable area pointer is being changed and BASIC would be unable to find Q.

When selecting an address for relocating variable storage, I suggest that the address not be near the address sign-change point, –32768 or 8000H. At several places in the program, addresses such as Q-2 or Q+6 are specified. If Q equals –32767, then Q-2 is outside the integer range and an error message will result. Similarly, if Q equals 32767, Q+6 is outside the integer range.

I designed the program for easy conversion into a longer demonstration program or into the separate programs of a useful chaining set. The two processing segments of the program each consist of five lines including the global variable definition lines. The first includes lines 120-160, the second lines 180-220. By replacing either block of lines with a routine of your own, the program can be customized.

If the local-global variable feature is unnecessary, the second set of processing lines and associated subroutine calls can be deleted. The several programs that comprise a chaining set could all be produced by inserting their routines into the middle of this demonstration program.

Program Use

To use the program, after typing it in and saving on tape or disk, first type RUN 1000 (enter). This initializes the pointer addresses at the two selected variable storage areas. Now type RUN (enter). Four lines of values are displayed. The first two are the before and after processing values of the variables in the first segment, the second two are the same in the second segment. Two numeric and two string variables are displayed, although the strings won’t appear on the first printouts from the two segments because their initial values are null.

The first number displayed on each line is the value of local array A. The second is the value of global variable B. The first string is local $S$, the second global $G$.

With successive runs of the program you will note that A is simply incremented with each execution of the program in the first segment, but the value representing the same variable name in the second segment is decremented by two with each program run. These two local variables maintain individuality despite their common name.

Global B is the same variable in both segments. It is incremented by two in the first segment and by three in the second. Note that in this case each segment picks up the value where it was left by the last segment executed.

The distinction between local and global variable treatment is especially evident in the string displays. Local string $S$ has an $S$ appended with each run of the first segment, while independent $S$ in the second segment appends an $X$ with each run. In the case of global $G$, the first segment appends a $G$, the second a $V$, resulting after several runs in a string of alternate characters instead of the repeated same characters of the local strings.

The variables will survive a new command and reload of the program (do not reinitialize with a RUN 1000 following reload unless you desire to zero the variables). They will even survive DOS reboot and reload of Disk BASIC provided you heed my warning about the top 64 bytes of memory (TRSDOS 2.2.23 only). To simulate the chaining of different programs, processing algorithms can be changed and different versions independently saved, or just change them between runs. Program editing will not affect the variables safely stored in middle memory.

Points of Interest

Several aspects of the program may be of interest. The let-
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ter Q was used as the first letter of all housekeeping variable names on the assumption that it is unlikely to be a variable name in a user routine. Since all the housekeeping variables are integer, all Q name variables are defined integer with the DEFINT statement.

Note that when new addresses are loaded into the 40Fh pointers via subroutine 300, a complex system of POKEs is required in lieu of a FOR-NEXT loop, to circumvent the problem mentioned earlier. However, FOR-NEXT works just fine when the updated pointer addresses are saved in memory via subroutine 400.

The CLEAR 200 at the beginning of the program requires a little discussion. If local variable strings are defined in two or more independent segments of a program, a special problem can occur after a number of runs. It results from the way strings are stored in memory. As noted earlier, in the case of string variables only the characteristics and a pointer are stored in the variable storage area. Most string literals are stored in high memory.

When BASIC stores string literals each newly defined string is placed in free space below the last stored string, even though the new string may be only a redetermination of a string variable and therefore a replacement for a string literal already stored. This continues until there is insufficient space left in the region reserved for strings to store the next defined string.

At this point a garbage detail in BASIC determines which literals still represent active variables in the program and which do not. The active literals are re-packed into space starting at the top of the string area and the rest of the space is made available for new string storage. Generally this will produce sufficient space to store the new string literal that initiated the cleanup. If not, an out-of-string-space error results.

The normal way to correct this error is to add a CLEAR nn statement or increase the size of the one already present. When no CLEAR nn statement is provided, the default value of 50 is assumed. If independent segments of a program are defined as described in this article, a problem potentially more serious than an error message can result. When the garbage cleanup occurs in one segment, the local variable strings defined in another segment are unknown to the garbage detail. As a result, they may be overwritten in the process of repacking the strings that are known.

There is no completely safe way to avoid this problem. However, specifying a relatively large CLEAR nn space can eliminate it for most applications. The CLEAR 200 statement in the program will delay its occurrence until after execution of many more runs than required to demonstrate the features of interest. However, try some runs with the CLEAR 200 statement deleted to see that the problem is evident after just a few runs.

This potential overwrite problem affects only strings, and only when two or more independent program segments are defined. It is not a limitation on simple variable transportation for chaining, which is considered the most useful of the several features demonstrated.

Logical AND expressions are used in program lines containing conversion of addresses to or from the most and least-significant byte components. With the variable storage area addresses currently selected for the program, these logic expressions are not needed. However, when users with more than 16K of memory use addresses above 6FFH, there can be a problem. Such addresses must be expressed in negative form in integer expressions or when used in PEEK and POKE statements. On the other hand, the component byte values of all addresses are retrieved from memory as positive integers and must be POKEd as positive numbers.

The logic expressions automatically take care of these sign changes when needed. Initially, you must specify high addresses in negative form (or in hexadecimal with Disk BASIC), but the AND expression will take care of required sign changes after that.
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My nature being what it is, cheap, I wanted to get all I could on each disk. When I got my second drive, I wanted to remove the DOS from all the disks but save the programs. I could then utilize the space previously occupied by the DOS for more programs. This article is about a program I wrote to kill the DOS.

Requires Apparatus

The program, KILDOS (Listing 1), requires NEWDOS by Apparat. It will work with NEWDOS, NEWDOS+, or NEWDOS 80.

Three versions of the program, with slight differences, are necessary for killing the DOS on a disk with NEWDOS, NEWDOS 80 or TRS. The changes are covered in Listings 2 and 3.

When you put a minimal DOS on a disk (by killing its utilities like DISKDUMP/BAS and TAPE/DISK/CMD), you will leave a little over 20 granules filled with system "brains." When you have one disk drive, every disk you use must have brains on it to give the system instructions. When you have more than one drive, you may leave the brains in drive 0 to provide housekeeping information for your all disks that run on a separate drive.

Table 1 is a listing of the allocated space for a minimal DOS on TRS. The allocation varies with operating systems, but you can see how much disk space can be gained.

A data disk needs only BOOT/SYS and DIR/SYS in any drive but drive 0. Obviously, more programs can be packed onto each disk if it contains no DOS.

How can we delete the DOS, but leave the programs? The simplest way is to KILL each system file one at a time. Since I had 40 full disks when my second drive arrived, the task would have taken a whole day. There had to be an automatic way to do it, so I wrote the program KILDOS.

Using the Program

Insert a NEWDOS disk into drive 0 and the disk with KILDOS on it into another drive. KILDOS could also be on the NEWDOS disk in drive 0. (It is a good idea to always write protect the DOS disk in drive 0 for safety.)

Now boot the system, load BASIC, and then run the KILDOS program. It will respond with a question asking which drive you want to use for the killing process. After you answer it, it will instruct you to load the disk to be deDOSed into the drive you specified.

When you hit ENTER you have begun the process; wait a moment and you will begin to see the results. The program lists the files it has killed, and, at the end, it tells you that you have no DOS and how many extra granules you have. The whole process takes about two minutes.

Once you have killed the DOS, you can proceed to fill the spaces with more files.

If you run into a glitch, the program will abort. If that hap-

Table 1. List of Extra Granules

<table>
<thead>
<tr>
<th>Directory</th>
<th>Granules</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOT/SYS</td>
<td>1</td>
</tr>
<tr>
<td>DIR/SYS</td>
<td>2</td>
</tr>
<tr>
<td>SYS0/SYS</td>
<td>3</td>
</tr>
<tr>
<td>SYS1/SYS</td>
<td>1</td>
</tr>
<tr>
<td>SYS2/SYS</td>
<td>1</td>
</tr>
<tr>
<td>SYS3/SYS</td>
<td>1</td>
</tr>
<tr>
<td>SYS4/SYS</td>
<td>1</td>
</tr>
<tr>
<td>SYS5/SYS</td>
<td>1</td>
</tr>
<tr>
<td>SYS6/SYS</td>
<td>3</td>
</tr>
<tr>
<td>FORM/CMD</td>
<td>3</td>
</tr>
<tr>
<td>BACKUP/CMD</td>
<td>3</td>
</tr>
<tr>
<td>BASIC/CMD</td>
<td>4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>24</td>
</tr>
</tbody>
</table>

5 REM ***** THIS PROGRAM BY R. SOLTYSIK PLANO, TX.
10 REM ***** THIS MUST BE USED WITH 2 DRIVES
20 REM ***** FOR USE WITH INVISIBLE UTILITIES INTACT
30 REM ***** MAKES DATA DISK OUT OF SYSTEM (DOS) DISK
40 REM ***** KILLS ALL DOS EXCEPT BOOT AND DIRECTORY
50 REM ***** THIS PGM FOR TRS 2.1, 2.2, 2.3
60 REM ***** YOU MUST USE NEWDOS IN DRIVE 0
70 REM ***** CLEAR DATA DISK:
80 CLEAR 5000: CLS: DIMAS(50): DEFINTA(3)
90 I=0
100 INPUT "DOS KILLING PROGRAM. WHICH DRIVE WILL BE USED?": D$0
110 IF D$="": GOTO 1120
120 IF D$="": GOTO 1120
130 I=I+1
140 FOR J=1 TO 10: READ A$[@]: NEXT 1
150 DATA "SYS0/SYS","SYS1/SYS","SYS2/SYS","SYS3/SYS","SYS4/SYS","SYS5/SYS","SYS6/SYS","FORM/CMD","BACKUP/CMD","BASIC/CMD"
160 FOR J=1 TO 10:CS="KILL +AS(J)+":"+D$: 170 CMD"CS"
180 PRINT A$[@]:"+D$; "
190 INPUT "OK TO KILL ALL?": K
200 IF K="Y" THEN 210
210 PRINT": DISK CONTAINS NO DOS"
220 PRINT: PRINT "YOU NOW HAVE 21 MORE GRANS ON THIS DISK"
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pens, you can modify the DATA
statements and the FOR-NEXT
loops of lines 140, 150, and 160
to run a partial kill, or you can
kill the remainder of the DOS
manually. I've had a few prob-
lems with disks that had direc-
tory errors and did not complete
the kill.

The program, as listed, will kill
the DOS on TRSDOS 2.1, 2.2 and
2.3. If you want to use it to kill
NEWDOS or NEWDOS + (ex-
cept NEWDOS 80), make minor
changes as shown in Listing 2.
For NEWDOS 80, make the
changes shown in Listing 3.

Listing 2. KILDOS Changes for NEWDOS and NEWDOS+

Listing 3. KILDOS Changes for NEWDOS 80

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STEPB0 allows you to step through any Basic or machine language program one instruction at a time, and see the address, hexadecimal value, 2log memnic, register contents, and step count for each instruction. The top 15 lines of the video screen are left unaltered so that the 'target program' may perform its display functions unobstructed. STEPB0 will follow program flow right into the ROMs, and is an invaluable aid in learning how the ROM routines function. Commands include step (trace), disassemble, run in step mode at variable step rate, display or alter memory or CPU registers, jump to memory location, execute a CALL, set breakpoints in RAM or ROM, write SYSTEM tapes, and relocate to any page in RAM. The display may also be routed to the line printer through the device control block so custom print drivers are automatically supported. STEPBO...

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TELECOMMUNICATIONS PROGRAM

This machine language program allows reliable high speed line transfers between two disk-based computers over modems or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminal modes, save RAM buffer or disk, transmit disk file, receive binary files, examine and modify UART parameters, program & custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the transmission was accurate. TELECOM...

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PROGRAM INDEX FOR DISK BASIC

Assemble an alphabetized index of your entire program library from disk directories. Program names and free space are read automatically (need not be typed in) and may be customized with your own Metzger set for the program. The list may also be searched for any disk, program, or extension, disks or programs added or deleted, and the whole list or any part sent to the printer. Finally, the list itself may be stored on disk for future access and update. The best thing since sliced bread! (January issue of 80 Microcomputing). Works with TRS80, NEWDOS, and NEWDOS/80. One drive and 30k required. INDEX...

$19.95

4 SPEED OPTIONS FOR YOUR TRS-80

The SK-2 drive modification allows CPU speeds to be switched between normal, an increase of 50%, or a 50% reduction, selectable at any time without interrupting execution or crashing the program. Instructions are also given for a 100% increase to 3.54 Mhertz, though the TRS 80 is not reliable at this speed. The SK-2 may be configured by the user to change speed with a toggle switch or on software command. It will automatically return to normal speed any time a disk is active, requires no change to the operating system, and has provisions for adding an LED to indicate when the computer is not at normal speed. It mounts inside the keyboard unit with only 4 necessary connections for the switch option (switch not included), and is easily removed if the computer ever needs service. The SK-2 comes fully assembled with socketed IC's and illustrated instructions. SK-2...

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INSTANT ASSEMBLER

The INSTANT ASSEMBLER is a new, powerful, tape-based editor/assemble and debugger for the TRS-80 Model II. It features immediate detection of errors as the source code is entered, assembly to memory as well as to tape, a built-in single-step debugging, a compactly coded source format that uses 1/3 as much memory as standard source, the ability to produce relocatable code modules, and the ability to link-load independently written modules. In addition, the INSTANT ASSEMBLER has many operational features including single stroke entry of DEFB and DEFW, continuous editing of successive lines, alphabetic listing of symbol table, separate command for listing error lines or the symbol table, block move function, and verification of source tapes.

INSTANT ASSEMBLER includes three separate programs. The assembler itself includes the single-stepper and debugger. In this mode you may have full register displays, decimal or hex entry, forward or backward memory displays, displayability of object code in memory, memory display in ASCII format, and hex-to-decimal or decimal-to-hex conversion. The single-stepper will step one instruction at a time or as a fast rate to any defined address. During assembly you may quickly switch from assembler to debugger and back again without losing the source code. This makes INSTANT ASSEMBLER an excellent learning tool for machine language programming. Also included on the tape are two versions of a tape linking Bailer which allow you to write your programs in smaller modules and link them together for final assembly.

INSTANT ASSEMBLER occupies 8375 bytes of memory. In a 16K machine this will leave you more than 7000 bytes which is enough to write assembly language programs of around 2000 bytes. This makes it ideal for users with only 16K machines. While this version was written specifically for tape systems, we will soon have a disk version as well. The instruction manual may be purchased separately for $5, which will apply towards the purchase of the INSTANT ASSEMBLER INTASM...

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RAM SPOOLER AND PRINT FORMATTER

This program is a full feature print formatting package featuring user definable line and page length (with line feeds inserted between words or after punctuation), screen dump, printer pause control, and baud rate selection. In addition, printing is done from a direct printer buffer and returns to environment so that the LPRINT or LIST command can be used in your program while printing is being done. Ideal for Selectric or other slow printers. Allows printing and processing to run concurrently. Output may be directed to either the parallel port, serial port, or the video screen. SPOOLER...

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MACHINE CODE FAST FOURIER TRANSFORM

This complete package includes 3 versions of the machine language FFTASM routine assembled for 32K and 48K machines, a short sample Basic program to access them, a 10K Basic program which includes sophisticated interactive graphing and data manipulation, and a manual of instructions and examples. The machine language subroutines are defined by a supporting Basic program to make data entry and retrieval extremely fast and easy for custom implementation. They perform 20 to 40 times faster than their Basic equivalent (256 points in 12.5 seconds), and return less than 1300 bytes of memory. The FTF is useful in analyzing stock market and commodity trends as well as for scientific information. FFTASM...

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RAMTEST FOR LEVEL II

This machine language program is a thorough test for several types of RAM errors. A complete test of each individual line of RAM takes just 14 seconds. Includes a separate test for power line glitches. RAMTEST...

$9.95

EDIT BASIC PROGRAMS WITH ELECTRIC PENCIL

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If you've ever dreamed of making a killing in the stock market, these programs may be of interest to you. They won't make a buy or sell decision for you, but they will help you predict future stock prices and market direction. I've included traditional guidelines for interpreting the results of each program.

Warning—The following programs may be hazardous to your financial well being! No one has ever been able to accurately predict the stock market. When using these programs as an investment aid, test and retest each to become familiar with the advantages and limitations of each. Remember—the final decision is yours.

Setting Up

You'll find most of the information you need in one of the major daily newspapers. The following figures must be tracked daily:
- Closing prices for each stock (or any other market index you select)
- Dow Jones Industrial Average
- Market Volume (transactions)
- Number of issues advancing (advances)
- Number of issues declining (declines)

Program Listing 1, UPDATE/DTA, creates and maintains your data files. These are compatible with any program requiring data from disk.

Program Listing 1 User Notes
- Stock price data must be entered in decimal form; a price of five and one half must be entered as 5.5.
- Zero must always be the last item entered, signifying that all data has been entered and identifying the end of the file.
- Stock price files may have any name.
- The Dow Jones Industrial Average must be named DOWIAVE.

```
10 CLS
20 DIM D(999)
30 INPUT "DO YOU WISH TO UPDATE AN EXISTING FILE (U)
 OR CREATE A NEW ONE (N)?":A$  
40 IF A$="N" GOTO 300
50 CLS
60 PRINT "PLACE DISK WITH DATA FILE IN DRIVE"
70 INPUT "ENTER NAME OF OLD DATA FILE":B$  
80 PRINT "NEW FILE WILL HAVE THE NAME ";B$  
90 INPUT "PRESS ENTER TO BEGIN.";A$  
100 OPEN"",1,B$  
110 A=1
120 INPUT1.D(A)
140 IF D(A)=# GOTO 160
150 A=A+1:GOTO 130
160 CLOSE 1:INPUT"PRESS ENTER TO CONTINUE";A$  
170 CLS:PRINT"ALL DATA READ FROM DISK."
180 PRINT"YOU CAN NOW ENTER THE NEW DATA"
190 PRINT
200 PRINT"ENTER ITEM ":A
210 INPUT D(A)
220 IF D(A)=# GOTO 240
230 A=A+1:GOTO 200
240 CLS:PRINT"ALL DATA HAS BEEN ENTERED."
250 PRINT"PLACE DISK TO CONTAIN THE UPDATED DATA IN DRIVE"
260 INPUT"PRESS ENTER TO CONTINUE.";A$  
270 OPEN"",1,B$  
280 FOR J=1 TO A:PRINT1,D(J):NEXT
290 CLOSE:END
300 CLS
310 INPUT"ENTER NAME OF FILE TO CONTAIN DATA":B$  
320 CLS  
330 A=1
340 PRINT"ENTER ITEM ":A
350 INPUT D(A)
360 IF D(A)=# GOTO 240
370 A=A+1:GOTO 340
380 END

Program Listing 1. UPDATE/DTA, used to create and maintain data files used by the market analysis programs.
```
"Warning—The following programs may be hazardous for your financial well being!"

Program Listing 2. FORECAST/MKT develops a quantitative measure of the historical market and stock price trend.

```
10 CLS
20 DIM P(800),V(800),Q(800),T(800),S(800),J(800),J1(800),J2(800),J3(800)
30 REM "THIS PROGRAM USES HISTORICAL STOCK PRICES AND"
40 REM "INDEX VALUES TO PROJECT FUTURE PRICES"
50 GOSUB 940
60 REM "THIS SECTION INPUTS INDEX VALUES"
70 CLS
80 GOSUB 880
90 IF A=20 GOSUB 2890
110 PRINT "THE COMPUTER WILL NOW GRAPH THE HISTORICAL FR"
120 PRINT","INDEX, AND THE PROJECTED PRICE AND INDEX."
130 PRINT "AFTER EACH GRAPH IS DRAWN, PRESS ANY KEY TO"
140 PRINT "CONTINUE."
150 U3=5 "I/ J INDUSTRIALS"
160 GOSUB 1670
170 GOSUB 2210
180 U3="STOCK PRICES"
190 GOSUB 1720
200 GOSUB 2320
210 GOSUB 1870
220 GOSUB 2550
230 REM "THIS SECTION COMPUTES THE SLOPE AND Y INTERCEPT"
240 REM "OF THE LINE OF BEST FIT FOR THE DATA"
250 CLS
260 FOR A=1 TO N-1
270 A1=V(A)+A1
280 A2=2+(A)+A2
290 B1=V(A)+P(A)+B1
300 B2=2+(A)+B2
310 NEXT A: A1=(1/(N-1)*A1)
320 FOR A=1 TO N-1
330 A5=(1/(N-1)*A5)
340 A3=(1/(N-1)*A3)
350 NEXT A
360 A4=A3*(N-1)
370 A6=A5*(N-1)
380 SLS=(B1-(1/(N-1)*A1*A2))/((B2-((N-1)*A2(2))
390 ICA1=(SLS*A2)
400 REM "THIS SECTION COMPUTES THE CORRELATION COEFFICI"
410 PA=A2
420 IA=A1
430 Bi=Bi*B2=0:B3=0
440 FOR A=1 TO N-1
450 Bi=Bi+(P(A)-PA)*(V(A)-IA)+Bi
460 Bi=(P(A)-PA)*(V(A)-IA)
470 B3=(V(A)-IA)*(B2
480 NEXT A
490 R1=(1/(N-1)*B1)/SQR((1/(N-1)*B2)*SQR((1/(N-1)*B3))
500 PRINT
510 PRINT "THE EQUATION OF THE LINE OF BEST FIT IS:"
520 PRINT
530 PRINT "Y = IC1* + ISL1* X"
540 PRINT
550 PRINT "YOU MAY NOW ENTER THE STOCK PRICE YOU WISH T"
560 PRINT "O GET. THE COMPUTER WILL RESPOND BY GIVING YO"
570 PRINT "THE LEVEL YOUR PRICE INDEX MUST REACH BEFORE YO"
580 PRINT "ACHIEVE THIS STOCK PRICE. THIS WILL BE FOLLOWED"
590 PRINT "BY THE COORELATION COEFFICIENT—A MEASURE OF TH"
600 PRINT "DEGREE OF RELATIONSHIP BETWEEN STOCK PRICES AND"
610 PRINT "INDEX VALUES."
620 PRINT: INPUT "PRESS ENTER TO CONTINUE";A5
630 CLS
640 INPUT "ENTER STOCK PRICE YOU WISH TO OBTAIN";FR
650 IF A5=IC1*(SLS*FR)
660 CLS
670 PRINT "THE INDEX MUST REACH":IV
680 PRINT "THE COORELATION COEFFICIENT":IR
690 PRINT "YOUR STOCK PRICE IS":FR
700 IF FR="S" GOTO 740
710 IF LPRINT"TRIAL PRICE":JFR
720 IF LPRINT "NECESSARY INDEX":IJV
730 LPRINT
740 PRINT "TO RUN AGAIN TYPE 1"
750 PRINT "TO CONTINUE TYPE 2"
```

Forecast/MKT Sample Execution
The past is one thing we can be sure of—it will never change. Program Listing 2, FORECAST/MKT, measures market history and stock price trends. It describes graphically the past action of the market. It measures a selected stock against the Dow Jones Industrial Average. (The Dow Jones Industrial Average is a market index that measures the general economic health of the country's business.)

Let's take our first look at the unknown—the future. Fit a straight line to the past data (least squares line of best fit). Extend this line into the future, as if the past trend of the stock and market will continue unchanged. This produces our first look at where the past wants to take us; what the future actually brings may be shockingly different.

Interpret the results of this program with extreme caution. The program projects stock and market values into the future assuming they continue their past performance and relationship to each other. Needless to say, this can't be guaranteed.

The line number column and the line number function column are shown in Table 1. To run it, the operator must have the stock price and market index data stored on disk. In the following example, stock prices are stored under the name LIONEL/P and the index is stored as DOW/AVE.

### Table 1. FORECAST/MKT Program Flow

<table>
<thead>
<tr>
<th>Line</th>
<th>Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Enters stock prices from disk.</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Enters index values from disk.</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>There must be an equal number of stock prices and index values, otherwise this line creates two arrays of equal length.</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>Plots Dow Jones Index to video screen.</td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>Optional output to line printer.</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>Plots stock prices to video screen.</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>Optional output to line printer.</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>Extends stock prices and index into the future assuming they maintain their past performance.</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>Optional output to line printer.</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>Computes coefficient of correlation that exists between stock prices and index values.</td>
<td></td>
</tr>
<tr>
<td>550</td>
<td>Using the correlation between price and index, the computer describes the relationship between them. At this point enter the stock price you wish to obtain. The computer will respond with the level the Dow Jones Average will probably have to reach before your stock reaches your desired price.</td>
<td></td>
</tr>
</tbody>
</table>

Details of the program are shown in Table 1. To run it, the operator must have the stock price and market index data stored on disk. In the following example, stock prices are stored under the name LIONEL/P and the index is stored as DOW/AVE.

### Limits of the Past

When we extend our line into the future, we assume the past trend will continue unchanged. This is a very dangerous, and wrong, assumption. At some point in time the past trend will change.

We must decide when this change will occur and what it will look like. From this point on, we are walking on air. Fortunately,
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1620 U13="STOCK PRICE PROJECTION"
1630 LL+95=CLS:GOTO 1770
1640 RETURN
1650 END
1660 END
1670 FOR I=1 TO N-1
1680 L(I-1)=V(2)
1690 NEXT
1700 KW=N-1:XL=(KW/11)
1710 GOTO 1770
1720 FOR I=1 TO N-1
1730 L(I)=P(2)
1740 NEXT
1750 KW=N-1:XL=INT((KW/11)+.9)
1760 GOTO 1770
1770 P2=8: P=8
1780 REM * SEARCH FOR HIGH AND LOW *
1790 IL=2000: IH=8
1800 FOR I=1 TO N
1810 IF L(I)<IL THEN IL=L(I)
1820 IF L(I)>IH THEN IH=L(I)
1830 NEXT
1840 RI=IN-IL: RI=RI/6
1850 CLS
1860 PRINT 0: 25, US
1870 P2=8
1880 FOR X=IN TO IL STEP -RI: PRINT 0(P2),X: PRINT 0(P2+5)
1890 IF X=9 TO 127 SET(X,4): NEXT
1900 IF X=12 TO 127 STEP 16: SET(X,39): NEXT
1910 PRINT 0(980), "(1): PRINT TAD(20), "( --> DAYS -->);PRIN T 0(951),NW
1920 FOR Y=8 TO 39 SET(T,11,Y): NEXT
1930 FOR Y=3 TO 39 STEP 2 SET(T,10,Y): NEXT
1940 SR=INT((KN/15)+.9):IF KN=180 SR=SR/100
1950 IF KN=11 PRINT "YOU MUST HAVE AT LEAST 11 ELEMENTS TO CONSTRUCT GRAPH":GOTO 2180
1960 X=13:X=2:IX=1:L=1K:X=2
1970 P2=1
1980 FOR X=1 TO KN STEP SR
1990 X3=40-(11(X)-X3):K3
2000 SET(KL3,K3)
2010 Q(F2)=K3
2020 X1=X1+1:P2=P2+1
2030 IF X1=127 GOTO 2050
2040 NEXT
2050 X1=X1+1
2060 FOR X=1 TO (KN-SR)STEP SR
2070 IF Q(F2)<Q(P2+1) GOTO 2130
2080 FOR E=INT(Q(F2)) TO INT(Q(P2+1)) STEP -1
2090 IF X1=127 GOTO 2170
2100 SET(X,2)
2110 NEXT Z
2120 GOTO 2160
2130 FOR Z=Q(P2) TO Q(P2+1)
2140 SET(X,2)
2150 NEXT Z
2160 X1=X1+1:P2=P2+1:NEXT X
2170 B4=INKEYS:IF B4="C " GOTO 2170
2180 IF LL=99 GOTO 1598
2190 IF LL=95 GOTO 1548
2200 RETURN
2210 REM OUTPUT TO QUICK PRINTER *
2220 INPUT "DO YOU WANT OUTPUT TO LINE PRINTER (Y/N)";W / W
2230 IF W="N" THEN RETURN
2240 FOR A=1 TO N
2250 V1(A)=V(A)
2260 NEXT
2270 GOTO 2360
2280 REM OUTPUT TO QUICK PRINTER *
2290 INPUT DO YOU WANT OUTPUT TO LINE PRINTER (Y/N) ; W
2300 IF W=\"N\" THEN RETURN
2310 LPRINT\+LPRINT
2320 FOR A=1 TO N
2330 V1(A)=P(A)
2340 NEXT
2350 GOTO 2360
2360 B=B+L=V1(1)
2370 FOR X=1 TO N-1
2380 IF VI(X)=\$ THEN VI(X)
2390 IF VI(X)<\$ THEN VI(X)
2400 NEXT
2410 LPRINT*;U3S
2420 LPRINT\+TAB(39)\*;--RANGE--\+TAB(39)\*;--RANGE--
2430 IF P39+1 TO 75 \LPRINT\*;NEXT\LPRINT\*\*;CHR\(13)\n2440 RASH=\+RA=78/RA
2450 FOR X=1 TO N-1
2460 LPRINT*;T
2470 T=RA\+(V(X)-L):T=INT(T)
2480 FOR X=1 TO T

Program continues

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we have a parachute; unfortunately, we do not know if it will open.

The remaining programs try to predict the change in trend and measure the risk involved in a particular stock. Each have their own advantages and disadvantages. At times the programs will give conflicting results and you must decide which results are more reliable.

Potential Reward . . . Guaranteed Risk
Program Listing 3, STOCK/ANA, estimates the risk and rate of return associated with a particular stock. The analysis is based on the historic relationship between stock price and index values and the past earnings per share of the stock. Remember that any future change in these relationships can change the amount of risk associated with that particular stock.

The program uses three statistical measures to estimate risk and return:

Rate of change in Earnings Per Share (EPS): As a general rule, the greater the variation in EPS from year to year, the greater is the uncertainty of future price. When measuring variation, look at rate of change and not the amount of change. To calculate rate of change, apply the least squares equation to the common logarithms of EPS, then calculate trend values in logarithms and convert those values back to dollar values by taking anti-logs of the logarithms. (See formula, Table 3.) The Beta Coefficient is a quantitative comparison of the price of a stock in relation to an index (DJU) for the same time period. A Beta that is greater than one (1.00) normally indicates your stock is less stable than the market. If the market increases, your stock would be expected to increase faster than the market.

If the market decreases, your stock would be expected to decrease at a greater rate than the market. As an investor, you would want to hold stocks with high Betas if you expect the market to rise.

A Beta that is less than one would be ex-

pected to be more stable than the market. In a rising market, a low Beta stock would not rise as much as the market. In a falling market, a low Beta stock would not be expected to fall as much as the market. If the market is expected to fall, an investor would want a portfolio of low Beta stocks, providing a degree of protection during a market decline.

Interpretation of Beta Coefficient:

Beta = 1.08
Rising Market. In a rising market the stock would be expected to increase 8 percent more than the market.
Falling Market. In a falling market the stock would be expected to decline 8 percent more than the market.
Beta = .95
Rising Market. In a rising market the stock would be expected to increase 5 percent less than the market.
Falling Market. In a falling market the
"This produces our first look at where the past wants to take us; what the future actually brings may be shockingly different."

The Alpha Value is a measure of the rate of return of an individual stock relative to the rate of return from the market index. An Alpha Value greater than zero indicates the rate of return from the stock was greater than the return from the index. An Alpha less than zero indicates the rate of return was less than the index rate of return.

How effectively does the Beta Coefficient measure your risk? Until recently it was widely accepted as the measure of risk. It retains a sizable following, but has come under attack. One major criticism of Beta is its use of the Dow Jones Industrial Average as a measure of the overall market performance. Large organizations today use computers to measure the entire market, rather than trying to estimate it with a market average. As this is a bit outside the ability of the microcomputer, you must decide for yourself how trustworthy the Beta is.

When selecting stock there is always a degree of risk. As a general rule, the greater the risk, the greater the potential profit. Each investor must decide for himself how much risk he is willing to accept. Never accept more than you feel comfortable with; never gamble unless you can afford to lose.

---

**STOCK/ANA: Sample Execution**

**Step 1:** PLACE STOCK PRICE DISK IN DRIVE

**Step 2:** PLACE DISK CONTAINING INDEX DATA IN DRIVE

**Step 3:** Computes standard deviation and variance;

- **STANDARD DEVIATION OF PRICE**: 0.44
- **STANDARD DEVIATION OF INDEX**: 1.45
- **VARIANCE OF INDEX VALUES**: 2.10
- **VARIANCE OF STOCK PRICES**: 1.9545E-03

**Step 4:** Computes Alpha and Beta coefficient:

- **ENTER DIVIDEND FOR LAST QUARTER**: 30
- **BETA COEFFICIENT**: 1.0524
- **ALPHA VALUE**: -0.0948

**Step 5:** Computes rate of change in earnings per share (EPS)

**Step 6:** Computes coefficient of determination:

**COEFFICIENT OF DETERMINATION = .242279**

---

**Program Listing 3.** STOCK/ANA estimates the risk and rate of return associated with a particular stock, based on the historic relationship between stock price and index values and the past earnings per share of the stock.

10 CLS
20 DIM P(800), V(800), I(800), E(20), N3(20), L3(20), X(20), Y(20), Z(800)
30gosub 1630
40 REM * THIS SECTION INPUTS INDEX VALUES *
50 CLS
60gosub 1380
70 NS=N
80 REM * THIS SECTION COMPUTES STANDARD DEVIATION AND VARIANCE *
90 PE=0: PW=0
100 FOR A=1 TO N-1
110 PE=PE+(P(A)+PW=V(A)+PW
120 NEXT
130 PA=PE/(N-1)
140 PE=PE-P(A)/(N-1) PW=PW/(N-1)
150 SP=0: SI=0
160 FOR A=1 TO N-1
170 SP=SP+(P(A)-PA) X 2+SP
180 SI=SI+(V(A)-PW) X 2+SI
190 NEXT
200 SP=SP/(N-1)
210 SI=SI/(N-1)
220 VP=SP
230 VI=SI
240 CV=SP/PA
250 CI=SI/1A
260 A=PRINT: PRINT
270 PRINT "STANDARD DEVIATION OF PRICE =" ; SP
280 PRINT "STANDARD DEVIATION OF INDEX =" ; SI
290 PRINT "VARIANCE OF INDEX VALUES =" ; VI
300 PRINT "VARIANCE OF STOCK PRICES =" ; VP
310 PRINT
320 INPUT "PRESS ENTER TO CONTINUE" : A
330 REM * COMPUTES BETA COEFFICIENT *
340 CLS
350 INPUT "ENTER DIVIDEND FOR LAST QUARTER =" ; X2
360 IF X2 <> 0 THEN 380
370 E=2 - 30
380 FOR A=1 TO N-2
390 IF (P(A)-PA)*X - E THEN 410
400 E=(P(A)-PA)*X - E
410 NEXT
420 IF (P(A)-PA)*X - E THEN 440
430 E=(P(A)-PA)*X - E
440 NEXT
450 IF (P(A)-PA)*X - E THEN 480
460 E=(P(A)-PA)*X - E
470 NEXT
480 IF (P(A)-PA)*X - E THEN 520
490 E=(P(A)-PA)*X - E
500 NEXT
510 X2=SP/PA
520 E=2 - 30
530 IF X2 <> 0 THEN 550
540 E=2 - 30
550 NEXT
560 CLS
570 PRINT
580 PRINT "STOCK/ANA: Sample Execution"
590 PRINT
600 PRINT "STANDARD DEVIATION OF PRICE =" ; SP
610 PRINT "STANDARD DEVIATION OF INDEX =" ; SI
620 PRINT "VARIANCE OF INDEX VALUES =" ; VI
630 PRINT "VARIANCE OF STOCK PRICES =" ; VP
640 PRINT
650 PRINT "INPUT "ENTER DIVIDEND FOR LAST QUARTER =" ; X2
660 IF X2 <> 0 THEN 680
670 E=2 - 30
680 NEXT
690 FOR A=1 TO N-1
700 E=2 - 30
710 PRINT "INPUT E (A) =" ; A
720 PRINT "E (A) =" ; A
730 NEXT
740 IF X2 <> 0 THEN 760
750 IF E(A) < 0 THEN A=ABS(E(A))+A ELSE A=ABS(E(A))
760 NEXT
770 IF A <> 0 THEN 790
780 GOTO 800
790 E=2 - 30
800 NEXT
810 NEXT
820 FOR A=1 TO N-1
830 PRINT "EPS FOR YEAR 1 =" ; EPS FOR YEAR 1
840 PRINT "EPS FOR YEAR 2 =" ; EPS FOR YEAR 2
850 PRINT "EPS FOR YEAR 3 =" ; EPS FOR YEAR 3
860 PRINT "EPS FOR YEAR 4 =" ; EPS FOR YEAR 4
870 PRINT "EPS FOR YEAR 5 =" ; EPS FOR YEAR 5
880 PRINT "EPS FOR YEAR 6 =" ; EPS FOR YEAR 6
890 PRINT "EPS FOR YEAR 7 =" ; EPS FOR YEAR 7
900 PRINT "EPS FOR YEAR 8 =" ; EPS FOR YEAR 8
910 PRINT "EPS FOR YEAR 9 =" ; EPS FOR YEAR 9
920 PRINT "EPS FOR YEAR 10 =" ; EPS FOR YEAR 10
930 PRINT "EPS FOR YEAR 11 =" ; EPS FOR YEAR 11
940 PRINT "EPS FOR YEAR 12 =" ; EPS FOR YEAR 12
950 PRINT "AVERAGE ANNUAL RATE OF CHANGE IN EPS =" ; EPS
960 NEXT
970 PRINT
980 PRINT "COEFFICIENT OF DETERMINATION = " ; EPS
990 NEXT
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OSI (8K) APPLE TRS-80

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- Examine or change memory using a formatted hex display
- Save areas of memory to cassette in binary (a "CSAVE")
- Display memory or read data or programs to a host system
- Move the video display page throughout RAM
- Send or receive RS-232 at up to 9600 baud
- Investigate and activate features of your computer, such as hi-res graphics or machine-language music
- Use your color computer as an intelligent peripheral for another computer, a color display or a 6809 program development tool

MONITOR ROM: The same program as the monitor tape, supplied on ROM. This allows BASIC to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The ROM plugs into the Extended Basic ROM Socket or a modified ROMPACK.
80C Monitor ROM Price: $39.95

INSIDE THE COLOR COMPUTER: This package is a disassembler which runs on the color computer and enables you to generate your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. Disassembler features include cross-referencing of variables and labels; output code which can be re-assembled; output to an 80-column printer, small printer or screen; and a data table area specification which defaults to the table boundaries in the interpreter ROM. A 16K system is required for the use of this cassette.
80C Disassembler Price: $49.95

CBUG IS HERE!!

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80 Microcomputing, June 1981 • 275
"At times the programs will give conflicting results and you must decide which . . . are more reliable."

810 E(A)=E(A)+ABS(K)
840 NEXT
850 N2=(N1/2)-.5
860 FOR A=N1 TO 1 STEP -1
870 M3(A)=N2
880 M2=M2-1.0
890 NEXT
900 L1=8:L2=8:L3=8
910 FOR A=1 TO N1
920 L1=L1+LOG(E(A))/LOG(10)+L1
930 L2=L2*(LOG(E(A))/LOG(10))+L2
940 L3=L3(A)+L2
950 NEXT
960 LB=L1/L1
970 LB=L2/L3
980 FOR A=1 TO N1
990 LY(A)=LB*(LY(A))
1000 NEXT
1010 FOR A=1 TO N1
1020 Y(A)=10*(LY(A))
1030 NEXT
1040 SU=0
1050 FOR A=1 TO N1-1
1060 SU=SU+((Y(A+1)/Y(A))*100)+SU
1070 NEXT
1080 VA=SU/(N-1)\n1090 VA=VA/100
1100 CLS
1110 PRINT:PRINT
1120 PRINT "AVERAGE ANNUAL RATE OF CHANGE IN EPS = ";VA
1130 PRINT
1140 PRINT
1150 IPW=y*LPRINT "RATE OF CHANGE IN EPS = ";VA:LPRINT "T:LPRINT
1160 PRINT:INPUT:PRESS ENTER TO CONTINUE";AS
1170 REM * COEFFICIENT OF DETERMINATION*
1180 M1=B;N2=B;M3=0
1190 FOR A=1 TO N1
1200 M1=E(A)+M1
1210 NEXT
1220 M2=M2+B;M3=0
1230 FOR A=1 TO N1
1240 M2=M2+(Y(A)-MA);MA=M2+M2
1250 M3=M3+(E(A)-MA);MA=M3+M3
1260 NEXT
1270 CD=M2/M3
1280 CLS
1290 PRINT:PRINT
1300 PRINT "COEFFICIENT OF DETERMINATION = ";CD
1310 PRINT
1320 PRINT
1330 IF WS=y*LPRINT "COEFFICIENT OF DETERMINATION = " T:LPRINT
1340 IF WS=y*LPRINT TAB(15)," = ";CD
1350 INPUT "PRESS ENTER TO CONTINUE";AS
1360 CLS
1370 END
1380 REM * READS INDEX VALUES FROM TAPE *
1390 CLS
1400 PRINT "PLACEMENT INDEX DATA IN DRIVE"
1410 INPUT "ENTER NAME OF DATA FILE";XVS
1420 A=1
1430 OPEN"1",2,XVS
1440 INPUT#2,V(A)
1450 IF V(A)=0 GOTO 1478
1460 GOTO 1500
1470 V$=INDEXES:IF V$="S" GOTO1500
1480 A=A+1
1490 GOTO 1440
1500 CLOSE 2
1510 IF A=N GOTO 1610
1520 IF XA GOTO 1580
1530 FOR C9=1 TO N
1540 V(C9)=V(C9+A-N))
1550 NEXT C9
1560 A=N
1570 GOTO 1610
1580 FOR C9=1 TO A
1590 P(C9)=P(C9+A-N))
1600 NEXT N=4
1610 PRINT
1620 RETURN
1630 CLS
1640 PRINT "PLACEMENT INDEX DATA IN DRIVE"
1650 INPUT "ENTER NAME OF DATA FILE";XVS
1660 A=1:N=1
1670 OPEN"1",1,XVS
1680 INPUT#1,P(A)
1690 IF P(A)=0 GOTO 1710
1700 GOTO 1740

Program continues
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Change Creates Profit—Maybe

Over any period of time the market will rise and fall. We would like to buy when the market is low and sell when the market is high. To do this, we must identify major changes in market direction before they occur or shortly after they begin. The following programs address the subject of major market trends.

Program Listing 4, MOVING/AVE, attempts to indicate major changes in the direction of the market or a stock price by comparing the stock's current price to an average of its past performance. The average of past performance is calculated by dividing the average of the first “N” days (normally 200 days are used); then one element, another element is added to the end of the series and another average is calculated:

<table>
<thead>
<tr>
<th>First Ave.</th>
<th>Second Ave.</th>
<th>Third Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

SUM SUM SUM: Divide sum by 200 to obtain the average for each series.

By calculating the moving average, the investor attempts to smooth out the minor changes in a stock’s past performance, creating a line that indicates its major trend. By comparing the current stock price to this smooth trend line, the investor can detect any deviations. These deviations are interpreted as buy and sell signals.

Buy Signals:
- If the 200 day average line flattens out or advances following a decline and the daily price of the stock penetrates that average on the upsurge.
- If the stock price is above the 200 day line and declines toward it, but fails to go through it, turning up instead.

Sell Signals:
- If the average line flattens out or declines following a rise, and the daily stock price penetrates that line on the downside.
- If the stock price is below the average line and rises toward it, but fails to go through and instead turns down again.

I have found this a very good indicator of major price trend. Of the three programs I have done on this subject, the moving average program has proved much more reliable than the other two.

MOVING/AVE—Sample Execution:
The user has the option of specifying the number of days plotted on the line printer. The computer will instruct you to enter number of days to be plotted to printer. If you wish to see a graph of the last 10 days, enter 10 and they will be plotted. This is primarily a time and paper saving device, eliminating duplication when the program is run on a regular basis.

Step 1: ENTER NAME OF DATA FILE? LIONEUP
Step 2: Computer begins calculating Moving Average (line 130 of program).
Step 3: Graph is plotted on line printer.

P indicates daily stock price on graph.

Table 2. FORECAST/MKT Formulas

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Individual Stock Prices</td>
</tr>
<tr>
<td>Y</td>
<td>Individual Index Values</td>
</tr>
<tr>
<td>X̄</td>
<td>Mean Stock Price</td>
</tr>
<tr>
<td>Ȳ</td>
<td>Mean Index Value</td>
</tr>
<tr>
<td>N</td>
<td>Number of Individual Items</td>
</tr>
</tbody>
</table>
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Program Listing 4. MOVING AVE indicates major changes in the direction of the market or a stock price, by comparing current stock price to an average of its past performance.

```
10 CLS
20 DIM P(1500), MA(1500)
30 A=1
40 PRINT "PLACE DISK WITH DATA FILE IN DRIVE";
50 INPUT "ENTER NAME OF DATA FILE" : AS
60 OPEN "", 1, AS
70 INPUT I1, A1
80 IF P(A)=8 GOTO 100
90 A=A+1: GOTO 70
100 CLOSE: CLS
110 NV=8: K=1
120 Q=1
130 A1=1: N=INT(A / 2) : IF N>200: N=200
140 FOR B=N TO A
150 FOR C=Q TO (Q+N-1)
160 PRINT I1, C: PRINT 18, B: PRINT 20, A
170 AV=P(C) / NV
180 NEXT C
190 AV=AV / : MA(K) = AV: K=K+1
200 Q=Q+1
210 NEXT B
220 N=5000: H=8
230 LI=5000: H=8
240 FOR B=1 TO A
250 IF P(B) < L I=P(B)
260 IF P(B) > H I=P(B)
270 NEXT B
280 FOR B=1 TO K
290 IF MA(B) < L I=MA(B)
300 IF MA(B) > H I=MA(B)
310 NEXT B
320 U=1: U/I=8
330 R=R-LI1=H1-1
340 H=H-1: R=R1=62/H1
350 LPRINT CHR$(15): AS
360 LPRINT 370 LPRINT INT(N) " DAY MOVING AVERAGE "
380 LPRINT: LPRINTTAB(30);": " <-------->
390 LPRINT: LPRINT: "T1"
400 PRINT "ENTER NUMBER OF DAYS TO BE PLotted TO PRINTE R";
410 PRINT " MUST BE LESS THAN " ; INT(A / 2)
420 INPUT Z
430 IF Z=INT(A / 2) GOTO 480
440 CLS: IF R>200 THEN N=N+9
450 FOR X=N-Z TO N
460 LPRINT I1;
470 T1=R-P(X-L): T1=INT(T1)
480 LPRINT TAB(T1) "P"
490 NEXT
500 T=1
510 FOR X=A-Z TO A
520 LPRINT I1;
530 T1=R-P(X-L): T1=INT(T1)
540 T2=R-(MA(T1)-L): T2=INT(T2)
550 T=T1
560 IF T1=T2 GOTO 620
570 IF T1<T2 GOTO 600
580 LPRINT TAB(T2) " ; T2" ; T2 ; "P" ; T2 ; P
590 GOTO 630
600 LPRINT TAB(T1) "P ; T1 ; P ; T1 ; P ; T1 ; P ; T1 ; P ; T1",
610 GOTO 630
620 LPRINT TAB(T1) "O"
630 NEXT X
640 END
```

Program Listing 5. TRADING/VOL measures the strength or weakness of a given price movement.

```
10 CLS
20 DIM DA(1000), DB(1000)
30 PRINT " PLACE DISK CONTAINING Dow/AVE FILE IN DRIVE"
40 INPUT " PRESS ENTER TO READ DATA FROM DISK. " ; AS
50 OPEN "", 1, "Dow/AVE"
60 A=1
70 INPUT I1, DA(A)
80 IF DA(A)=8 GOTO 100
```

Program continues
$ DISCOUNT $

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See List of Advertisers on page 306

80 Microcomputing, June 1981 • 281
"As a general rule, the greater the risk, the greater the potential profit."

```
90 A=A+1:GOTO 70
100 CLOSE
110 CLS
120 PRINT"PLACE DISK CONTAINING VOLUME FILE IN DRIVE";
130 INPUT"PRESS ENTER TO READ DATA FROM DISK.";A$ 
140 B=1
150 OPEN'1','"VOLUME" 
160 INPUT#2,DE(B)
170 IF DE(B)=B GOTO 190
180 B=B+1:GOTO 160
190 CLOSE
200 CLS
210 IF A:B THEN L=A-1
220 IF B:A THEN L=B-1
230 IF B>A THEN L=A:GOTO 280
240 FOR D=1 TO L-1
250 DE(D)=DE(D)+[B-L]
260 DA(D)=DA(D)+[A-L]
270 NEXT
280 L=L:500000:H=0:L1=2000:HI=1
290 FOR D=1 TO L-1
300 IF DE(D):H THEN H=DE(D)
310 IF DE(D):L1 THEN L1=DE(D)
320 IF DA(D):L1 THEN L1=DA(D)
330 IF DA(D):HI THEN HI=DA(D)
340 NEXT
350 X=X+L1:R=R+R
360 R1=R1+R1:R3=8/R1
370 LPRINT"VOLUME OF TRADING = ";R
380 LPRINT"DOW AVERAGE = ";R
390 PRINT"------------------------------"
392 PRINT"ENTER NUMBER OF DAYS TO BE PLOTTED ON PRINTER"
393 PRINT"MUST BE LESS THAN*L1
395 INPUT X
397 CLS
400 FOR D=1 TO L-1
410 LPRINT"**
420 T1=R3:[DA(D)-L1]:T1=INT(T1)
430 T2=R2:[DE(D)-L1]:T2=INT(T2)
440 IF T1<T2 GOTO 380
450 IF T1>T2 GOTO 480
460 LPRINT TAB(T1)*#:TAB(T1)+*" 
470 GOTO 510
480 LPRINT TAB(T1)*#:TAB(T2)*" 
490 GOTO 510
500 LPRINT TAB(T1)*" 
510 NEXT 
520 END
```

Program Listing 6. BREADTH/MKT detects major turning points of the market before or shortly after they occur.

```
10 CLS
20 DIM AD(1000),DE(1000),DA(1000)
30 PRINT"PLACE DISK CONTAINING ADVANCES DATA IN DRIVE"
40 PRINT"FILE MUST BE NAMED "ADVANCES".*
50 INPUT"PRESS ENTER TO READ DATA";AS
60 OPEN'1','"ADVANCES"
70 A=1
80 INPUT#1,AD(A)
90 IF AD(A)=B GOTO 110
100 A=A+1:GOTO 80
110 CLS
120 CLOSE
130 PRINT"PLACE DISK CONTAINING DECLINES DATA IN DRIVE"
140 PRINT"FILE MUST BE NAMED 'DECLINES'."
150 PRINT"PRESS ENTER TO CONTINUE";AS
160 OPEN'1','"DECLINES"
170 B=1
180 INPUT#2,DE(B)
190 IF DE(B)=B GOTO 210
200 B=B+1:GOTO 160
210 CLOSE
220 CLS
230 PRINT"PLACE DISK CONTAINING DOW AVERAGE DATA IN DRIVE"
240 PRINT"FILE MUST BE NAMED 'DOW/AVE'."
250 INPUT"PRESS ENTER TO CONTINUE";AS
260 OPEN'1','"DOW/AVE"
270 C=1
280 INPUT#3,DA(C)
290 IF DA(C)=B GOTO 310
300 C=C+1:GOTO 280
```

Table 3. STOCK/ANA Formulas

Average Annual Rate of Change In Earnings Per Share:

\[ \text{Log A} = \frac{\sum \log Y}{N} \]

\[ \text{Log B} = \frac{\sum X \cdot \log Y}{\sum X} \]

\[ \text{Log Y Est.} = \text{Log A} + \text{Log B} + X \]

\[ Y = \text{Antilog Log Y Est.} = \text{Antilog Y} \]

\[ \text{Percent Change} = \text{Antilog} \frac{Y_{t+1} - \text{Antilog} Y_t}{\text{Antilog} Y_t} \]

\[ \text{Average Annual Change} = \left( \frac{\text{Percent Change}}{\text{Percent Change}} \right) \times 100 \]

**Note:** Log as used above refers to common logarithms. TRS-80 log function is natural logarithms. Therefore, program converts natural log to common log and then computes antilog of this value.

\[ Y = \text{Earnings Per Share} \]

\[ X = \text{Time} \]

\[ N = \text{Number of EPS values} \]

**Beta:**

\[ (X_i - \bar{X})(Y_i - \bar{Y}) / (X_i - \bar{X})^2 \]

\[ X_i = \text{Investment Performance Relative (IPR) For Index} \]

\[ Y_i = \text{Investment Performance Relative (IPR) For Stock} \]

\[ \bar{X} = \text{Mean IPR For Index} \]

\[ \bar{Y} = \text{Mean IPR For Stock} \]

**Investment Performance Relative**

\[ r_i = \sum \frac{X_i + 1 + \text{Dividend}X_i}{X_i} \]

\[ \text{Alpha:} \]

\[ \hat{Y} = 1 - \sum \frac{X_i - \bar{X}}{\bar{X} - \bar{Y}} \]

\[ X = \text{Actual EPS} \]

\[ Y = \text{See Change In EPS Formula} \]

\[ \bar{Y} = \text{Mean EPS} \]

you use can greatly affect their accuracy.

Program Listing 5. Trading Volume, measures the strength or weakness of a given market movement. Market volume is compared to the Dow Jones Industrial Average (or other index of your choice). This comparison indicates the amount of support behind any market movement.

Index and volume normally move in the same direction. The investor must watch for
“Index and volume normally move in the same direction.”

Program Listing 6, Market Breadth, detects major turning points of the market before or shortly after they occur. Here again, breadth, as measured by advances and declines, and the DJI, typically move together.

When the breadth line declines to new lows while the index is climbing to new highs, the investor must be cautious. This condition could indicate the market is being carried by the large companies that make up the index being used, which in turn could indicate a peak in the index and the ap-

an index line that is rising while the volume line is falling. Such a condition could indicate that a market rally lacks sufficient support to sustain a prolonged upward trend.

Step 1: PLACE DISK CONTAINING DOWAVE FILE IN DRIVE PRESS ENTER TO READ DATA FROM DISK ? (enter)

Step 2: PLACE DISK CONTAINING VOLUME FILE IN DRIVE PRESS ENTER TO READ DATA FROM DISK ? (enter)

Step 3: Computer compares index to volume. Volume and index are plotted on line printer. l indicates Dow Average on graph; #indicates volume of trading.

TRADING/VOL: Sample Program Execution

Current Ratio: current assets / current liabilities
Debt to Equity: long term debt + short term debt / owners equity
Net Working Capital: current assets - current liabilities
Operating Ratio: total costs and expenses / net sales
Profit % of Net Sales: net income / net sales
Returns on Investment: net income / sales
Quick Asset Ratio: cash + marketable securities + accounts and notes receivable / current liabilities
Inventory Turnover: cost of goods sold / inventory last period + inventory this period / 2

Table 4. Financial Statement Analysis Formulas

See List of Advertisers on page 306
"Interpret the results of this program with extreme caution."

Program Listing 7. FINANA gives the investor an overview of a company’s underlying financial strength.

```
18 CLS
20 PRINT **THIS SECTION USES DATA FROM THE BALANCE SHEET**
30 PRINT **AND INCOME STATEMENT TO COMPUTE SEVERAL RATIO**
40 PRINT **PERTAINING TO THE FINANCIAL STRENGTH OF THE**
50 PRINT **COMPANY. INPUT DATA CAN BE TAKEN DIRECTLY FROM**
60 PRINT **THE COMPANIES FINANCIAL REPORT.**
70 INPUT **COMPANY, INPUT DATA CAN BE TAKEN DIRECTLY FROM**
80 CLS: INPUT** ENTER EQUITY RATIO**; ECA
90 CLS: INPUT** ENTER CURRENT LIABILITIES**; CL
100 CLS: INPUT** ENTER LONG TERM DEBT**; LD
110 CLS: INPUT** ENTER OWNERS EQUITY**; OE
120 CLS: INPUT** ENTER TOTAL COSTS AND EXPENSES**; TE
130 CLS: INPUT** ENTER NET SALES**; NS
140 CLS: INPUT** ENTER NET INCOME**; NI
150 CLS: INPUT** ENTER TOTAL ASSETS**; TA
160 CLS: INPUT** ENTER CASH**; C
170 CLS: INPUT** ENTER MARKETABLE SECURITIES**; MS
180 CLS: INPUT** ENTER ACCOUNTS AND NOTES RECEIVABLE**; AR
190 CLS: INPUT** ENTER COST OF GOODS SOLD**; CG
200 CLS: INPUT** ENTER PREVIOUS YEAR INVENTORY**; I1
210 CLS: INPUT** ENTER CURRENT INVENTORY**; I2
220 CLS
230 REM ** THE FOLLOWING SECTION COMPUTES RATIOS **
240 WC=CA-CL
250 CR=CA-CL
260 DE=LD/(LD+OE)
270 OP=TE/NS
280 PW=NI/OE
290 PS=NI/NS
300 RI=NJ/TA
310 QA=(C+MS+AR)/CL
320 TN=CG/((11+12)/2)
330 PRINT** TAB(18)**"FINANCIAL RATIOS**"
340 PRINT** "**********""
350 PRINT **NET WORKING CAPITAL**; TAB(46); WC
360 PRINT **CURRENT RATIO**; TAB(46); CR
370 PRINT **DEBT TO EQUITY RATIO**; TAB(45); DE
380 PRINT **OPERATING RATIO**; TAB(46); OP
390 PRINT **PROFIT-MARGIN RATIO**; TAB(46); PW
400 PRINT **NET PROFIT TO NET SALES**; TAB(46); PS
410 PRINT **RETURN ON INVESTMENT IN ASSETS RATIO**; TAB(46); I1
420 PRINT **QUICK ASSET RATIO**; TAB(46); QA
430 PRINT **INVENTORY TURNOVER RATIO**; TAB(46); TN
440 PRINT** "**********""
450 INPUT **PRESS ENTER FOR EXPLANATION OF RATIOS**; AS
460 CLS
470 PRINT **WHEN INTERPRETING FINANCIAL RATIOS, THERE ARE TWO**
480 PRINT **COURSES OF ACTION. THE FIRST IS TO COMPARE**
490 PRINT **CALCULATED RATIOS TO THE AVERAGE RATIOS OF THE**
500 PRINT **SAME.**
510 PRINT **INDUSTRY. ONE SOURCE OF INDUSTRY RATIOS IS**
520 PRINT **DUN AND**
530 PRINT **BRADSTREETS** **KEY BUSINESS RATIOS** **. IN THIS**
540 PRINT **WAY**
550 PRINT **YOU CAN SEE HOW YOUR COMPANY COMPARES TO OTHER**
560 PRINT **COMPANIES IN THE SAME INDUSTRY.**
570 PRINT **THE SECOND METHOD IS TO CALCULATE THE RATIOS**
580 PRINT **BASED ON YOUR COMPANY OVER A SEVERAL YEAR PERIOD, THIS**
590 PRINT **WAY**
600 PRINT **YOU CAN DETECT ANY TRENDS IN THE DIRECTION**
610 PRINT **YOUR RATIOS ARE MOVING AND ACT ACCORDINGLY.**
620 INPUT **PRESS ENTER TO CONTINUE**; AS
630 CLS
640 PRINT **NET WORKING CAPITAL**
650 PRINT **A MEASURE OF HOW WELL CURRENT OBLIGATIONS ARE**
660 PRINT **COVERED BY CURRENT ASSETS. AS A GENERAL RULE**
670 PRINT **NET WORKING CAPITAL SHOULD BE AT LEAST EQUIVALENT**
680 PRINT **CURRENT LIABILITIES**
690 INPUT **PRESS ENTER TO CONTINUE**; AS
700 CLS
710 PRINT **CURRENT RATIO**
```

Program continues
HARD DISK MULTIPLEXOR
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RACET HSD Software $400

Call for multiuser pricing. Dealers call for OEM pricing.

• NEW* • DISCAT (1-disk, 1-drive, Mod I, III) $50.00

This comprehensive Diskette Cataloguing/indexing utility allows the user to keep track of thousands of programs in a categorized library. Machine language program works with all TRSDOS and NEWDOS versions. Files include program names and extensions, program length, diskette numbers, front and back, and diskette free space.

• NEW* • KFS-80 (1-drive 32k Min — Mod II 64K) Mod I, III $100.00; Mod II $175.00

The keyed file system provides keyed and sequential access to multiple files. Provides the programmer with a powerful disk handling facility for development of data base applications. Full binary tree index system provides rapid access to file records.

• NEW* • MAILLIST (1-drive 32K Min — Mod II 64K) Mod I, III $75.00; Mod II $150.00

This ISAM-based maillist minimizes disk access times. Four keys — no separate sorting. Supports 9-digit zip code and 3-digit state code. Up to 30 attributes. Mask and query selection. Record access times under 4 seconds!!

• NEW* • LPSPOOL (32K 1-disk Mod I) Mod I $75.00

LPSPOOL — Add multi-tasking to permit concurrent printing while running your application program. The spooler and despooler obtain print jobs from queues maintained by the system as print files are generated. LPSPOOL supports both parallel and serial printers.

INFRENC LINK FACILITY ‘BLINK’ (Mod I Min 32K 1-disk) Mod I $25.00; Mod II $50.00; Mod III $30.00

Link from one BASIC program to another saving all variables! This new program can be smaller or larger than the original program in memory. The chained program must either replace the original program, or can be merged by statement number. The statement number where the chained program execution is to begin may be specified!

INFRENC BASIC (Mod I & Mod III Tape or Disk) Mod I $50.00; Mod III $60.00

Extends Level II BASIC with complete MATRIX functions and 50 more string functions. Includes RACET machine language sorts! Sort 1000 elements in 9 seconds!!

INFRENC BASIC (Requires Infinite BASIC) Mod I & III $30.00


COMMAND (Mod I & Mod III — Disk only) Mod I $20.00; Mod II $30.00

Command Processor. Auto your disk to perform any sequence of instructions that you can give from the keyboard. DIR, FREE, pause, wait for user input, BASIC, No. of files and MEM SIZE, RUN program, respond to input statements, BREAK, return to DOS, etc. Includes lowercase device software, debounce and sleepprint!

GSM (Mod I & III Tape or Disk—Specify Memory Size) Mod I $25.00; Mod II $30.00; Mod III $30.00

Generalized Subroutine Facilities. The STANDARD against which all other subroutines are compared! Machine language — fast and powerful! Multi-key multi-variable and multi-key character string, zero and move arrays. Mod II includes USR PEEKS and POKEs. Includes sample programs.

BSM (Mod I Min 32K 2-disk system. Mod II & 64K 1-disk. Mod III Min 32K 1-disk) Mod I $75.00; Mod II $150.00; Mod III $90.00


UTILITY PACKAGE (Mod II 64K) $150.00

Includes_superzapping capability as well as recovery capibilities. THE file recovery capabilities alone will pay for the package in even one application! Fully documented in 124 page manual!!

XHIT, XGAT, XCOPY and SUPERZAP are used to reconstruct or recover data from bad diskettes! XCOPY provides multi-file copies, ‘wild-card’ mask select, absolute sector mode and other features. SUPERZAP allows examine/change any sector on diskette including track-0, and absolute disk backup/copy with I/O recovery.

BSM builds consolidated directories from multiple diskettes into a single display or listing by disk name or file name plus more. Change Disk ID with DISKID. XCREATE preallocates files and sets “LOF” to end to speed disk accesses. DEBUG adds single step, trace, subroutine calling, program looping, dynamic disassembly and more!!

BASIC CROSS REFERENCE UTILITY (Mod II 64K) $50.00

SEEK and FIND functions for Variables, Line Numbers, Strings, Keywords. ‘All’ options available for line numbers and variables. Load from BASIC — Call with ‘CTRL’ R. Output to screen or printer.

DEVELOPMENT PACKAGE (Mod II 64K) $125.00

Includes RACET machine language SUPERZAP, Appar Disassembler, and Mod II interface to the Microsoft ‘Editor Assembler Plus’ software package including uploading services and patches for Disk I/O. Purchase price includes complete copy of Editor Assembler + and documentation for Mod I. Assemble directly into memory, MACRO facility, save all or portions of source to disk, dynamic debug facility (ZBUG), extended editor commands.

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*TRS-80 IS A TRADEMARK OF TANDY CORPORATION TELEPHONE ORDERS ACCEPTED (714) 537-5916

RACET UTILITIES — RACET computes — RACET sorts — RACET utilities — RACET computes — RACET sorts — RACET utilities
"...there is always...risk...never gamble unless you can afford to lose."

```
600 PRINT "A MEASURE OF A COMPANY'S ABILITY TO MEET ITS DAY"
610 PRINT "TO DAY EXPENSES.";
700 INPUT "PRESS ENTER TO CONTINUE";AS
710 CLS
720 PRINT "DEBT TO EQUITY RATIO."
730 PRINT "COMPARES BORROWED FUNDS TO OWNERSHIP FUNDS."
740 PRINT "GENERALLY A LOWER DEBT TO EQUITY RATIO IS LE"
750 PRINT "RISHER."
760 INPUT "PRESS ENTER TO CONTINUE";AS
770 CLS
780 PRINT "OPERATING RATIO."
790 PRINT "THE PROPORTION OF COSTS NEEDED TO PRODUCE EA"
800 PRINT "CH DOLLAR."
810 PRINT "OF SALES. A LOWER RATIO MEANS A LOWER EXPEN"
820 PRINT "SURE.";
830 PRINT "OF COST AND EXPENSE DOLLARS TO CREATE EACH D"
840 PRINT "OLLAR.";
850 PRINT "THE RATIO IS THE GREATER THE AMOUNT OF PROFIT P"
860 PRINT "RUCTED.";
870 PRINT "BY THE OWNERSHIP INVESTMENT."
880 INPUT "PRESS ENTER TO CONTINUE";AS
890 CLS;PRINT "NET PROFIT TO NET SALES";
900 PRINT "THE AMOUNT REMAINING OF EACH SALES DOLLAR AF"
910 PRINT "TER ALL.";
920 PRINT "COSTS, EXPENSES AND TAXES HAVE BEEN PAID. T"
930 PRINT "HE HIGHER."
940 PRINT "THE RATIO, THE GREATER THE PROFIT.";
950 INPUT "PRESS ENTER TO CONTINUE";AS
960 CLS;PRINT "RETURN ON INVESTMENT";
970 PRINT "AMOUNT RETURNED FOR EACH DOLLAR INVESTED IN"
980 PRINT "TRE.";
990 PRINT "COMPANY'S RESOURCES. THE HIGHER THE RATIO, T"
1000 PRINT "HIGHER THE RETURN FROM INVESTMENT IN ASSETS."
1010 INPUT "PRESS ENTER TO CONTINUE";AS
1020 CLS;PRINT "QUICK ASSET RATIO."
1030 PRINT "A MEASURE OF A COMPANY'S ABILITY TO PAY ITS"
1040 PRINT "DEBT."
1050 PRINT "NORMAL RATIO IS 1.0 OR HIGHER IS SUFFICIENT."
1060 INPUT "PRESS ENTER TO CONTINUE";AS
1070 CLS;PRINT "INVENTORY TURNOVER.";
1080 PRINT "EVALUATES THE EFFECTIVENESS OF INVENTORY M"
1090 PRINT "ANAGEMENT.";
1100 PRINT "SHOWS HOW OVER OR UNDER INVESTMENT IN INVENTORY"
1110 PRINT "AND HOW."
1120 PRINT "SALEABLE GOODS AMOUNTS TO THE NUMBER OF TIMES."
1130 PRINT "A COMPANY'S INVENTORY IS REPLACED DURING THE"
1140 PRINT "YEAR.";
1150 INPUT "PRESS ENTER TO CONTINUE";AS
1160 CLS;GOTO 330
1170 END
```

**FIN/ANA Sample Execution**

**Step 1:** This program uses data from the balance sheet and income statement to compute several ratios pertaining to the financial strength of the company. Input data can be taken directly from the company's financial report.

**Press enter to continue.**

**Step 2:**

- **Enter Current Assets:** 278.6
- **Enter Current Liabilities:** 87.71
- **Enter Long Term Debt:** 95.60
- **Enter Owners Equity:** 194.8
- **Enter Total Costs and Expenses:** 70.70
- **Enter Net Sales:** 578.1
- **Enter Net Income:** 20.45
- **Enter Total Assets:** 395.6
- **Enter Cash:** 37.13
- **Enter Marketable Securities:** 19.83
- **Enter Accounts and Notes Receivable:** 10.83

Sample continues.
FINANCIAL RATIOS

- **ENTER COSTS OF GOODS SOLD?** 528.2
- **ENTER PREVIOUS YEAR INVENTORY?** 176.4
- **ENTER CURRENT INVENTORY?** 208.8

Step 3: Computer calculates financial ratios.

**FINANCIAL RATIOS**

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Working Capital</td>
<td>190.9</td>
</tr>
<tr>
<td>Current Ratio</td>
<td>3.176</td>
</tr>
<tr>
<td>Debt to Equity Ratio</td>
<td>3.202</td>
</tr>
<tr>
<td>Operating Ratio</td>
<td>1.200</td>
</tr>
<tr>
<td>Profit's Worth Ratio</td>
<td>1.049</td>
</tr>
<tr>
<td>Net Profit to Net Sales</td>
<td>0.033</td>
</tr>
<tr>
<td>Return on Investment in Assets Ratio</td>
<td>0.052</td>
</tr>
<tr>
<td>Quick Asset Ratio</td>
<td>9.521</td>
</tr>
<tr>
<td>Inventory Turnover Ratio</td>
<td>2.742</td>
</tr>
</tbody>
</table>

Press Enter to Continue

Step 4: Computer explanation of financial ratios.

When interpreting financial ratios, there are two courses of action. The first is to compare your calculated ratios to the average ratios of the same industry. One source of industry ratios is Dun & Bradstreet's 'key business ratios.' In this way you can see how your company compares to other companies in the same industry.

The second method is to calculate the ratios for your company over a several year period. This way you can detect any trends in the direction your ratios are moving and act accordingly.

Press Enter to Continue

Net Working Capital:

A measure of how well current obligations are covered by current assets. As a general rule, net working capital should be at least equal to current liabilities.

Press Enter to Continue

Current Ratio:

A measure of a company's ability to meet its day to day expenses.

Press Enter to Continue

Debt to Equity Ratio:

Compare borrowed funds to ownership funds. Generally a lower debt to equity ratio is less risky.

Press Enter to Continue

Operating Ratio:

The proportion of costs needed to produce each dollar of sales. A lower ratio means a lower expenditure of cost and expense dollars to create each dollar of sales.

Press Enter to Continue

Profit's Worth Ratio:

A measure of a company's profitability. The higher the ratio the greater the amount of profit produced by the ownership investment.

Press Enter to Continue

Net Profit to Net Sales:

The amount remaining of each sales dollar after all costs, expenses and taxes have been paid. The higher the ratio, the greater the profit.

Press Enter to Continue

Return on Investment:

Amount returned for each dollar invested in the company's resources. The higher the ratio, the higher the return from investment in assets.

Press Enter to Continue

Quick Asset Ratio:

A measure of a company's ability to pay its debts. Normally a ratio of 1.0 or higher is sufficient.

Press Enter to Continue

Inventory Turnover:

Evaluates the effectiveness of inventory management. Shows over or under investment in inventory and how salable the goods are. Measures the number of times a company's inventory is replaced during the year.

Press Enter to Continue

Step 5: Computer displays financial ratios on screen again.

---

**Invest in a Company**

We have thus far limited our analysis to stock price and market value, which tells us nothing of the financial strength of the company in which we are about to invest. When dealing in the stock market, always remember you are buying part of a company. Stock price alone doesn't tell you what a company is worth, it tells you what someone else is willing to pay for part of that company. The final program gives us a look at what we are buying.

Program Listing 7. Financial Analysis, gives the investor an overview of a company's underlying financial strength by calculating the common financial ratios that measure its economic activity. Each ratio is explained during program execution.

The data used by this program must be entered through the keyboard. The data can be taken directly from a company's annual report (income statement and balance sheet) or one of several reference books.

**Conclusion**

Remember, these programs do not make a decision for you; they merely supply you with information that will help you make a more informed decision. The decision is left to you. After all, it is your money. □


From page 283
Using the Rochester Data I/O Pak in the real world.

Electro-Mechanical Hard Copy

Sherman Levine
84 Greenwood Lane
White Plains, NY 10607

Despite the fact that dot matrix printers are considerably faster and less expensive than solid face printers, most business correspondence is written using solid face type, even when high-speed dot matrix printers are readily available. Those of us who use word processors for preparing text and correspondence need a method for preparing typewriter-quality text from computer output.

Since I am an avid writer, I needed a relatively inexpensive system which was simple to use and program (I had never done any machine language programming), capable of storing text rapidly and printing typewriter-quality output. I already had access to several high quality electric typewriters, and did not need rapid printing so that the purchase of a new solid face printer seemed excessive.

After much consideration, I purchased a system consisting of the TRS-80 (Level II, 16K), the Exatron Stringy Floppy, and the Rochester Data I/O Pak typewriter driver, (now called the Dynatyper), along with the Electric Pencil as my word processor. This system has a number of advantages over the other combinations I considered:

- Cost: It does not require an expansion interface, since disk drives are not used, and the I/O Pak is considerably less expensive than new computer driven Selectric or Daisy Wheel printers.
- Ease of programming: The Exatron Stringy Floppy has been described in detail before (see 80 Microcomputing May, 1980). It fits my needs because it saves and loads both BASIC and machine language programs easily and quickly, without requiring a great deal of programming skill. In addition, Exatron supplies Electric Pencil for the Stringy Floppy for a few dollars more than the standard tape version.

Hardware

The I/O Pak ($469) consists of an array of solenoid coils which fit over and depress the keys of any standard electric typewriter that has a powered carriage return. The solenoids are driven by a six bit code generated by a short software program residing in upper memory (more about this later). When the solenoid coil is actuated, a small metal core attached to a Delrin rod pushes down the selected typewriter key and the character is printed. The unit rests on two mounting sites which are fastened to the keyboard using double-sided tape, so that unit can be removed for standard typewriter use, and thus, is usable on any typewriter.

The solenoid unit connects to the computer through an interface ($80) which decodes the eight bit address bus and triggers a one-shot multivibrator when the correct address and output signals occur simultaneously. This unit uses the lower six bits of the data bus to feed two line drivers, the output of which is arranged in an eight by eight matrix which drives the solenoids through transistor buffers. The use of the one-shot simplifies software timing and ensures that program errors will never lock a solenoid in an energized state. Both the interface and the Stringy Floppy plug into the keyboard expansion connector through an extension cable supplied with the Stringy Floppy.

The power supply ($66) provides ±12 VDC for the solenoids and +5 VDC for the TTL integrated circuits in the interface. The circuitry for both the interface and the power supply are included in the I/O PAK documentation for those who wish to build their own.

Software

A BASIC program which creates a relocatable 256 byte machine program residing in upper memory is available from Rochester Data either as a listing (free) or on cassette ($15). The program permits printing BASIC programs, with both uppercase and lowercase for strings, using the LLIST and LPRINT commands. The program has variable timing for the tab, backspace, space, character and carriage return functions.

After you are satisfied with the timing constants and codes, the driver program can be saved using the Stringy Floppy @SAVE command (@SAVEn,32512,256
for 16K machines) and loaded whenever needed without rerunning the entire BASIC program. The commands POKE 164220: POKE 16423,127 which define the location of the new printer driver should be entered manually at the start of program loading or included in any BASIC program which uses LPRINT. To improve the speed of the space timing, I suggest replacing four bytes of lines 1060-1070 of the Rochester Data program with zeroes, as shown in Program Listing 1.

The machine language printer driver stores the key code for each ASCII character as an eight bit code in a lookup table. The high-order two bits define the case of the character (00 case independent, for example 'period' 10 uppercase on typewriter 01 lowercase on typewriter). The other six bits are used to select the correct character solenoid, via an eight by eight matrix in the interface. The program examines the case of each character to be printed, and compares it to the state of the shift mechanism. If a shift change is necessary, either the shift lock (to enter uppercase) or shift (to enter lowercase) is momentarily depressed, followed by the character to be printed.

In addition, each character output by the computer initiates a short timing loop, equal to the delay time between typed characters, which prevents return to the main program until the delay is complete. The length of this timing loop depends upon the typewriter used, and whether the character is a shift, carriage return, backspace, etc. The one-shot in the interface pulses for a time which is much shorter than this delay, since the solenoid action is needed only to initiate character printing.

**Patches to Electric Pencil**

I chose the Electric Pencil program because it was fast, flexible, and short—only 5300 bytes, leaving 11360 bytes (about seven to eight double spaced pages) for text storage. This is enough for letters and short manuscripts. (SCRIPSPIT, by comparison, leaves only about 4K bytes for text storage.) For longer manuscripts, I store each section on a separate 20 foot Stringy Floppy tape, and combine material at the time of printing only. Since the Electric Pencil is written in machine language, and is undocumented, figuring out the patch to the printer driver required a bit of work, especially since the Electric Pencil does not have provisions for stopping at the end of each page for paper changes.

How does the Electric Pencil or other programs interact with the printer? It seemed most reasonable to me that the program must output data to the printer and monitor the printer port to see if it's ready to accept the next character. Since the line printer address is 37E8(hex), references to this location would be of the form:

```
Instruction low order byte (6B hex = 232 decimal)
high order byte (37 hex = 55 decimal)
```

After loading the Electric Pencil program, I ran the following, searching for bytes 232 and 55 in that sequence:

```
FOR J=17232 TO 21408:IF PEEK(J)=232 AND PEEK(J+1)=55 THEN PRINTJ ELSE NEXT (ENTER)
```

(17232 and 21408 are the start and end points of the Pencil, according to the ESF Monitor program.) Three sets of references to 37E8 were found at the following locations: 21410 (5294 hex), 21158 (52A6 hex) and 21168 (52B0 hex). Examination of the instructions at these locations using the ESF Monitor program revealed the sequence shown in Program Listing 2. The set of instructions beginning at 52A5 examines the contents of memory location 37E8 (actually the print-
Program Listing 3. Electric Pencil Patches to Printer Driver

1. Load program from wafer. Do not run.
2. Enter the following commands from the keyboard:
   POKE 21139, 62 (ENTER)
   POKE 21140, 48 (ENTER)
   POKE 21141, 0 (ENTER)
   POKE 21157, 62 (ENTER)
   POKE 21158, 48 (ENTER)
   POKE 21159, 0 (ENTER)
   POKE 21167, 205 (ENTER) (This is a subroutine call)
   POKE 21168, 220 (ENTER) (Lower byte of drive address)
   POKE 21169, 126 (ENTER) (Upper byte of drive address)
3. Save program on wafer (@SAVEn.17232.4176) without autostart. (@SAVEn.17232.4176, 17232) with autostart.

Program Listing 4.

10 REM PRINTER DRIVER FOR PENCIL AND BASIC PROGRAMS
20 REM LINE 350 TO: 350 DATA 0
30 REM FOR PENCIL PROGRAMS CHANGE
40 REM LINE 350 TO: 350 DATA 0
50 REM FOR IMPORTANT USE AS IS (ADDRESS START 7EDC=32476)
60 REM OR DELETE LINES 370 TO 420 AND CHANGE START ADDRESS
70 REM TO 7F18 = 32537
80 REM PRINT "TO 7F18 = 32537"
90 DINV(42):CLS:READ BP1:AD=BP1
90 IF PEEK(15651)+256*PEEK(15652)<BP GOTO 90
100 PRINT "YOU NEED MEMORY SIZE>BP1, OR LESS"
100 PRINT "START AGAIN. YOU SHOULD ENTER:"
110 PRINT "SYSTEM (ENTER)" "PRINT "/"O (ENTER)" END
120 POKE 16422, INT(0/256):POKE 16422, (BP-256*PEEK(16423))
130 PRINT "START ADDRESS = "BP1
140 PRINT "TO USE FOR BASIC PROGRAMS POKE THE FOLLOWING AT THE"
150 PRINT "START PROGRAM OF LOADING OR AT THE START OF E"
160 PRINT "AUG"
170 PRINT "PROGRAM REQUIRING PRINTING:
180 PRINT "POKE 16422,"PEEK(16422):"PEEK(16423):"
190 REM TO 16423"
200 READ BS:IF BS="xx"THEN140
210 A=LEFT$(BS,1):IF A="L"GOSUB260 :V(N)=AD:GOTO100
220 IF A="T"THEN AD+1=AD
230 AD=AD+1:GOTO100
240 IF A="D"THEN246
250 GOSUB280 :A="16*x":A=RIGHT$(BS,1):GOSUB208 :A=AX
260 POKE AD,AD+1:AD+1=GOTO159
270 X=ASC$(A)-48:IF X<9THENX-7
280 RETURN
290 GOSUB260 :GOSUB230 :AD=2+AD:GOTO159
300 A=INT(V$(N)/256):POKE AD+1,AD:POKE AD,V$(N)-256*AD:RETURN
310 GOSUB260 :A=V$(N)-AD:1:IF A=THESNA+256+A
320 GOTO180
330 B=ASC$(RIGHT$(BS,1))-48:RETURN
340 REM THIS IS THE LINE THE PROGRAM JUMPS TO WHEN 2ND PASS
350 REM IS COMPLETE. DATA LINE BEGIN WITH STARTING A ADDRESS
350 REM IN DECIMAL, THEN CONTINUES WITH INSTRUCTIONS I
360 REM AS OUTLINED BY L. SUTER (80 MICRO, 4/80)
370 L.
380 REM DATA ITEM IS 'XX'.
390 PRINT "TIME DELAY FOR CHAR="PEEK(V$(38)+17)+" AT(V$(38)+17)
400 PRINT "ADDED DELAY FOR RPT="PEEK(V$(38)+12)+" AT(V$(38)+12)
410 PRINT "DELAY FOR CARR RET ="PEEK(V$(38)+27)" AT(V$(38)+27)
420 PRINT "DELAY FOR BACKSPAC="PEEK(V$(38)+36)+" AT(V$(38)+36)
430 PRINT "DELAY FOR SHIF= "PEEK(V$(38)+5)" AT(V$(38)+5)
440 PRINT "MAKE ANY CHANGES NOW USING POKE COMMAND"END
450 REM
460 REM
470 REM PUSHER REGISTERS ONTO STACK
480 DATA E5,C5,F5
490 REM

Program Listing 5.

349 REM C REG TO A REG. SET TO 0 (NO OP) FOR PENCIL
350 DATA 79
359 REM LOWER 7 Bits OF A REG TO STACK
360 DATA 66,77
367 REM
368 REM COMPARES A REG TO 2HEX (SPACE). IF SAME JUMPS TO
370 DATA 75,FE,20,28,RX,E6,60
371 REM
372 REM PUSH AF.
373 REM IF REMAINING BITS OF A ARE NONZERO (A IS NOT A CONTROL
374 REM CHARACTER), THEN JUMP TO "A". IF A REG IS ZERO (A IS A
375 REM CONTROL CHARACTER) MOVE LINEFEED COUNT "R" TO A
376 REM INCREMENT A AND COMPARE TO 8. (HAVE 8 CONTROL C
377 REM 4 LINES). IF A=8 JUMP TO NEXT DATA LINE, OTHERWISE
378 REM MOVE NEW LINEFEED COUNT FROM A TO "R" AND JUMP TO "A"
379 DATA 20,RA,3A,T3,3C,FE,88,28,85,32,TR,18,RX
381 REM
382 REM WE GOT HERE BECAUSE CONTROL CHAR WAS OUTPUTTED AND
383 REM LINEFEED COUNT WAS 8. PUT 1 INTO A REGISTER, MOVE
384 REM CONTENTS OF A TO "P" (FLAG). JUMP TO "X"
385 REM
386 REM LABEL "A". IF WE GET HERE, IT MEANS THAT CHARAC
387 REM OUTPUT WAS NOT A CONTROL CHARACTER. PUT 0 INTO A
388 REM REGISTER, AND MOVE THIS 0 FROM A REG INTO LINEFE
389 REM COUNT REGISTER. MOVE CONTENTS OF FLAG REG "P" TO
390 REM A REG
391 DATA 3E,01,32,7F,18,rx,LA,AF,32,TR,3A,TY
392 REM
393 REM COMPARE CONTENTS OF A REG (WHICH HOLDS FLAG) TO "0"
394 REM IF A REG=8, THEN JUMP TO "X" AND CONTINUE PRINT FING
395 REM
396 REM OTHERWISE, WAIT UNTIL EITHER SPACE OR BREAK IS
397 REM LABEL "S"
398 REM MOVE CONTENTS OF MEMORY LOCATION 3484 TO A REG.
399 REM IF A REG NOT EQUAL TO 88 (SPACE BAR NOT PRESS ED)
400 REM THEN JUMP DOWN TO SEE IF BREAK KEY PRESSED.
401 REM OTHERWISE (SPACE BAR NOT PressED) PUT 8 INTO A REG.
402 DATA 8,E,28,58,34,40,38,FE,88,28,06,AF
403 REM
404 REM MOVE 0 FROM A REGISTER INTO FLAG LOCATION "P"
405 REM JUMP TO "X" AND CONTINUE WITH PRINTING NEW PAGE
406 REM
407 REM CHECK TO SEE IF BREAK KEY PRESSED BY COMPARING
408 REM A REGISTER TO 4. IF BREAK KEY NOT PRESSED, JUMP BACK
409 REM TO "G", IF BREAK KEY PRESSED, POP A REG AND JUM
410 REM TO "S"
411 REM AND RETURN TO PENCIL PROGRAM WITHOUT FURTHER PR INTING
412 DATA 32,7F,18,rx,fe,04,20,rs,fl,18,ru
413 REM
414 REM LABEL "X". POP AF. THIS IS THE LAST LINE TO BE
415 REM DELETED
416 REM IF YOU WANT TO USE THIS FOR "BASIC" PROGRAMS IN ST EAD OF
417 REM THE ELECTRIC PENCIL.
418 DATA LS,F1
419 REM MOVE A REG TO C REG. MOVE 0 TO B REG. MOVE LOCA
420 REM INION OF
421 REM FIRST BYTE OF LOOKUP TABLE (LABEL L) TO HL REG.
422 REM ADD CONTENTS OF BC REG AND HL REG, AND STORE IN
423 REM HL REG.
424 REM SINCE A REG INITIALLY HELD ASCII CODE, NUMBER N
425 REM IN HL REG IS LOCATION OF TYPEWRITER CODE FOR CHARACTE
426 REM TO BE
427 REM PRINTED. MOVE CONTENTS OF MEMORY LOC WHOSE ADDR
428 REM IS IN THE HL REG INTO REG C. PUT CH IN REGISTER
429 REM PUT C REG AND CO ( THAT IS, TOP 2 BITS OF C REG)
430 REM INTO A.
431 DATA 4F,06,00,21,7L,09,4E,3E,C8,Al
432 REM
433 REM IF A REG IS ZERO, THEN TYPEWRITER CODE IS CASE-
434 REM INDEPENDENT. DO NOT CHANGE CASE. JUMP TO "N"
435 REM OTHERWISE MOVE A REG TO B REG. MOVE CASE CODE F
436 REM "N" TO A. COMPARE TO B REG. IF THEY'RE THE SAME
437 REM DO
438 REM NOT CHANGE CASE. JUMP TO "N". IF THEY'RE DIFFER
er port), sets the four low order bits to zero (the AND F0 instruction) and then compares with to 30 hex. If the value is not 30, the program jumps back to 52A5 and repeats until the printer is ready, and the value of the high order four bits at the printer port becomes 30 hex. Once this occurs, the POP AF instruction moves the byte to be sent to the printer in the A register, and the LD (nn),A instruction then moves the contents of the A register into location 37E8, the printer port.

The set of instructions which begins at 5293 has a different purpose. The Electric Pencil instructions state that the program checks once to see if a printer is connected, and if it is not, uses the serial output for all subsequent printing. The instructions move the contents of 37E8 to the A register, and then compare to FF, using the result of that comparison for subsequent jumps. It seemed probable to me that an unconnected printer port would be sensed as all "ones", (that is, FF) so that any other value at that location would indicate that a printer was indeed connected.

Once I realized what these instructions were doing (and it took a fair amount of time), I was able to patch into the new printer drive in the following way: The two instruction sequences where the program moves the contents of the printer port of the A register (Program Listing 2) were simply replaced by sequences which loaded 30 hex into the A register, so the program would behave just as if there were a connected ready printer at all times. (Time delays for printing are all included in the new printer patch.) In addition, the instruction and then compares this to 30 hex. If the value is not 30, the A register to the printer port was replaced by a subroutine call to the new printer patch. Program Listing 3 summarizes the instruction for altering the Pencil program and reloading it on the String Floppy wafer.

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tions: First, it decodes ASCII output and converts it to the appropriate solenoid code. Second, when shifting is required, it activates the shift lock (for uppercase) or shift (for lowercase) key solenoids before activating the character solenoid. Third, timing loops are provided to allow enough delay between typed characters. A short additional delay occurs when the same key is activated twice in succession. Longer delays are used for carriage return and backspace. Fourth, the device halts printing at the end of each page (of Pencil text) to allow for paper change. Fifth, rarely used characters ($,#) may be redefined to provide other functions. Sixth, the new driver is completely relocatable to any location in memory.

The first part of the printer driver program provides the logic for stopping at the end of each type page. I discarded the idea of having the driver keep its own line count because of problems resetting the system during partial-page printouts, tables, etc. I eventually realized that the Pencil output consists of multiple consecutive line feeds without intervening typed characters at the end of every text page. (It actually outputs a space, a line feed and a carriage return.) The new patch is written so that if the carriage returns four times in a row without intervening typed characters, the typewriter will continue to print any subsequent carriage returns and spaces, (so that as many lines as required can be skipped), but will halt printing for paper change before any character is printed. To resume printing at that point, press the space bar. To return to the Pencil program and stop printing, press Break and hold until the cursor reappears on the screen.

The remainder of the program is a modification of the one included with the I/O Pak, and is described in detail in the program remarks. In particular, the program provides extra delay when the same key is typed twice in succession. This feature, which is useful for "non-Selectric" typewriters, allows a 20
to 30 percent increase in typing speed for random text beyond that possible for successive typed characters. In addition, rarely used characters ($, #) may optionally be used for 'lowercase one' and backspace functions respectively. The 'lowercase one' is useful in typewriters in which the top left-hand key is not used for the number 'one'.

Program Details

Two program listings are provided. The first is a BASIC program which uses L. Sutor's Macropeke assembler (80-Microcomputing April, 1980) to create a completely relocatable machine language printer driver. Once this program runs, it may be saved on Stringy Floppy wafer using the (@SAVEn, start addr,292) command, and used without reassembly. As written, it is usable for BASIC programs, though a number of lines could be deleted, (namely the end-of-page logic) for minimal memory use. It may be used for Electric Pencil text by modifying line 350 as outlined in the program listing.

The second listing is a short loader (which I store as program one on a Stringy Floppy wafer) which first checks to ensure that sufficient memory size is reserved for the printer driver, then loads the printer driver machine code (@LOAD2), and offers the choice of printing options for the $ and # symbols. The timing loop values are then displayed for easy modification if desired.

Finally, the Electric Pencil program itself is loaded from the same wafer (@LOAD3) and automatically begins. The unusual order of the program lines is due to the fact that the Pencil overwrites all of the BASIC program but the beginning when it is loaded.

I save the three programs, loader, machine language printer driver and Pencil on a single 10 foot wafer, and will be happy to provide copies of both BASIC program listings to anyone sending me a 20-foot wafer. I will not make copies of the Electric Pencil. As noted above, Exatron sells the Electric Pencil modified for saving text on wafer for $10 above the price of the cassette version.

I had relatively few problems. The cable between the interface and the I/O Pak is a bit short (4 feet), and limits the positioning of the typewriter. Rochester Data was nice enough to send me an 8-foot cable in exchange for the original one when I mentioned the problem. The only other problem of consequence has been an occasional sticking of the solenoid plungers within the coils. This was completely solved by application of a very small quantity of 'Tri-fion' Teflon lubricant to the plunger shafts, and has not recurred.

The Rochester Data I/O Pak is a reliable interface between computer and typewriter, and allows generation of high-quality text at minimal cost, though slower than the more expensive solid face printers.

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Some suggestions on using READ, DATA and RESTORE.

On Embedding Data

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Sylmar, CA 91342

Computer programs operate on data, and that data can be broadly divided into two categories. Some data will not change from one program run to the next; such a value is called a constant. Other data may change with each program run, and these values are referred to as variables. For example, we find the area of a circle by multiplying the square of the radius by \pi. In this operation, \pi is a constant and the measure of the radius is a variable.

Somewhere in the program we must enter the data into the computer. To find the area of a circle we could do it this way: 10 INPUT"ENTER PI";PI:INPUT"ENTER RADIUS";R. This line will load the data, but is somewhat inefficient. Each time we run it, \pi has to be re-entered.

A better idea would be to put the value of \pi into the program itself, or embed that value in the program. Such a line would look like this: 10 PI = 3.14159:INPUT"ENTER RADIUS";R. Now when the program is loaded, so is the value for \pi. Embedding constants in the program is more practical than entering them over and over.

Efficient Embedding

The READ, DATA and RESTORE instructions are very efficient at embedding constants. Used in conjunction with FOR—NEXT loops, constant data can be loaded into memory locations rapidly and precisely.

Assume that we need to store the days of the week in locations A$(1) through A$(7). It could be done this way:

```
10 AS(1) = "MONDAY"
20 AS(2) = "TUESDAY"
30 AS(3) = "WEDNESDAY"
```

Etc.

This will load the data, but the following will do the same:

```
10 FOR X = 1 TO 7:READ AS(X):NEXT
20 DATA SUNDAY,MONDAY,TUESDAY,WEDNESDAY,
THURSDAY,FRI
```

The latter method is more efficient, both in time and in byte space. As the amount of data increases the savings become more substantial.

The READ A$ instruction is used in conjunction with the data instruction, and they actually form a routine. When the computer encounters a read instruction it looks for the first data line and then takes the first available item of data in that line and loads it into the indicated memory location. More than one location can be loaded with a single read instruction and more than one item of data can be written into a single line.

Memory locations and data are separated by commas, and a one-to-one correspondence exists between memory location and data item. The first data item will be read into the first listed location, the second item into the second location, and so forth.

Every time the TRS-80 loads an item of data it marks off that item so it will not be used again. The item is not lost forever, however, and can be restored.

When there is too much data to be listed in a single line, another line with a greater number can be started, and it will be read after the data in the first line is exhausted.

Requirements

There are some requirements which must be observed when using the READ-DATA instructions. First is the string/non-string problem. Trying to use the line READ A$:DATA MARCH will get you an error message. A is a value location and will not accept string data. You must match up string locations with string data and vice versa. Numbers may be loaded into string locations, such as in READ A$:DATA 890, but such data are then loaded as symbols and not as values. Asking the computer to PRINT A$ + A$ will not return 3960: 19801980 is returned, as a concatenation has been indicated and not a sum.

Precision presents another problem. Run these lines:

```
10 READ A$.DATA 3333333333333333
20 B# = A$:PRINT B#
```

What happened to the nice string of threes? The data is a double precision figure and it was read into a single precision memory location. We then shifted back to double precision in the B# location and destroyed accuracy. If we try to get double precision numbers from single precision locations, anything after the sixth digit may be nonsense. When dealing with different precisions it pays to be scrupulous about using type declarations on variable names.

Also be careful about the number of items involved. Look at the following line: 10 READ A,B,C,D,E:DATA 1,2,3,4. Running this line will return an ?OD, or out of data, message. The computer cannot read five items of data when only four are given. There must be an item of data for each specified memory location. We can, on the other hand, have more data items than read locations, and this can be used to advantage if the data you are using needs to be updated periodically.

```
10 FOR X = 1 TO 2
20 FOR Y = 1 TO 5
30 READ A(Y):PRINT A(Y)
40 NEXT:NEXT
50 DATA 1,2,3,4,5,6,7,8,9
```

On the first complete cycle of the Y loop,
the numbers 0, 1, 2, 3 and 4 are loaded into the indicated locations and then printed. On the second cycle of the Y loop numbers five to nine are written over in the old locations and the printout finishes with all ten digits printed. When using these instructions, it is advisable to match locations and items with attention to type, precision and number of items.

The comma is used to denote the end of a data item so that more than one item can be listed in a single line. This can pose a problem if commas are needed inside a single item of data. The line: 10 READ AS;DATA SMITH, WILLIAM is not going to work as expected. The program will not crash, but all that will be loaded into AS is SMITH. The comma is the culprit, denoting the end of the first data item.

Since the colon is used to define multiple line statements, it is also off limits, as are leading spaces, although trailing spaces may be included. Run the following: 10 READ AS;B,E;DATAONE;TWO. Even though a space was included before the word two, the printout reads ONETWO.

There are several ways of getting around these limitations and they are illustrated in the following lines:

```
10 READ FS,MS,LS;DATA MARY,T,BROWN
20 READ CM$,CS$;SP$;DATA "","",""
30 PRINT LS;CM$;SP$;FS;SP$;MS$;CS$
40 XS = "";YS = "";Z = ""
50 PRINT LS;Z;XS;FS;XS;MS;YS
60 PRINT LS;CHR$(44);CHR$(32);FS;CHR$(32); MS;CHR$(58)
```

Line 10 loads MARY into FS, T. into MS and BROWN into LS. The first method is illustrated in lines 20 and 30. Although illegal characters cannot be loaded as parts of data items, they may be loaded if enclosed in quotes. Line 20 loads a comma into CM$, a colon into CS$ and a space into SP$. Printout is accomplished by line 30.

Lines 40 and 50 show another method. Here the comma, colon and space are loaded into separate string locations by assignment. Printout is done by line 50. The CHR$ instruction may also be used as demonstrated in line 60. Tricky characters are easily printed using this system. As the ASCII number for the space is 32, for the comma 44 and for the colon 58, line 60 accomplishes the desired effect.

It is possible that after data has been loaded and marked off once, it may be needed again, and the restore instruction is used for that purpose. Its use allows data that has been read to be read again starting with the first item. Note that all data will be restored, and you cannot be selective about what you need without special programming. The following lines illustrate the use of the restore statement:

```
10 FOR X = 1 TO 2
20 FOR Y = 1 TO 5
30 READ A(Y);PRINT A(Y);
40 NEXT
50 RESTORE
60 NEXT
70 DATA 1,2,3,4,5
```

On the first cycle through loop Y all the data was used, but as the computer comes out of the loop and hits the restore instruction in line 50, all the data is again available so that the second pass of the Y loop can use it again. If line 50 is deleted the program will crash, as there is not enough data available. Placement and use of the restore instruction requires practice. These three statements are indispensable in programs in which a lot of constant data is needed.

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The six percent add-on rate, they told us, didn’t really tell the story because it was based on the total amount of the loan. What we must now be quoted, according to Regulation Z, is the Annual Percentage Rate or APR. This is figured on the unpaid balance, month by month. So our six percent loan turns out to be more like 11.08 percent. But, who does the figuring? Therein lies the rub.

APR calculation is a lengthy and involved procedure that could take hours to figure with pencil, paper and log tables. Even the abacus wizards would have trouble. It’s no wonder that computer programs you see covering direct reduction loans tell you how to figure everything but APR.

Realizing the difficulty of calculating APR, the Federal Reserve Board obligingly offered a book of Annual Percentage Rate Tables. But, even if you had the book, you still had to do some figuring, and strict accuracy often made it necessary to interpolate between columns of the tables. The chance for mistake was great.

If you got curious, you could send away for Supplement I to Regulation Z, which contains the general equations for figuring APR. Taking our original example, and assuming a monthly payment of $81.94 ($2950/36), it could be solved like this:

\[ \frac{2500}{1 + 0.06} + \frac{2500}{2(1+0.06)} + \ldots + \frac{2500}{36(1+0.06)} \]

To use it you plug in a guess for \( i \), go through the whole procedure and see how close your guess was to computing 2500. If you’re not close enough, you change the value of \( i \) and go through the procedure again, repeating as often as necessary so the final APR value gets within 1/4 of one percent of the correct figure.

In 1969 when the regulation went into effect you had to have a computer to solve such a problem. Fortunately, programmable calculators, and pre-programmed financial calculators came along to fill the void. But they are relatively slow, and all the methods used to solve for APR are iterative (repeating) procedures that require you to make an initial guess. The speed of the process is dependent on the accuracy of your guess, and typical times for calculator solutions vary from 15 to 45 seconds.

The Hewlett-Packard HP-80, a financial calculator, figured APR from the add-on rate, using this formula:

\[ \frac{n}{r} = \frac{1-(1+i)^{-n}}{i} \]

where \( r \) is the decimal add-on rate and \( APR = \frac{1200}{i} \).

The math book that applied to

Program Listing 1. Left bracket is an up arrow.
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the HP-55 programmable calculator used a slightly different formula, where you needed to know the principal, payment and number of periods. It looked like this:

\[ \frac{\frac{k+1}{f(k)} - n}{f(k)} = \frac{1 - (1 + i)^{-n}}{i} \]

The point of all this is that APR calculation is difficult, and that's why you don't see it in published programs. But, the truth of the matter is that it can be easily solved by your computer.

**Short and Sweet**

The TRS-80 BASIC program in Listing 1 is short and sweet. The calculations have been broken down into easily digestible portions. The calculations keep repeating until the change from one answer to the next is equal to or less than 10^-12. That's far better accuracy than the required 1/4 of one percent required by Regulation Z.

What about speed and accuracy? Take a look at a similar problem and its results:

- HP-55: 10.3166\(\frac{1}{3}\) 30 seconds
- TI Bus. Analyst: 10.3165\(\frac{1}{4}\) 10 seconds
- TRS-80: 10.3156\(\frac{1}{4}\) 1\(\frac{1}{2}\) seconds

In the case of both calculators the result was a monthly percentage rate which you had to multiply times 12 to get APR. The TRS-80 output is true APR.

It is interesting to note that using precise values with the TRS-80 accomplishes nothing of importance. If you're interested in other values of the direct reduction loan formulas, you can find them in many books and financial software.

Here, then, is one more example of something your computer can do better and faster than other methods, with comparable accuracy. Like the financial calculators, you don’t even have to make a guess. The program does that for you.

"Who's the clown who wrote 'I'm being held in this computer against my will'?!"
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