August 1980 $2

80 microcomputing™

the magazine for TRS-80 users*

SPECIAL GAMES ISSUE

Plus:
More than 30 articles, reviews and columns.
Complete contents on page 5.

*TRS-80 is a trademark of the Tandy Corp.

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The easiest, least expensive way to generate spectacular multi-color graphics, sharp two-color alphanumerics: Your computer, a color tv set and the Percom Electric Crayon™.

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Colors are brilliant and true, and up to eight are available depending on the mode.

As shipped, the Electric Crayon™ interfaces a TRS-80* computer. It may be easily adapted for interfacing to any computer or to an ordinary parallel ASCII keyboard.

But that's not all

The Electric Crayon is not just a color graphics generator/controller.

It is also **a complete self-contained control computer.** With built-in provision for 1K-byte of on-board program RAM, an EPROM chip for extending EGOS™, its on-board ROM graphics OS, and a dual bidirectional eight-bit port — over and above the computer/keyboard port — for peripherals. The applications are endless.

Shipped with EGOS™, 1K-byte of display memory and a comprehensive user's manual that includes an assembly language listing of EGOS™ and listings of BASIC demo programs, the Electric Crayon™ **costs only $249.95.**

Options include:

- LEVEL II BASIC color graphics programs on minidiskette: $17.95.
- A 34-conductor ribbon cable to interconnect the Electric Crayon™ to a TRS-80*: $24.95.
- RAM chips for adding refresh memory for higher density graphics modes: $29.95 per K-byte.
- Electric Crayon™ Sketchpad, a sketching grid of proportioned picture elements (pixels) in a tv aspect ratio. For 128 x 192 or 256 x 192 graphics modes. 11-inch by 17-inch, 25-sheet pads: $3.95 per pad.

SYSTEM REQUIREMENTS: the video circuitry of the Electric Crayon™ provides direct drive input to a video monitor or modified tv set. An internal up-modulator for rf antenna input may be constructed by adding inexpensive components to the existing video circuitry.

Prices and specifications subject to change without notice.

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PERCOM DATA COMPANY, INC.
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Get into computer color graphics the easy, low-cost way with a Percom Electric Crayon™. Available at Percom dealers nationwide. Call toll-free, 1-800-527-1592, for the address of your nearest dealer, or to order direct if there is no Percom dealer in your area.

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Quality is the real difference. Low price is merely a dividend.

High quality. Competitive pricing. And a proven track record.

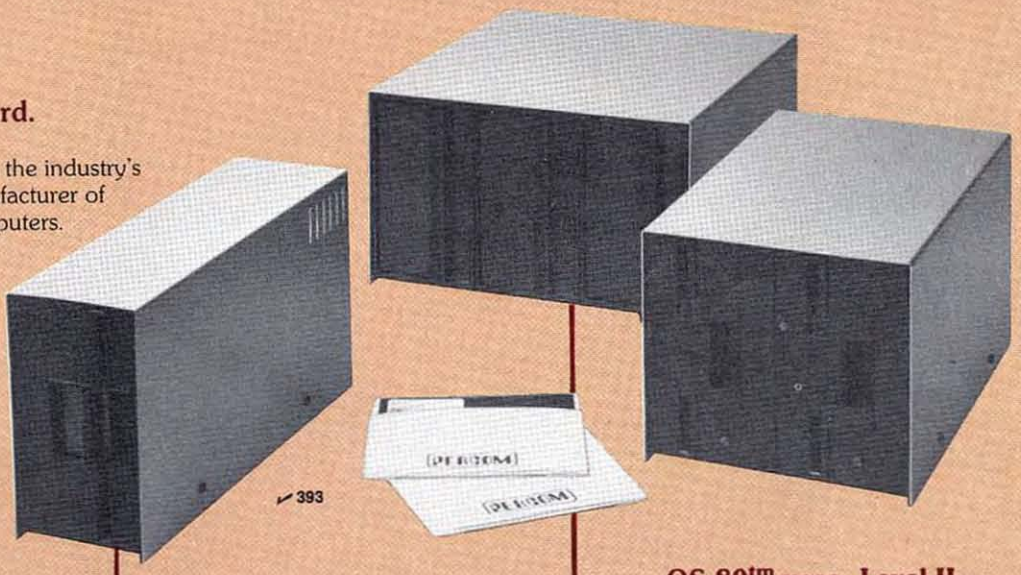
Three reasons why Percom is the industry's number one independent manufacturer of mini-disk systems for microcomputers.

And if you're looking at mini-disk drives, extra storage capacity is an added bonus.

In fact, you store almost one fifth more data on Percom TFD-100™ drives and over two-and-one-fourth times as much on TFD-200™ drives.

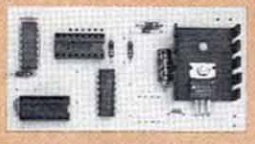
Besides extra testing and superior design, you get free, with each system, a software patch on minidiskette that not only upgrades TRSDOS* for operation with the newer 40- and 77-track drives, but also deglitches version 2.1.

Available in 1-, 2- and 3-drive configurations, Percom drives for the TRS-80* computer start as low as $399.



✓393

The gift of speech



Called Speak-2-Me-2™, this clever interface module makes a Texas Instruments' Speak & Spell† the voice of your computer — announcing, imploring, commanding with expressions and sentences created from the Speak & Spell† vocabulary.

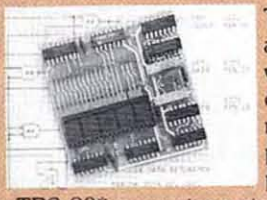
Speech is controlled either at the keyboard or by your own Level II BASIC programs. Or by Percom minidiskette word games (available soon).

Speak-2-Me-2™ is installed in the battery compartment of your Speak & Spell†, and power is provided from an ordinary calculator power pak. Supplied with an interconnecting cable, operating software and a comprehensive users manual, Speak-2-Me-2™ costs only $69.95.

(Speak & Spell™ not included.)

✓408

the Separator:™ End "CRC error. Track locked out!"



This plug-in adapter virtually eliminates data read errors, a problem that plagues TRS-80* computer systems. The SEPARATOR™, so called, is installed in the Expansion Interface without modifying the host system. When installed, data and clock signals are reliably separated during playback, an essential function that the separator circuitry of the host computer performs very poorly. Price is only $29.95.

Note. Opening the Expansion Interface may void the Tandy limited 90-day warranty.

✓409

OS-80™ uses Level II BASIC commands

With OS-80™, Level II BASIC commands are used for DOS and Disk BASIC functions.

You extend the OS-80™ utility set indefinitely with your own BASIC disk-resident utilities.

OS-80™ resides in less than 7-Kbytes of RAM.

The program is supplied on minidiskette along with a simple file manager, BASIC disk utilities and an OS-80™ "Handbook" that you expand and maintain.

All are helpful programming examples.

Price, with instruction manual, $29.95.

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NEW! OS-80™ Machine Language SAVE / LOAD Utility. Only $19.95 on minidiskette w/instructions.

Quality Percom products are available at Percom dealers nationwide. **Call Percom's toll-free order number, 1-800-527-1592, for the address of your nearest dealer or to order direct.**

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META TECHNOLOGIES

FOR YOUR TRS-80® DISK SYSTEM

★NEW★ MTC AIDS-III* ★NEW★

MODEL I . . .$69.95 MODEL II . . .$99.95

Introducing the latest addition to MTC's family of data management systems, AIDS-III. NO PROGRAMMING, easy to use. COMPLETE PACKAGE including demonstration application, documentation and MAPS-III (see below).

- Up to 20 USER-DEFINED FIELDS of either numeric- or character-type.
- CHARACTER-type fields may be any length (total: up to 254 characters).
- NUMERIC-type fields feature automatic formatting, rounding, decimal alignment and validation.
- Full feature EDITING when adding or changing records:
  - ENTER FIELD (can't type-in more characters than specified).
  - BACKSPACE (delete last character typed).
  - DELETE FIELD contents.
  - RESTORE FIELD contents.
  - RIGHT-JUSTIFY FIELD contents.
  - SKIP FIELD (to next or previous field).
  - SKIP RECORD (to next or previous record).
- SORTING of records is MACHINE CODE assisted.
  - 200 RECORDS (40 characters) in about 5 SECONDS.
  - ANY COMBINATION of fields (including numerics) with each field in ascending or descending order.
- SELECTION of records for Loading, Updating, Deleting, Printing and Saving is MACHINE CODE assisted.
  - Specify up to 4 CRITERIA, each using one of 6 RELATIONAL COMPARISONS.
  - LOAD or SAVE selected records using MULTIPLE FILES.
  - Example: Select records representing those people who live in the state of Colorado, but not in the city of Denver, whose last names begin with "F" and whose incomes exceed $9000.00.
  - Example: Select records representing those sales made to XYZ COMPANY that exceed $25.00, between the dates 03/15 and 04/10.

MAPS-III (MTC AIDS PRINT SUBSYSTEM), included at no charge, has the following features:

- Full AIDS-III SELECTION capabilities.
- Prints user-specified fields DOWN THE PAGE.
- Prints user-specified fields in titled, columnar REPORT FORMAT, automatically generating column headings, paging and (optionally) indentation.
- Can create a single report from MULTIPLE FILES.
- Prints user-defined formats for CUSTOM LABELS, custom forms, etc.

BELOW ARE TESTIMONIALS from owners of AIDS systems. These are absolutely authentic statements and are typical of the comments we receive.

"This program will do more for my business than all the other programs I have, combined."
David Wareham, Vice President (EDP), National Hospital and Health Care Services Inc.

"We have 32 different Data Base Management packages for the TRS-80. AIDS-III is easily the best. It also makes it easier for us to step up to our Model II since the package is available for both computers."
Jack Bilinski, President, 80 Microcomputer Services

"Your AIDS program is far and away the finest information management system that I've ever seen. I am currently using it to maintain a clear picture of the demographic data on all the kids in our residential treatment program and it is working for me superbly."
Frank Boehm, Director, Front Door Residential Treatment Program

- COMPATIBLE with AIDS-II data files and AIDS subsystems.
- Move up from AIDS-II and EXPAND to 20 field capability WITHOUT REENTERING DATA.
- AIDS-II (Model I or II) owners may UPGRADE FOR ONLY $25.00.

*WARNING! This program is written in BASIC and can be listed in the normal manner. Modification of program code is NOT RECOMMENDED due to its extreme complexity.

MTC AIDS - II

Ailing information? Doctor it up with AIDS-II. This Automated Information Directory System offers twelve user-defined fields with full feature editing when adding or changing records. Selective Loading, Updating, Deleting, Printing and Saving records may be accomplished using any of six relational comparisons. Also features machine code assisted sorting (200 records in about 5 seconds) by any combination of fields, and much more! Unique "windowing" capability allows directories of unlimited size. Window size is typically 200 or more records in 32K. Can be used for mailing lists, client reference reporting, appointment "calendars", inventory records and other information systems. Easy to use. Defining a system takes about a minute. MAPS-I (MTC AIDS PRINT SUBSYSTEM) is included at no charge. MAPS features full AIDS-II selection capabilities, prints user-specified fields down the page, produces user-specified columnar report formats with automatically generated column headings and paging, and allows user-defined print formats for custom forms, labels, etc. Add subsystems for additional capabilities. May be upgraded to AIDS-III when required.

MTC AIDS-II . . . . . $ 49.95
For Model II . . . . . $ 79.95

AIDS

CALCULATION SUBSYSTEM (CALCS)

MTC's most popular AIDS subsystem. Use for report generation involving basic manipulation of numeric data. Prints user-specified fields in titled, columnar report format, automatically generating column headings, paging and (optionally) indentation. Features full AIDS-III selection capabilities and can create a single report from multiple files. Provides the additional capabilities of user-specified balance forward computations, columnar subtotals, columnar totals and user-defined computations (allows multiplication, division, addition, and subtraction of field values and constants). Features may be used in combination. For example, the calculation of a user-defined quantity/cost column may simultaneously be listed by itself, used as part of a balance forward computation and as part of either (or both) a columnar subtotal or columnar total. Use for accounting, inventory, financial and other numeric-based information systems.

MTC CALCS . . . . . $ 24.95
For Model II . . . . . $ 39.95

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META TECHNOLOGIES

Fellow TRS-80 User:
I'd like to thank you for your continued interest in our products and tell you something about MTC's approach to marketing. MTC's marketing efforts are directed at several areas:

- Market Expansion. This is accomplished by increasing market coverage (more types of product) and by increasing market share (more people buying a given product). Unlike many of our smaller competitors, we tend to concentrate on fewer product areas, but in greater depth.
- Product/Market Investigation. When enough of our customers tell us they are interested in a particular type of product, we either create the product, or acquire it, to fill the need. Sometimes a product is created or acquired that fills a previously unrecognized need. It is Marketing's job to inform our customers of its existence and potential benefit.
- Corporate/Product Promotion. As in any business it is important that you, the customer, think of MTC, rather than our competitors, when you need diskettes, educational or other quality products. Our distinctive name and logo are part of a unique corporate identity. We use expensive ad space for "letters" to our fellow TRS-80 users because we think it is important that you know something about the people you buy from. We promote our products using a variety of means, including product reviews and announcements, enclosing product information sheets with all orders shipped, and direct mailings, along with our normal advertising. This month we are introducing our regularly featured Product Preview section as a means of informing you of new developments. We will also be publishing a newsletter, which will be sent to all our customers, featuring new product announcements, programming hints and tricks, product reviews, letters to the Editor, a customer response questionaire and more.
- Distribution Extension. We are interested in increasing market exposure through coordination, not competition, by fostering a network of reputable dealers. For example, LTM Inc. offers the full line of MTC products and takes orders via toll-free phone calls and mail. They, however, advertise in other publications. In this way, each company maximizes its market penetration.

Next, let's look at who buys MTC products. Our customers typically fall into one of three groups. Most prominent is the businessman/hobbyist. He is relatively new to small computers, has some programming knowledge and is using a 48K, Model I with two disk drives. He wants to learn more about the machine and how to program it, but will buy a "solution" to a problem if it exists and is inexpensive. Second are Fortune 500 companies and governmental and educational organizations, such as school systems, major universities, and even the United States Army! The third group is the advanced hobbyist/computer professional. These customers buy our programming tools to save time. While not generally interested in educational products, they do purchase our AIDS systems in considerable quantities.

We specialize in products that use high technology and that solve problems for a broad class of users. They provide continual benefit and lasting value. That's why we don't offer game programs or specialty software (such as a $200 concrete foundation cost estimation package for building contractors).

While the majority of our products are created by our technical staff, we are always interested in seeing quality work by others. We are especially interested in outstanding communications packages, educational products like REMASSEM and REMDISK, system-type software for Model II (such as BASIC extensions and machine code routines), hardware diagnostics packages and related programming tools.

We at MTC look forward to providing you with the quality products and service you deserve and should expect. If we offered you anything less, we wouldn't be Meta Technologies Corporation.

Sincerely,

Wendy K. Sayer

Wendy K. Sayer
Marketing

Apparat, Inc. introduces

NEWDOS/80

Apparat's long-awaited successor to NEWDOS+ is here! This is not an enhanced version of NEWDOS, but a completely new product. Simplified DOS commands can be instantly executed from BASIC, even within a program, without disturbing the resident code. System options, such as password protection, number and type of disk drives, BREAK key enable/disable and lowercase modification recognition, can be quickly and easily changed. Five new random-access file types allow record lengths of up to 4096 bytes, and no FIELDing! A powerful CHAIN facility allows keyboard INPUTs to be read from a disk file. An improved RENUMBER facility permits groups of statements to be relocated within program code. Diskettes may even be designated as RUN-ONLY! Features all NEWDOS+ utilities (SUPERZAP 3.0, etc.) and much more! One MTC technical staff member said having NEWDOS/80 is "better than sex" (you'll have to judge for yourself!). Includes 180-page instruction manual and MTC QUE card.

NEWDOS/80 ..... $ 149.95

CALL REGARDING OUR NEWDOS+ UPGRADE PRICING.

★ PRODUCT PREVIEW ★

General Business System for Model II

This product will be a full-feature, professional-grade business system, with fully integrated General Ledger, Accounts Receivable and Accounts Payable. A Payroll subsystem will be added later. Some of the major features and facilities are:

- General Ledger can handle a chart of accounts having more than 1000 accounts and sub-accounts.
- User defines and controls the account number structure to suit his own needs.
- Transactions can be entered and stored up to the limit of available disk storage (typically more than 5000 on a multi-drive system).
- Accounts Payable and Accounts Receivable are fully integrated with the General Ledger.
- Extremely high-speed, machine code assisted sorting is used for reports, etc.
- Financial Reports are user-defined and formatted.
- Formats of customer statements (Accounts Receivable) and checks (Accounts Payable) are user-definable.

We are targeting for release of this product in early fall, 1980.

← MORE PRODUCTS ON PAGE 4

mTc-SHIRTS

HIGH-QUALITY, POLY-COTTON BLEND T-SHIRTS. White with Navy Blue neck and sleeve "ringers". MTC logo on sleeve. Top quality transfers of your choice on front.

Specify size (S.,M.,L.,XL.) and Transfer:

- META TECHNOLOGIES MAKES EVERY BYTE COUNT!
- DON'T TOUCH MY BITS!
  01111110
- RAM it!
- MICRO LOVERS TAKE SMALLER BYTES!

mTc-SHIRTS..... $5.95

MAILSORT(Model I) $19.95

MAILSORT replaces existing sort in Radio Shack Disk Mailing List* system. Sort by any combination of fields, such as NAME, within CITY, within STATE. Hi-speed in-memory routine sorts 300 records in approximately 60 seconds. Minimum 32K recommended. For use with old or new versions.

PEEK&POKE..... $14.95

Frustrated because PEEK and POKE have been removed from Model II BASIC?. Satisfy your curiosity with PEEK&POKE from MTC. Included are 8-bit and 16-bit (LSB, MSB) self-relocating machine language routines, instructions, and demo program.

Transfer PROGRAMS and DATA from MODEL I to MODEL II

TRAN-SEND

$49.95 by MTC

Requires MODEL II and MODEL I with disk & RS-232. Simple to use, not a kit - nothing else to buy. Complete with custom cable, 5¼" & 8" floppies, instructions. May be used over phone lines.

Custom Cable only $19.95

Suitable for use with Radio Shack* transfer program(ACT 0131)

✓Reader Service Index—see page 194

80 REMARKS

by Wayne Green

". . . Radio Shack would do better if they were honest with their customers and didn't try to deceive them."

Painful Fact of Life

You probably have people asking you, as a computer "expert," what system you recommend. It's a very difficult question to answer. Owners of TRS-80 systems are all too familiar with the many deficiencies of the system. Some get so excited over the lack of color that they buy Apple or Compucolor systems. Others want a system with more business support and go for a Cromemco or an MSI. The arguments are endless since all of the systems have both benefits and drawbacks.

The main benefit of the TRS-80 is one which Radio Shack can't even mention, yet it's the single benefit which makes the system the main one which can be honestly recommended for a newcomer to computing. This is the software support.

By virtue of the large number of Radio Shack stores—there are more Radio Shacks than there are McDonalds, believe it or not—plus their marketing and promotion savvy, there are more TRS-80 systems out there than everything else combined. Programmers, being aware of this situation, have tended to first write programs for sale to TRS-80 owners. Thus we find the situation where there are more programs for the 80 than for all other systems combined. We find not only quantity, but also better quality. The pressures of the marketplace are such that poor programs tend to fall by the wayside and the better ones survive.

Radio Shack can't advertise this because they are trying as hard as they can to keep this fact a secret from their customers. They don't want the TRS-80 buyers to know that there is anything more than their handful of mediocre programs available. These are the programs put out by Radio Shack and sold from their stores. Some might call this greed, others might term it practical business sense. That depends on whether you are working for Radio Shack or independently.

It is my belief that Radio Shack would do better if they were honest with their customers and didn't try to deceive them. But then, I'm certainly not above suspicion as far as having a personal interest is concerned.

It is a full time job just to try to keep up with the programs being released for the 80, much less try to evaluate them as to their usefulness and value. There are thousands of programs . . . thousands. From my experience at least 25 percent are worth buying and using. The rest extend from absolute rip-offs to stuff of minimal value, despite some very high prices. Buyer beware!

The Radio Shack owned stores are not allowed to sell any products not made by Radio Shack . . . nor even let the customers know that such exist. No books or magazines which hint at outside sources are permitted to be sold in the stores.

Where this practice may all come home to roost will be when some other company spends the money to convert many TRS-80 programs to their own system and thus ends up with far more programs apparently available than Radio Shack is showing in their stores.

Gathering Strength

Oddly enough, though the Japanese have been slow to get into this field, they are now gathering their strength, apparently backed by their government. It has been the Japanese who are the most understanding of the importance of software and who have been most serious in dealing with us about their support. They seem willing to spend whatever it takes to get programs to support their systems. Thus, while Radio Shack is trying to discourage software support, Japan is pushing for it. What will this mean in one or two years as far as equipment sales is concerned?

"They have built up a bureaucracy akin to that in Washington. . ."

For the time being, considering the amount of software support for the TRS-80, it is difficult to recommend any other system for newcomers. Add in the splendid training courses available with the system, the dealer network and the growing service. In the long run the efforts by Radio Shack to prevent others from making money from the 80 may do them in, but, for now, they have things their own way.

The Tandy people should be a little more humble, for the TRS-80 went a long way toward saving the whole company. Lafayette started to get into computers and then dropped the ball. They went into bankruptcy. Radio Shack had many of the same problems: a disasterous drop in CB sales, a slowing of hi-fi sales, and a general drop is consumer electronics sales. Without the surge of business from the 80, the Tandy balance sheet could have turned red and their stock plummeted.

Radio Shack has a major problem that probably can't be solved. If you look at their financial reports you see that almost 50 percent of their expenses go for their management staff. They have built up a bureaucracy akin to that in Washington and such an overhead is very hard to ever cut down. I've talked with several friends at Ft. Worth and they assure me that the firm would run much better with less than half as many people. The Japanese firms are lean and mean, so they may be able to run rings around Radio Shack. The Japanese production lines are more automated, and their advertising and promotion is superb.

The next couple of years will be important. Either Radio Shack and the other American manufacturers will blunder into giving the market to Japan . . . or they will get their act together and win out. So far the blundering seems to be prevalent.

We're hearing rumblings from the Tandy folk about a couple of new systems to be announced in the near future. One is supposed to be an ultra low cost system ($295?) which will probably be much like a Level I, but with a modulator for using a TV set as a monitor.

Recent TV ads for black and white TV sets for around $60 do tend to make this approach attractive. I don't think anyone can do more than dump inventory at a loss at those prices, so the ads may be more a reaction to the present recession and an attempt to raise cash from a dead inventory by a large firm than any hint of a general lowering of TV prices.

Digression

To digress (as usual), television sets do *not* make good monitors for computers. The problem has to do with the "el cheapo" circuits they build into bargain sets, plus the limitations of bandwidth between television channels. The wider the bandwidth of the i-f (intermediate frequency) of a set, the sharper will be the picture on the screen. This is the main difference between a computer monitor and a TV set—sharpness. This is why your screen is relatively fuzzy on your TRS-80. The monitor shipped with the system was originally designed for a TV set and modified.

The limited bandwidth of TV sets is one of the major drawbacks to the color systems such as the Apple. You'll be bumping into this, one of these days, when Tandy announces their TRS-80 Color.

There have been conflicting reports about Tandy changing over to a new microprocessor chip in the new system. The folks at Tandy deny this, but others point to very large orders for the Motorola 6809 chip as proof that the new TRS will be based on that, rather than the Z-80. My own reading of the entrails suggests that the Z-80 will stay and that the 6809 may be

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MAILFORM: Create MAILFILE: The ONLY complete name and address list entry/editor program written in machine language. Instant search on any field, complete cursor control, just fill in the form!

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EXTRACT: Take out information from MAILFORM, the machine language mailing list. Find the names you need by Zip Code, Street Address, Gender, Age or any other way!

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LABEL: Prints labels from MAILFILE.

CONVERT: Make MAILFILE from RS mail list.

MOD II version available soon

SPECIAL DELIVERY will run on your TRS-80® with TRSDOS,® NEWDOS® or any other TRS®-like DOS.

If you bought SPECIAL DELIVERY from us, send us the disk and we will update it to include EXTRACT for $25. If you haven't already taken advantage of our SPECIAL DELIVERY program, we'll send you the complete program including EXTRACT for just $125 (Disk). We can also send you the Electric Pencil® for $150.

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✓42

Demand a Demonstration from your local Dealer or write for a brochure of our complete line of fine software.

used to power an intelligent terminal such as a printer.

Too Simple?

While this magazine is aimed at the TRS-80 users, it is not solely for the beginner. Some articles may put off readers by being far too fundamental. On the other hand, some of the material is definitely for the advanced user and may, at first, be pretty puzzling. Have patience . . . it will sort itself out if you hang in there.

Articles Needed

We need more articles to help rank beginners understand computers. Perhaps, before you become so much of an expert that you have forgotten how to write in English, you can take the time to help those who are just starting down the road?

For instance, beginners would like to know about the various types of disk systems. I don't recall any definitive articles on them yet. A good article would explain about formatted and unformatted disks, single and double density, single and double side, different sizes, Winchester technology, what a disk controller does. There should be good photo illustrations of the various disk systems and disks.

The Factory

While in Fort Worth talking with the Tandy people about Instant Software support, Sherry and I paid a visit to their TRS-80 plant. They have taken over a huge J.C. Penny store and converted it into a facility where they manufacture both the Model I and Model II systems. It is impressive.

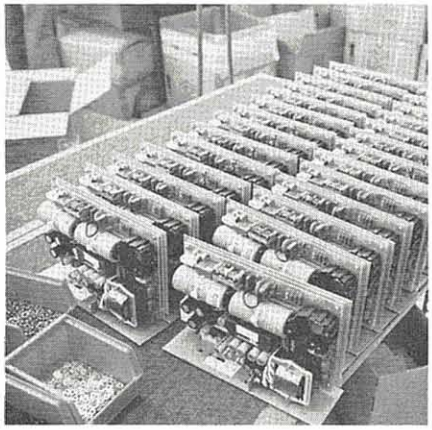
Except for the monitor and the Model II power supply, everything seems to be made right there in Fort Worth. They stuff the circuit boards, run them through a wave soldering unit which solders everything at one time, clip off the wire ends, run a test and put them together. They test again, put them in their cabinets and run even more tests. A good deal of their time and effort is spent on trying to make sure that the units will work when received. Despite all this, the first Model II received by us for test in New Hampshire didn't work.

Computers are fairly sturdy, but I sure hope they are able to come up with something better than a disk system for storage, for those are terribly delicate. Not much can happen to a computer board in shipment, but the disk units can get bent out of shape, as can the tube in the monitor. Say, how about a little gadget packed with each computer system carton which would indicate if the box had been subjected to more than a given number of G's of acceleration. These aren't too difficult to make and they could be sent back by the dealer after the unit had been delivered. This would put the onus for the damage to the unit on the carrier and thus tend to force them to emphasize to their workers that computers must not be kicked from a truck to the ground.

They have a completely automated testing

Continue to page 32

The system starts out with the CPU board being stuffed with chips and parts. Two boards at a time move along the production line.



The power supply boards from Asia are unpacked and inspected.

The disk units are unpacked and inspected, then installed in the system.

Once stuffed, the boards are inspected to make sure all the parts are there. . . and in the right place.

The system now starts getting put together. The monitor units, at the left, have been unpacked and inspected. They are covered to prevent damage.

Next the system is inspected and then given a 24-hour burn-in under high temperature conditions. This is designed to aggravate parts failures over this critical test period.

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CP-181

80 INPUT

". . . while experimenting with my Disk BASIC, I learned an interesting fact. It has to do with the execution times of FOR-NEXT loops."

Simple Interface

I am writing this letter in response to Peter Noeths' June article "Teletype Interface." He offers a circuit to run a model 33 teletype as a printer for the TRS-80. As Level II 16K owners, Mr. Cory Gates and I have a much faster and cheaper way of interfacing the model 33.

When Mr. Gates and I bought our ASR 33, we considered using a UART to transform from parallel to serial. Soon after buying the ASR 33, we met with a TRS-80 owner who has interfaced his ASR 33. Mr. Leon Hogan runs his 33 with a single open collector and RSM-2. Using RSM-2's TRS232 software, he runs at the 110 baud needed for the ASR 33. RSM-2 will output to the cassette latch in serial at any of six bauds.

Building the interface is a simple 30 minute job. First of all, open your keyboard. Solder a wire to the GND on J1 (power jack). This will supply the ground needed for the interface. Next solder a wire to the 74LS75 at pin 3. This chip is the cassette latch. Pin 3 is Q Prime or the data inverted and serves as your single line. Now tie this wire to the base of the transistor. This transistor serves two needs. It acts as an open collector to run the power supply and inverts the data to the normal state. After this, tie the emiter to the GND on the keyboard and the GND on the teletype. Last, but not least, the power. Tie the negative terminal to the collector and the positive terminal to the single on the teletype. To test the hardware just run this:

```
10 FOR I=1 TO 1000:OUT 255,2:NEXT
20 FOR I=1 TO 1000:OUT 255,0:NEXT:GOTO 10
```

The printer should lock and then unlock.

Now, all that is needed is the software. If you have RSM-2, run it and set the 'Y 1 0 1'. This will set the baud to 110 and line-feed after carriage return. To print with LPRINT and LLIST use this program:

```
7FB0:  21 B9 7F     LD    HL,7FB9
7FB3:  22 26 40     LD    (4026),HL
7FB6:  C3 19 1A     JP    1A19
7FB9:  21 FF 7F     LD    HL,7FFF
7FBC:  34           INC   (HL)
7FBD:  AF           XOR   A
7FBE:  CD E9 7F     CALL  7FE9
7FC1:  59           LD    E,C
7FC2:  CD E4 7F     CALL  7FE4
7FC5:  06 08        LD    B,08
7FC7:  79           LD    A,C
7FC8:  1F           RRA
7FC9:  4F           LD    C,A
7FCA:  D4 E4 7F     CALL  NC,7FE4
7FCD:  DC E8 7F     CALL  C,7FE8
7FD0:  10 F5        DJNZ  7FC7
7FD2:  AF           XOR   A
7FD3:  D3 FF        OUT   FF
7FD5:  7B           LD    A,E
7FD6:  FE 0D        CP    0D
7FD8:  20 1A        JR    NZ,7FF4
7FDA:  AF           XOR   A
7FDB:  32 FF 7F     LD    (7FFF),A
7FDE:  0E 0A        LD    C,0A
7FE0:  1E 00        LD    E,00
7FE2:  18 D5        JR    7FB9
7FE4:  3E 01        LD    A,01
7FE6:  18 01        JR    7FE9
7FE8:  AF           XOR   A
7FE9:  D3 FF        OUT   FF
7FEB:  21 6A 02     LD    HL,026A
7FEE:  2B           DEC   HL
7FEF:  7C           LD    A,H
7FF0:  B5           OR    L
7FF1:  20 FB        JR    NZ,7FEE
7FF3:  C9           RET
7FF4:  3A FF 7F     LD    A,(7FFF)
7FF7:  FE 46        CP    46
7FF9:  C0           RET   NZ
7FFA:  0E 0D        LD    C,0D
7FFC:  18 BB        JR    7FB9
7FFE:  00           NOP
COMMAND?
```

Enter this program with TBUG and punch with 'P 7FB0 7FFF 7FB0 LISTER'. To use it, enter 32687 at memory size and load it with 'SYSTEM' and then 'L'. Execute with '/'. Now the printer commands will work. This program is written so you can relocate it using EDTASM with little work.

I hope that I have saved someone time and money.

Ray Nuber
Olathe, KS

Relative Time

Recently, while experimenting with my Disk BASIC, I learned an interesting fact. It has to do with the execution times of FOR-NEXT loops. Using the real-time clock I came up with the following relative times:

```
FOR I=1TO32766:NEXT I (real) - 107 seconds
FOR I=1TO32766:NEXT (real) - 77 seconds
FOR I=1TO32766:NEXT I (integer) - 76 seconds
FOR I=1TO32766:NEXT (integer) - 46 seconds
FOR I=1%TO32766%:NEXT (integer) - 45 seconds
```

These times were for my Model I with an Expansion Interface. This seems to indicate that using just NEXT for each FOR-NEXT loop can save a considerable amount of time. However, see the Level II manual page 4/10 (2nd ed - 4/12) for a warning on this usage as it relates to GOTOs.

I also noticed that using variables in an integer FOR-NEXT loop makes little or no difference for smaller loops. Try it on a loop less than 10000 using variables to define the range of the loop. This is because they are evaluated only once. See the manual for more details.

It is interesting that the manual makes no mention of this difference in speed in their section on speeding up execution. The jump from integer NEXT variable to integer NEXT saves almost as much time as the jump from reals to integers!

Richard Zeller
Mill Valley, CA

EDTASM Error

Thanks for publishing the EDTASM Index (June '80'). To me, it's this kind of useful article that really makes a magazine like *80 Microcomputing* worthwhile in the long run.

The author, Terry Kepner, also found three errors in the Editor/Assembler manual. I wish to point out another. On page 81, the description of the instruction BIT b, (HL) should read:

". . . with the contents of the MEMORY LOCATION POINTED TO BY THE HL register pair . . . "

In addition, the number "444" appears three times near the bottom of the page. In each case the number should be "4444."

Thank you, and keep those great issues coming.

Jeff Berkowitz
Isla Vista, CA

Good News

I am impressed with the new magazine. The content is excellent. Please work for careful review and proofreading of submitted programs and information. In the Feb. issue, for example, Wes Thielke gives some pointers for accessing the ROM routines. I tried his procedure for using the SET/RESET routine (Table 3), however I get a SN ERROR message and a return to BASIC after it has set a point. I have tried everything I can think of to solve the

problem. Can you help me out?

Good news for light pen builders. You can build the light pen descibed in the April issue ("Build a Light Pen" by Wayne Holder) using all Radio Shack parts. The circuit does not appear to be critical. Here is my list of parts:

```
PQ1:   Phototransistor: RS# 276-130
Q1,Q2,Q3,Q4:   PNP Transistor: RS#276-1604 (15 in one pak)
R1:   #271-025
R2:   #272-061 (use in place of 2.4 meg).
R3:   use two 2.2 meg resistors in series.
R4:   #271-034
C1, C2:   #272-1069
C3:   #272-996
```

Although several substitutions have been made, this set of components works well. You will not be able to fit this into the pen, however. I built the amplifier circuit on a separate board. For the pen, I took a standard push-top ballpoint, broke out the "push" mechanism, and installed the phototransistor' at the point. You do not have to have the phototransistor flush with the point, it can be behind the point slightly; the sensitivity is excellent. The cost of the pen is greatly reduced, and if you have some friends you can divide the leftover 2N3906 transistors.

Roger A. Kendall
Lexington, MO.

Etch-a-Modification

In the May 1980 issue of *80 Microcomputing* James K. Shrum's "Etch-a-Screen" is an excellent drawing program.

At the end of his article he wrote, "Should anyone come up with any modifications I'd like to hear about them."

After working with the program, I found the following to be the ones I used most.

While drawing a racetrack, I discovered I had made a mistake. I then proceeded to push the break key and type RUN. This cleared the screen and returned me to the home position (O,O).

Why couldn't I have just pushed a key to clear the screen?

I added this line and it did the job and left me at my current position.

```
135 IF S="C" THEN CLS: GOTO 30:'clears the screen when
you type "DC".
```

While drawing a diagram of a pinball game I had a need to see where I was on the screen.

These lines show the values of X and Y, as they stand at the current position on your screen.

```
105 IF P = 1 PRINT @ 55,;X;Y;

145 IF S = "P" THEN
P = 1: GOTO 30:          'prints the current value of X,Y
                         so you know where you are on
                         the screen.

155 IF S = "Y" THEN
P = 0: PRINT @
55,CHR$(198);: GOTO
30:                      'turns off and erases position
                         teller.
```

In a few cases I found myself wanting to start at the bottom-righthand corner.

Why can't we start or move to any place on the screen?

This line lets you input exactly where you want to go to or start.

```
165 IF S = "I" THEN
PRINT @ 952,;: INPUT
X,Y: PRINT @ 952,
CHR$(196);: GOTO 30:     'lets you set set X and Y anyplace
                         on the screen.
```

The above line also clears the bottom line of the screen.

These additions will fit in with your 4K machine provided that you remove all REM's.

Here is a list of all the commands possible for "Etch-a-Screen" if you enter my additions.

Type "D" before entering your command.
T - Puts you into the text mode.
S - Saves a drawing on cassette.
L - Lets you load a previously saved program.
New additions
C - Clears the screen and leaves you at your last position.
P - Prints the values of X and Y so you know where you are on the screen.
Y - Turns off the position teller.
I - Lets you input the values of X and Y which will move you to that position.

Thank you, James Shrum for such an excellent program.

Randy Long
Yorba Linda, CA

Small Corrections

A couple of small corrections will help the "MENUE" program in DOS to BASIC by Gary Alcorn in the 80 input section, May issue:

```
Memory location 6B20 becomes D8 (was E3)
Memory location 6B21 becomes 43 (was O3)
```

As well, it is possible to load a program of any size (not just 5 characters as stated). However, one must terminate with the two bytes 22, OA.

The program will run as originally written under TRSDOS 2.3, but the key debounce will not work.

R. Hewko
Dawson Creek, B.C.,
Canada

Only 258 Bytes of Buffer

The last paragraph of page 115 of April's issue *should* state that the PRINT #-1 statement writes no more than 248 bytes to tape. Remember that the TRS-80s I/O buffer (extending from addresses 16870 to 17128) is only 258 bytes long, and a few bytes are needed for housekeeping purposes.

The BREAK DISABLE article on page 128 contained two errors. Change line 10 to read

```
10 CLS : FOR X = 32743 TO 32767
```

Delete the last ,0 from the DATA statement, which is redundant.

Finally, how about getting Dennis Kitsz to provide us with an assembly language version of KBEEPFIX so that users can reassemble it with a different starting address. There was no indication that the program was relocatable. Right now KBEEPFIX conflicts with other programs.

John Blommers
Edmonton, Canada

80 AID

Free Info

I think the following information to your readers concerning Computer Bulletin Boards will save you and Radio Shack a number of phone calls.

I think the evolution of Forum-80 systems are the best thing that could have happened to the computer hobbyist. The article in the May issue of *80 Microcomputing* by Jim Cambron was excellent.

I would like to add that if you do not disable the parity error routine before calling a system, you will always get vertical lines between the characters the system sends.

If you don't know how to disable the patch, send me a blank cassette and an S.A.S.E. and I will copy mine for you.

Steve Maguire
12 Suburban Blvd
Delran, NJ 08075

HELP

As an owner of TRS-80 with interface and disks, I have a problem that I'm sure many others also have.

When the TRS-80 is on, it makes interference not only on my CB-radio base station, but also on the surounding stations. Is there anything to do about that?

I hope to get help from you or some of your readers to solve this problem.

Per Evensen
Tingvallavagen 8
S- 186 00 VALLENTUNA
Sweden

Several weeks ago, 80 Microcomputing received the following letter from one of our readers. As you will see, the letter from Computronics, Inc. suggests that Delmer Hinrichs, author of the well-received "BASIC Word Processor" that ran in May 80, had based his work on ground already broken by Dr. Hubert S. Howe.

80 Microcomputing asked Mr. Hinrichs for some clarification. There was never any assertion, as Mr. Hinrichs interprets of plagiarism, but rather, 80 Microcomputing thought a footnote might be appropriate.

Mr. Hinrichs response surprised even our managing editor, who, upon review, agrees with Mr. Hinrichs.

Mr. Hinrichs letter, somewhat abridged, follows.—Eds.

Asserts a "Rehash"

I am in total agreement with your comments in the May, 1980 issues of *80 Microcomputing* pertaining to copying software. What about almost copying software?

Pages 50-55 of *80 Microcomputing* contain an article called "BASIC Word Processor." The article and the program itself is a "rehash" of what first appeared in our H & E Computronics, Inc. Monthly Newsmagazine. The program uses identical variables and identical commands (with sufficient modifications to get around the copyright laws). The article accompanying the program even uses our eight basic features that appeared in the article accompanying our program.

The article and program appearing in *80 Microcomputing* is probably sufficiently different to avoid prosecution under the copyright laws (although we wouldn't be interested in following that course). We would like *80 Microcomputing* to acknowledge the original source for the material. We are certainly happy (and pleased) to give *80 Microcomputing* the rights to publish anything that comes from our Newsmagazine. We would just like *80 Microcomputing* to give us proper credit and ask for prior permission.

By the way, The Word Processor is the program that we have been giving away (at no charge) with each subscription. The original version appeared in our April, 1979 issue. The updated version appeared in our April, 1980 issue (both enclosed).

Keep up the good work. I know that it is impossible to find the orignial source for everything being written.

By the way, our word processor is selling for $99 by a company in Florida (without our permission). People are very angry when they find out that we give it away for free. We have the rights to unlimited free distribution. The Word Processor was written by Dr. Hubert S. Howe, Jr.

Howard Y. Gosman, President
H & E Computronics, Inc.

Surprising Rebuttal

I was very surprised to receive your letter and the copy of Mr. Gosman's letter, in which he claimed that my article/program, "BASIC Word Processor", published in the May 1980 issue of *80 Microcomputing*, was a "rehash" of Dr. Howe's article/program published in the April 1979 issue of *Computronics*. I *had* seen and tried Dr. Howe's program, along with several other BASIC word processors, but had found that none were satisfactory (Dr. Howe's program I found too slow, lacking features that I felt were necessary, and insufficiently debugged). I thought, "I can do better" and decided to write my own program.

"Program plagiarism is a serious charge . . . bear with me"

It was a number of months after I had last looked at Dr. Howe's excellent write-up of a mediocre program that I got around to writing up my program. After receiving your letter, I again looked at Dr. Howe's article. Yes, we do organize things similarly: We first list features, then operation in general, then operation in detail. While this is a natural way to organize an article, perhaps Dr. Howe's earlier article had left its impression.

We both list eight features, a startling coincidence. However, five are descriptions, in different words, of features that any good BASIC word processor should have; three are different.

Actually, even features that sound the same may be different. For example, we both claim, in different words, upper and lowercase text entry using an unmodified TRS-80. Reading further, you find that with my program, (shift-letter) gives uppercase, and (letter) gives lowercase, the same as a typewriter. With Dr. Howe's program, (shift-letter) gives lower case, and (letter) gives uppercase, very awkward for entering normal text.

Program plagiarism is a serious charge, so please bear with me. The following comparisons are based on only Dr. Howe's April 1979 program; I have not seen the April 1980 updated version that Mr. Gosman mentions, so I cannot comment on the revised program.

Program Features

Do the programs have different features? I think so. While some features appear duplicated, most actually work quite differently.

My program has the COMPILE command, my term for the command to move words between lines to make all lines the correct length. I think that this feature is essential for a practical word processor; otherwise, if lines are made too short or too long by EDITing or reFORMATing, many lines may have to be manually changed or even retyped. Dr. Howe's program does not have anything similar.

My program allows entry of do-not-justify markers to skip justifying of any line; his does not. mine displays this marker, as well as end-of-page and trailing-space markers on the video; his does not show any such special markers. My program has subcommands for moving the text in a line to the extreme right of the line, of centering it; his does not. Mine shows on the video display what the program is doing during time-consuming operations; his does not. Other non-shared features are mentioned below.

Dr. Howe's program does have one feature that mine lacks; the ability to store text in a disk file.

Program Organization

Are the programs organized in a similar fashion? I think not. Mine puts the commands in alphabetical order; his does not. For logic branches, I tend to use the ASCII number of the character, and use ON—GOTO for multiple branches; he uses string characters and groups of IFs. I try to protect against user errors; he does less checking. I try to put subroutines after the calling point; he puts them wherever convenient. I display the text after it has been changed; he does not. I use string variables "Y" and "N" for yes-no questions; he uses numeric variables.

We do both compress the spaces out of our respective programs to save memory.

Program Commands

Dr. Howe has 14 commands in his program; I have 17. Of these, ten have the same name, and thus appear the same at first glance. Actually, only three, DELETE, HELP, and MOVE have essentially the same effect, and even on these, the BASIC code is different. On the others:

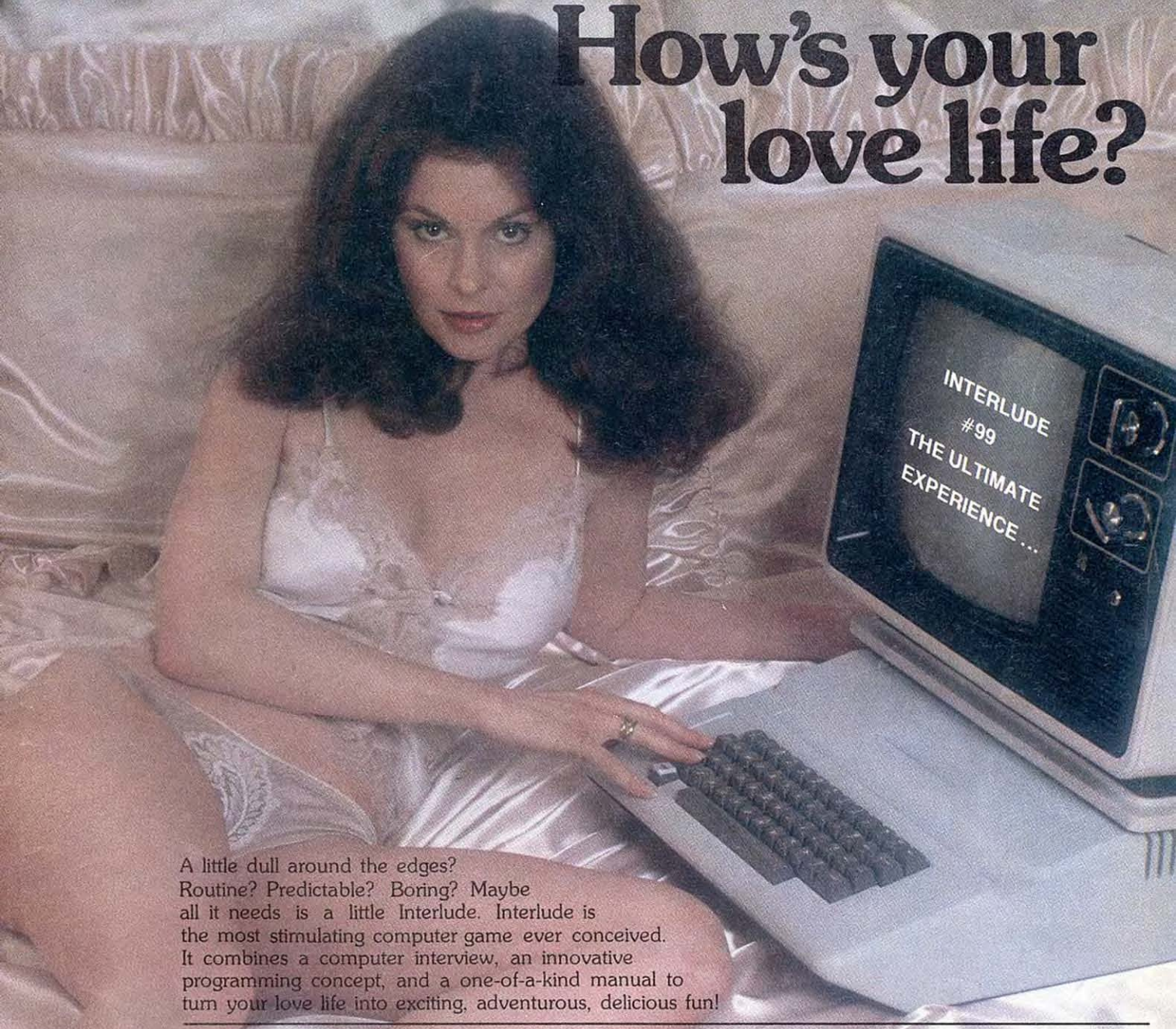
EDIT—We have both more or less followed the Level II editing format. Dr. Howe leaves out the Again subcommand and the "n" preceding the left-arrow, right-arrow, Space, Change, Delete, and Search subcommands. I addded subcommands shift-right-arrow (move text to right), shift-down-arrow (center text), and shift-@ (exit from EDIT).

INSERT—Dr. Howe INSERTs text only into empty lines; I move the following text down to make room for the new text line or lines.

JUSTIFY—Dr. Howe's program will

Continued to next page

How's your love life?



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Hinrichs from page 14

not right-justify lines that end with a space or punctuation; mine will. With my program, a marker is added to a line to leave it unchanged; his does not have this option. Dr. Howe can't JUSTIFY short lines; I can. The actual adding of spaces is quite different; I start at a random position and distribute added spaces uniformly, at adjacent or alternate original spaces; Dr. Howe doesn't.

LOAD—Delimiters (" , :) or leading spaces that may occur in text cannot be SAVEd and LOADed from tape. Both Dr. Howe and I got around this problem by translation, adding an eighth bit to the seven-bit ASCII code (by adding 128). Dr. Howe tests for the problem characters, and changes them in the text file before and after a SAVE, and after a LOAD; he then SAVEs or LOADs one text line at a time. I translate all characters, put them into a buffer array, then SAVE or LOAD four lines at a time. The practical difference? A lot of time and tape. My translation is much faster, no re-translation is needed after a SAVE, and there are only one-fourth as many data files to record or read.

PRINT—In Dr. Howe's program, PRINT may mean either print on the printer, or display on the video display; in mine, PRINT means PRINT. My program can set the left margin, print page numbers on all pages except the first, print the entire text without intervention, and print text with line numbers without offsets to the text; Dr. Howe's cannot.

REPLACE—Dr. Howe's REPLACE must start at a line that contains text, but can then continue in blank lines. In my REPLACE, only one line, with or without text, is affected.

SAVE—See LOAD.

ADD is similar to Dr. Howe's FILL, but adds a single character to the text file quicker, besides correcting the upper-lowercase reversal, which Dr. Howe's program does not do. My program moves a too-long word to the next line much faster than does Dr. Howe's program. If a word ends on the last position of a line and (space) is then entered, Dr. Howe's program incorrectly moves the word to the next line; mine does not. In my program, shift-right-arrow moves text to the extreme right of the line; in Dr. Howe's, it fills the line with spaces.

FORMAT is similar to Dr. Howe's SET, but has 10 format variables, compared to only six for SET.

I could continue listing differences until this letter was longer than my original article, but I think that the conslusion is obvious from this sampling: While there is a superficial resemblance, due to the two programs having a common goal, the actual features and the detailed operation of the programs are quite different.

Delmer D. Hinrichs
Washougal, WA

DEBUg

Bugs in Doodle Bug

Due to a lapse in communication between myself and the editors at the last minute when the June 1980 issue of *80 Microcomputing* went to press, the line numbers used for reference in my article "Doodle Bug" do not correspond to the line numbers in the actual program listing. The table below provides the corrections that need to be made *to the text* portion of this article, starting on page 74. The corrections are listed in the order that they appear in the text.

Line numbers referenced in text of article:	Corrections to text so that line numbers will correspond to program listing:
p. 74 300-385	265-350
500-585	410-485
RUN 400	RUN 355
400	355
300	265
RUN 600	RUN 490
p. 76 435, 445, 660 and 665	390, 400, 575 and 580
999	595
110	165
116 and 220	175 and 225
GOTO 115	GOTO 170
GOTO 220	GOTO 225
215	220
GOSUB 999	GOSUB 595
65	105
35	75
125 and 260	185 and 255
430 and 450 (disk)	395 and 405 (disk)
657 and 680 (cassette)	575 and 590 (cassette)
RUN 400	RUN 355
RUN 600	RUN 490

R. Daniel Bishop
Point Lookout, MO 65726

Life Re-Lived

Readers will have noticed by now some missing items from two programs in the LIFE article published in June *80*. Here they are:

In Listing 6 there should be no line 15. That is actually *selection* 15 in line 2010 (you wondered where that went? Well score one for automation). Also, line 3100 was swept up from the floor, I suppose. As many readers have deduced, line 3100 should read GOSUB 9999.

Now the assembly listing of LIFE itself. Lines 245 and 265 now read *LIST OFF and *LIST ON. Instead, these lines should be dropped and lines 250 and 260 added, reading:

```
250 DEFM 'LOADING LIFE9 ..... WAIT FOR
    "GOOD LOAD"'
260 DEFM '.....THEN ENTER "/"'
```

I suppose an overanxious accountant sliced out lines 6450 and 6460. They originally read:

```
6450 COPY DEFM '* COPYRIGHT 1979 BY DENNIS
                BATHORY KITSZ.'
6460            ' ALL RIGHTS RESERVED *'
```

...but you are welcome to place any 64-character message in that place.

I would also like to mention that for those readers without the patience to type in the complete listings, I have prepared LIFE9 on cassette, along with the BASIC seed listing, for $9.

Dennis Bathory Kitsz
Roxbury, Vermont 05669

SCRNPRNT

I thoroughly enjoyed "Screenprint" in the May 1980 issue, but found a bug in the listing. Line 194 should be:

```
LD (4049H), HL
```

H was left out in the assembly (look at the object code). Otherwise SCRNPRNT is working faithfully.

John Sowers
Petersburg, VA

Roseland Re-visited

In the article "Adventures in Roseland" (June, *80*), the program listing was incorrect.

Lines 40, 50 and 60 should have read:

```
40   X=(R*COS(J))+64
50   Y=(R*SIN(J))+47
60   SET(X,47-(Y/2))
```

Donald E. Edwards
Royal Oak, MI

EXATRON STRINGY FLOPPY T.M.

SPEED
LOW COST
RELIABILITY

Exatron is a California based corporation that has been in business since 1974. As well as the Stringy Floppy, Exatron designs, manufactures and sells state-of-the-art electro-mechanical equipment for a variety of commercial and industrial applications. Exatron is an established supplier of automatic test equipment to manufacturers, and large OEM users, of integrated circuits worldwide.

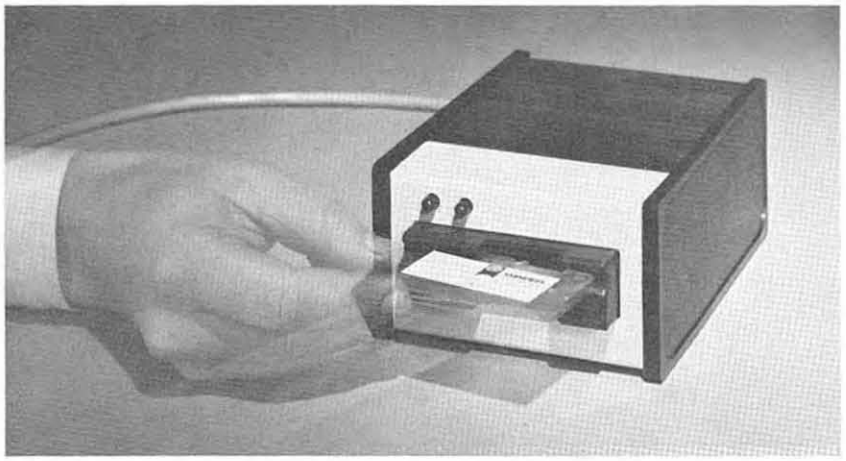
The software in every ESF adds a parity bit to every byte saved on tape, and a checksum to the end of every file. These are checked both after recording data and upon replay, any detected error is indicated by a message on the video display. This system of automatic error checking gives confidence in any data saved, also each wafer is rated for at least 2,000 complete passes past the record/replay head.

- ►Assembled and tested
- ►All operating software in ROM
- ►Fully automatic operation
- ►Professional quality
- ►No Expansion Interface required
- ►Large Owners Association
- ►High speed operation
- ►Extremely reliable
- ►No technical knowledge needed

WHAT IS IT?

The Exatron Stringy Floppy (ESF) is an extremely fast, reliable, economical alternative to cassette or floppy disk storage of computer programs or data.

Totally self-contained, the ESF has no buttons, switches, knobs or levers to adjust or forget. All of ESF's operations are under the computer's control.



TRS-80 is a trademark of the Radio Shack Division of Tandy Corporation.

HOW DOES IT WORK?

The ESF uses a miniature tape cartridge (called a 'wafer') as the data storage medium, about the size of a business card and 3/16th of an inch thick. The tape used inside the wafer is a special Mylar based Chrome Dioxide type, specially developed for digital applications. Wafers are available in several lengths, 5 feet being the smallest and capable of holding up to 4 thousand bytes of information – the 75-foot wafer is the largest available and can hold up to 64 thousand bytes of data.

The wafers contain a single reel of the special tape connected as a continuous loop, the ends being spliced together with a piece of reflective tape. In operation the ESF drive unit pulls the tape from the center of the reel inside the wafer, causing the entire reel to rotate. Thus, the tape automatically winds itself around the outside of the reel at the same rate as which it is pulled from the center. This process is similar to that found in an 8-track cartridge.

The ESF transport mechanism is very simple, consisting of a precision die-cast aluminum block – with a capstan, drive motor and magnetic record/replay head mounted on it. The wafer loads into a slot in the casting (it will only fit the correct way) and the tape is driven at a single point by the capstan, past the record/replay head.

HOW DO YOU USE IT?

Once connected to your computer the ESF operating system needs to be activated—simple. Just type 'SYSTEM'(enter), and in response to the ? prompt type '/12345' (enter). Your TRS-80 will instantly display the ESF sign on message 'EXATRON STRINGY FLOPPY VERSION 4.1', and from this point onwards you will have the extra commands '@LOAD', '@SAVE' and '@NEW' recognized by your TRS-80.

The ESF's operating system is built into the electronics of the unit, in much the same way that BASIC is built into the computer, so it is always available – the SYSTEM command is to let your computer know that the ESF has been connected. If you normally reserve some memory for subroutines then the ESF software will relocate itself under your selected top of memory. The ESF uses only 4 bytes of your available RAM, these bytes are used to 'point' to the 2048 bytes of software in the ESF unit itself.

WHAT'S THE CATCH?

Well, the only catch that most people find is that they have to actually pay Exatron for their unit! Even this is no big deal.

Starter Kits are available with the Exatron Stringy Floppy, a supply of wafers, a bus extender and a selection of useful programs – for $299.50.

Through regular advertisements in both Kilobaud Microcomputing and 80 Microcomputing, owners are kept informed of the latest developments in wafer-based software. Plus hundreds of user 'workshops' are starting up over the country, so you can always be sure of being near to another ESF owner.

Exatron also gives a 30-day full money-back guarantee, with a 1 year parts and labor warranty on the unit.

If you have any questions about the ESF then give Exatron a call on the Hot Line (outside CA) **800-538-8559.**

East Coast customers can call **800-343-4424** (inside MA **617-899-3862**)

Open House Workshops take place from 9 am till 1 pm every Saturday at Exatron's factory in Santa Clara, and on the East Coast the last Saturday in each month at Micro Communications, 80 Bacon Street, Waltham MA 02154. All are welcome.

exatron

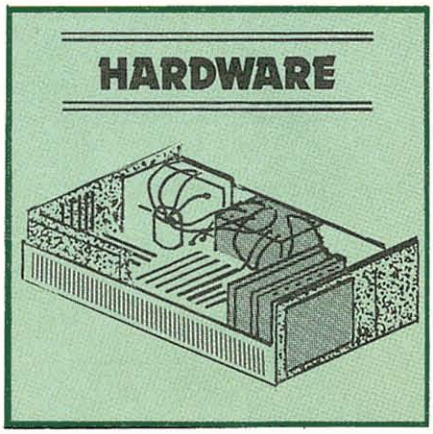
3555 Ryder Street
Santa Clara, CA 95051
408-737-7111

✓3

✓Reader Service index—see page 194

REVIEWS

"I realized the time I was saving . . . was lost . . . in the amount of time spent typing reports from the video display."



Trendcom 100 Printer
Trendcom
Sunnyvale, CA
$375

by John D. Adams

I have no idea what one does with a wire wrapping tool. I find PC boards artistically attractive but regard their operation with puzzled awe. The mere idea of a logic probe sends me to the liquor cabinet. But I do love my computer. I am one of those computer users who really is a *user*.

I have owned my TRS-80 for over a year and a half, have dutifully learned my Level II BASIC and expanded my RAM to 16K. I am now writing software which occasionally astounds me by working. As a teacher of Algebra II and Accounting, using my TRS-80 has increased exponentially during those 20 months.

Time Saved, Time Lost

Several months ago, I realized that the time I was saving by using a computer was lost twofold in the amount of time spent typing reports from the video display. I was losing my eyesight, my patience and my sanity. It was clearly time for hard copy, and I had to have a printer that I could plug in and run.

My first forays were frustrating and disappointing. I found a lot of decent printers for around a thousand bucks, but I couldn't afford them *and* support the government and my family at the same time. Besides, I could not see paying more for a printer than I did for my entire system.

I had nearly resigned myself to several years more of typing from the video until I could save up a thousand dollars—provided the car did not fall apart on the freeway—when I tried a local computer store looking for a used printer. There, a salesman demonstrated the Trendcom 100 printer. He gave me a program listing to check on the copier and said he had an interface cable that plugged directly into the TRS-80.

I went home to think about it. The listing copied fine—it even made a good ditto master on a thermal copier. I called a second computer store for their opinion and got no negative feedback.

So I bought one. With foreboding, of course. Things that work well for everyone else seldom work for me. The manual is short, concise and clear. A separate page concerning TRS-80 applications is included.

Inside the cabinet is a slide switch that activates a self-check routine and prints out the 96 character set, illustrating both upper and lowercase. The manual states that if this works, you should hook it up.

One end of the ribbon cable is furnished with an interface card housed in a black plastic box about 3½" by 5" by ¾". I was told that this is for systems without the expansion interface. I had some trouble figuring out which was the top of the box, but finally realized that it could go only one way and still leave access to the reset button. This is a fair indication of my electronics expertise.

The other end of the cable plugs into the printer and is notched; not even *I* could get it in backwards. Hook up the cable, plug the power cord into a grounded receptacle, and you are ready to go. The power supply is included inside the printer case.

Bi-directional Printer

The unit's weight will surprise you. It is a microprocessor-controlled, bidirectional printer. It prints a 40 character line at 40 characters a second. Trendcom projects the head life at 10^8 characters. The warranty is satisfactory, and the salesman assured me that repair support is available. Interface cables are also available for the Apple II, the PET and for RS232 applications.

It is refreshingly quiet, making sound only when the print head changes direction and advances the paper. Loading is easy, and the paper feed is even and regular. Operation requires only the LLIST and LPRINT commands. The PRINT USING and the PRINT TAB statements may be used, making formatted output a snap.

The Trendcom even prints upper and lowercase without a TRS-80 hardware modification by reversing the normal shift procedure. Lowercase is not a prize winner, but it is readable and offers contrast.

The drawbacks for me are few and minor. The printer uses thermal paper in blue or black at about four cents per foot, which is not cheap. Unless you do a great deal of printing, this should not be critical. The paper is also narrow, measuring slightly less than 4½ inches and cannot be exposed to sunlight or heat.

A small LED on the front panel to indicate power on/off status would be handy.

So far I have not been able to get the printer to print an up arrow for exponentiation. It prints an open bracket sign instead. Using the CHR$(91) notation does not help. If anyone knows how to get around this, I would appreciate hearing from you.

Two self-protecting circuits are built in. The first resets the unit when line voltage drops below 90 percent of the rated needs. Operation resumes automatically when power is up again. The second circuit locks if the print head does not return to the left margin. This is cleared by turning the power off and then on again.

I am completely satisfied with the Trendcom 100, especially considering that my cash outlay was over $100 less than I would have spent on the Radio Shack Quick Printer. For someone with my computer budget and my computer needs, the Trendcom 100, like the TRS-80 itself, is ideal. ■

```
DECEMBER 5          -63      -100      91
DECEMBER 6          -82      -97       97
DECEMBER 7          -94      -90       100
DECEMBER 8          -100     -78       99
DECEMBER 9          -98      -62       94
DECEMBER 10         -89      -43       87
DECEMBER 11         -73      -22       76
```

Sample Listing from the Trendcom 100.

Okay, now you've had a chance to see what I have in mind for you with *80 MICROCOMPUTING*. Oh, I admit that we're just getting started and that the magazine will be improving a lot as we go along. We have some interesting ideas in the works for you.

With the TRS-80* (or 90 . . . etc.) being the most popular microcomputer in the entire world, you are going to benefit from this in many ways. The more computers there are out there of one kind . . . the more good programs you are going to have for this system. I hope that is obvious. You may be sure that *80 MICROCOMPUTING* will be packed with the shorter programs and reviews of the larger ones. You can waste an awful lot of money on stuff that looks great in the ads, but fizzles out when you try to use it. You need our reviews.

The wealth of programs will also mean that there will be much better programs for the TRS-80* than any other system. Put yourself in the seat of a computer programmer and you'll understand this. If you are going to spend several months developing a comprehensive program, and it takes all of that to write and debug a big program, would you write it for a system which has sold one hundred units or one which has sold over 300,000 systems? The answer is obvious . . . and this is why we are already seeing programs coming out for the TRS-80* which are far better than anything for any other system on the market. This is tough for other systems . . . the law of the computer jungle.

Between our connections with Instant Software, the largest publisher of microcomputer programs in the world, and Kilobaud MICROCOMPUTING, you know that *80 MICROCOMPUTING* is going to be your most important link with software for the TRS-80*.

With Instant Software being sold and promoted in every country in the world where the TRS-80* is being sold, our input of programs is also the best in the world. We get programs submitted from everywhere . . . often from 50 to 100 a week! You'll get the cream of the crop either published or reviewed in *80*.

*TRS-80 is a trademark of Tandy Corp.

HARDWARE TOO

The same law of the computer jungle holds for hardware. Would you, as a manufacturer, market an accessory for a system which has sold 100 units or would you go first for the one which has sold hundreds of thousands. It is, as with software, self-evident why the great bulk of the hardware accessories for computers are for the TRS-80* these days.

80 MICROCOMPUTING has the advantage of the use of the largest and most complete microcomputer lab in the world . . . the one developed for Instant Software and Kilobaud MICROCOMPUTING. This means that most new pieces of equipment are tested and in use by our staff . . . and this means that we can tell you what we think is outstanding . . . and where we find ripoffs. This lab is important to you.

SUBSCRIBE

If you are not already a subscriber to *80 MICROCOMPUTING*, please get signed up right now. The yearly rates are $18, and that is a bargain. Just one single program of use to you can be worth much more than that. One review of an accessory could save you many times that much investment. I would appreciate it if you would appoint yourself a committee of one to get more subscribers for the magazine. You will benefit even more than we do here at the magazine . . . because the more readers we have, the more ads we will be able to attract . . . and the more ads, the more pages of articles you will get every month.

The *80* market can, I think, support a couple of hundred pages of ads . . . and that would mean a magazine of nearly 500 pages a month. That should hold you. You may not have time left to use your computer.

ENCYCLOPEDIA

If you've read Kilobaud MICROCOMPUTING, you know that I try hard not to duplicate published material. My concept is that every reader should save every issue (we sell inexpensive boxes for this so they can sit on your library shelf) and treat the magazine as a continuing encyclopedia of computing. I make sure that much of the material in each issue is written in simple language so it will be understandable by even the rawest newcomer to computers. Oh, I have articles for the more advanced users too, so you'll have something to look back over later and use as your understanding of your system grows.

Try to think of *80 MICROCOMPUTING* as more of a large club newsletter than an ivory tower high-level publication. I'll leave the pomp to other publishers . . . the ones with the well-deserved inferiority complexes who cater to their inadequacies by publishing esoteric baloney. This magazine is written by the readers and edited by people whose aim is to help you enjoy your TRS-80*.

SAVE

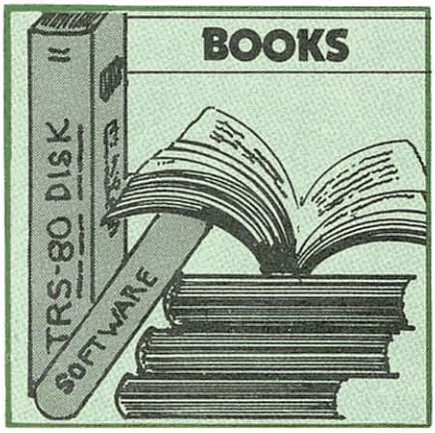
With each issue costing $2.50 at your computer store, that's $30 a year. For $18 a year you can subscribe . . . at least for now. As the magazine expands, please do not be surprised if the cover price increases, along with the subscription price. I started *73 Magazine* for radio amateurs twenty years ago with a cover price of 37¢ (two for 73¢) and it is up to $2.95 a copy now (and it is the largest of the ham magazines).

For you bargain hunters . . . and those who find that one year goes by all too rapidly, the three year rate for *80* is $45. This, too, will be going up . . . reflecting the inflation, paper increases, postage increases, and a short vacation for me in Hong Kong next year. Someone has to pay for that.

DO YOU OWN A TRS-80*?

THEN READ ON . . .

If the coupon below has been used, please fill out subscription form on the Reader Service card in the back of the magazine.



The Micro Millennium
by Christopher Evans
Viking Press
$10.95

by Nancy Robertson
***80* Staff**

Have you ever heard of compucide, or computer killers? A few weeks ago the anchorwoman on a Boston news program told listeners that an anti-computer ring had been short-circuiting computers in the metropolitan area. Other individuals had been arrested for attacking terminals with hammers and pouring honey down keyboards. The incidence of computer sabotage has become so common that a legal term has developed—compucide.

At least one of Christopher Evans' predictions from his book *The Micro Millennium* has come true: The anti-computer movement of the early phase of the Computer Revolution has begun.

The Micro Millennium claims that we are in the early phase of a sweeping cultural revolution spurred by the advent of microprocessors. The book begins with a concise and personable history of the people and scientific advancements which have brought the computer to its present development.

Eccentric Babbage

The first person to build a calculator and design a computer, Evans writes, was an eccentric Englishman named Charles Babbage. Early in the nineteenth century, Babbage built an enormous machine of cogs and wheels run by a handcrank that calculated mathematic equations. The Difference Machine, as Babbage called it, was built several decades before the discovery of electricity. While he was still working on its construction, Babbage began to design his Analytical Engine to deal with a variety of problems besides sums. Nobody paid much attention at the time.

Evans takes his readers through the stories of several other scientists and inventions until we come to the first operating computers, which came into existence in the United States and England during the second World War.

But by Evans' definition, the Computer Revolution did not begin until the invention of the transistor. In one stroke the transistor multiplied processing speeds at exponential rates, shrank the size of computers and opened the way to expanding their memory capacity.

Evans cogently predicts the computer's role in the short-term future. He compares the Computer Revolution with the Industrial Revolution which caused changes in all levels of society through "emancipation of the power of the muscles." While segments of society fought against it, the momentum of the Industrial Revolution could not be turned back. Machines replaced laborers, and a period of widespread unemployment followed. As the economy adjusted to mechanization, the work day dwindled from 18 hours to the current seven or eight hours. Society adjusted to a higher standard of living.

The Computer Revolution, Evans argues, will bring "the emancipation of the power of the brain." The changes will occur, he predicts, at unparalleled speed.

One of the main functions of computers is information storage and retrieval. Since the invention of the printing press until the present, books have been the most reliable and efficient means of recording, preserving and disseminating thoughts and facts. In a short time, Evans believes the entire contents of the Library of Congress will be able to be stored in the memory of a microprocessor. As microcomputers become as common as television sets, a greater wealth of information will be available to more people than was ever believed possible.

Because they barter information, the professions, such as law, medicine and teaching, will be the jobs most severely affected by the spread of computers, according to Evans. Changes will be so vast and so rapid that backlash is inevitable.

Businesses will be run by microprocessors communicating with microprocessors. Everybody will work shorter days. Most people will work at home. Concentration of the population in urban centers will become unnecessary. Commuting will die out. Eventually, the need to work may disappear all together.

These are just a few of the changes Evans predicts as a result of the computer's information storage and retrieval functions.

Problem Thinkers

Computers solve problems too. They think. Evans writes about the possibility of Ultra Intelligent Machines (UIMs) far surpassing the highest human IQ. Evans, a psychologist, is quite lucid about the definition of thinking. It is equally clear that he believes computers will surpass human intelligence. He gives credence to the belief that computers are already capable of creative and original thought, as opposed to programmed logic. A computer, programmed to test new proofs of Euclidean geometry, developed its own proof of the theorem "which shows that the base angles of an isosceles triangle are equal." Evans writes that the proof "had not before been known to Man."

Unfortunately, *The Micro Millennium* does not explore the ramifications of UIMs as cogently as it presents the history, present and short-term future of computers. Evans gets bogged down with straw dogs. He voices hollow objections to artificial intelligence that are transparently set up to be knocked down. The book begins to lose its interest.

In the last chapters, the focus is lost altogether. The book rambles to an unintelligent close. But before he runs out of steam, Evans is able to convince us that the Revolution is inevitable. Organized networks of compucide crusaders won't turn back the tide. ■

EDAS 4.0
Roy Soltoff
and Bill Schroeder
Galactic Software
Mequon, WI
$229

by Jake Commander

The TRS-80 Model II, presumably because it's more sophisticated than the Model I, is being approached with respect by software suppliers. The software written for it also appears to be more sophisticated (which usually means more expensive) and seems to be written with much greater professionalism.

EDAS 4.0, the editor/assembler package from Galactic Software, is no exception and has a very good chance of becoming the standard assembler of the Model II, just as EDTASM became the standard Model I assembler. The assembler uses most of the same EDTASM commands plus other more powerful additions.

EDTASM Is a Subset

Using the EDTASM commands as a subset of the EDAS 4.0 command set is one of the most attractive things about the package. A machine language programmer familiar with the Model I assembler will be able to plug in and switch on EDAS 4.0.

For the newcomer to EDAS 4.0, a full menu of commands, including syntax, is viewable merely by hitting the ENTER key. It's a thoughtful touch which saves wearing out the manual.

As you'd expect from a product of this quality, the manual is comprehensive and well laid out. It contains an in-depth overview, full command summary, and also includes a full reference list of Z-80 opcodes and address modes.

I had the pleasure of assembling a fairly large program using EDAS 4.0 and had no problems whatsoever. In fact, just like any good assembler or compiler, its usefulness is taken for granted after a very short time.

One particularly nice thing which you can do is to assemble directly to either memory or disk. That means you can check out an assembled routine quickly in RAM, return via a simple RET instruction, reassemble the routine if necessary, and save the object code as a disk object file. You can only do this when your object code doesn't overwrite the assembler itself, its symbol table or any other illegal address.

You can also use this direct-to-memory op-

tion in conjunction with the Model II debugger, giving you an extremely powerful method of developing machine code software with minimal expenditure of time and effort.

The usual options, such as line print of assembly output, pause on errors, no listing, no object code generation or no symbol table, are also available at assembly time.

The symbol table printout does lack a cross-reference index, which is something I found conspicuous by its absence. It's about the only thing I found missing from this product.

One thing I particularly liked was the object code printout from a DEFM command. Bytes are printed out in a neat block for easy reference. Model I users will remember the peculiarities of their equivalent pseudo op. Other pseudo ops supported include DEFB, DEFW, DEFS and END.

Excellent Editor

The EDAS 4.0 editor is excellent. You can edit in either line or global mode. To the layman, that means you can manipulate source code by altering single lines or by altering the whole text buffer. For instance, if you discover you've used an illegal label, opcode, or whatever, there's no problem! Just use the global replace command and you can change all the illegal references at a single stroke. The editor will display each changed string as it comes to it. EDTASM eat your heart out!

Yet another new feature which I could have used hundreds of times is a block move command. It is invaluable. If you want to move a subroutine or a table to a more convenient position in the source code, then just use a simple M command. This will move a whole block of lines from one place within the text to another, and then automatically renumber the text. It's the sort of command that makes you wonder how you previously managed without it. The renumber facility is, of course, also available as a separate command.

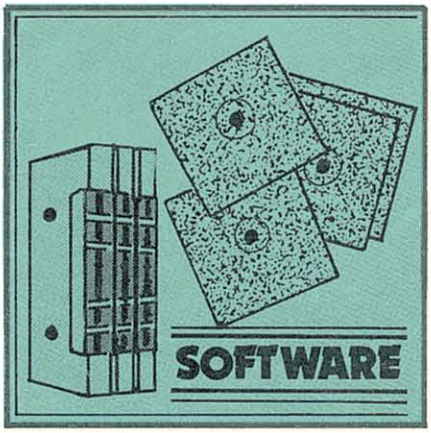
The line editor functions in the same manner as the Level II BASIC line editor, except that while in the edit mode, the edited characters appear in reverse video. All user prompts and error messages also appear in reverse video, which makes feedback just that bit more obvious.

Other thoughtful touches include a screen clear that uses the F1 key, and advancing the text page by using the F2 key. Forward and reverse scrolling is provided with the appropriate up or down-arrow key.

By now you should be getting the idea that this assembler does it all. Disk file handling is simplicity itself. W and L commands perform the writing and loading of source files. Once you've specified a source filespec, you don't need to keep repeating it in subsequent writes. The assembler will default to the original filespec if you omit it. This gives some protection against accidentally overwriting a source file by giving the wrong filespec, which can happen too easily after a long, mind-numbing session at the keyboard.

Text concatenation is yet another feature which you come to take for granted with this assembler. Model I users will, no doubt, be glad to know that source files can be transferred to EDAS 4.0 on the Model II. My own experience proved this, although it took a couple of goes before I got it right.

Though it's priced high, like most business software, no serious assembly language programmer is likely to find a more useful piece of software. ■



Pyramid
Radio Shack
Tandy Corporation
Fort Worth, TX
$14.95

by William O'Brien

Radio Shack's entry into the world of adventure games for the TRS-80 is titled Pyramid. The game is yet another example of Radio Shack's inability to deal with the consumer in a consumer's market.

An exasperated survivor of Adventureland and a glorious savior fresh from Programma's Wilderness Campaign for the Apple, I sat down to attack Pyramid.

Limited Instruction

The game's explanation is minimal. In a four-page booklet barely one side of a full page is used to explain it.

While proponents of adventure games may argue that directions should be limited to allow the user to grasp the theory and action, this is hardly fair to someone who has never been exposed to the genre.

Sadly, too, as with some other Radio Shack programs, the instructions seem to assume that the reader is either a child or an adult with the mentality of a slightly premature corned beef.

Pyramid suffers from the lack of a command word base. Command words reviewed in Pyramid are limited to GET, GO, SCORE, LOOK, INVENTORY, TAKE, DROP, THROW, CLIMB and HELP. Although this might seem a sizable base for a vocabulary, I don't think it is sufficient.

The scenario starts with the would-be explorer in the desert, standing in front of the tip of a Pyramid. You proceed using the assumed and known vocabularies.

Firstly, the LOOK command produces a "You can't go in that direction" response when nothing is apparent. More correct would be an "I see nothing," or "Nothing is there." "Looking" is not synonymous with "going" in the real world, however, the words seem to prompt similar responses in this game.

We go down a passageway, collect a few items, perhaps chase the elusive statue of a bird that comes alive if you approach it. A little exploration nets us a scepter with an ankh at the top and a small empty box.

Down some steps, we enter a vast hall stretching almost endlessly toward the west. Two passages appear, one on either side, with another set of stairs leading down.

We may, at this point, discover a lump of gold in a room down the left passage, along with a sign that says, "You'll never get it up the stairs." And you can't.

The north passage to the throne room is guarded by an industrious serpent. Should we choose the lower passageway, we find the same snake (or its twin sibling) guarding an identical passage. That leaves us the long stretch to the west.

Hope not here, pilgrim. There, a bottomless chasm is impossible.

Don't try to jump it, you won't make it. You can try typing HELP, but don't expect any. You will only see the response, "I'm as confused as you are!"

It seems that this is the only response programmed for that command (or so I was told by a member of Computer Services), and it is the only response you will get.

You're on your own.

If you try climbing down, you can't. You can't go around, either. I decided that my only alternative was to do something not mentioned in the meager instructions. I called Texas.

Go Wave a Scepter

That call was as enlightening as typing HELP. I was told I should try waving my magic scepter. What magic scepter, I naively asked. Why, the magic scepter I must have picked up in another room.

"The one with the ankh on it?" I queried.

"Yes," a voice squeaked out.

"But it never said it was a *magic* scepter," I replied.

That's the point of the game; you have to find these things out, I was told.

I was so disgruntled that I didn't return to the game. But that was because of the answer to my final question.

"Are you people down there really happy with the way this game performs?" I asked, and immediately dreaded the question.

"Of course we are!" I was told.

"You mean, you find nothing wrong in the way it operates?" I pried.

"No, not at all," he said, "in fact, a lot of people have called to complain that it is too difficult and to find out how to use it." ■

↙Reader Service index—see page 194

THE ASSEMBLY LINE

by William Barden, Jr.

"The algorithm for the ping-pong simulation is fairly simple, at least for this specialized case."

In a previous column, we looked at a high-speed graphics subroutine called SET. This month we're going to finish the discussion of high-speed assembly language graphics by showing how a modified version of SET can be used for graphics that may even operate too fast for some applications! (And they said that assembly language wasn't useful...).

The new version of SET is shown in Listing 1. It has been modified to provide a reset capability. As in the old version, the position of the pixel to be set or reset is in the HL register pair on subroutine entry. The H register contains an X value of 0 through 127, while the L register contains a Y value of 0 through 47. In this version, however, the A register contains a zero if the pixel is to be set and a one if the pixel is to be reset.

To use the subroutine, put a valid value for X and Y in the HL register pair, and set the A register to a 0 or 1. The subroutine will set or reset the specified pixel and return to the calling program.

We won't repeat the discussion of the basic operation of the SETRST subroutine except to say that it converts the X,Y coordinates into a character position (0-1023) and bit position within the character position (0 through 5), and then sets or resets a single bit of the 6144 bytes within video display memory to change the pixel, or picture element. A complete discussion can be found in the previous column.

This month's version retains all of the old code and adds some reset logic. The new code is indicated by the boxed-in areas of the figure. Setting a pixel involved loading the byte in video display memory that contained the pixel involved, ORing in a single bit for the pixel position, along with the graphics mode bit in bit 7, and storing the altered byte back in video memory.

Resetting a pixel is very similar. After the byte containing the pixel is loaded, the single bit for the pixel is reset by ANDing in a mask value from the MASK1 table. This mask value has all bits set except for the bit to be reset for the pixel.

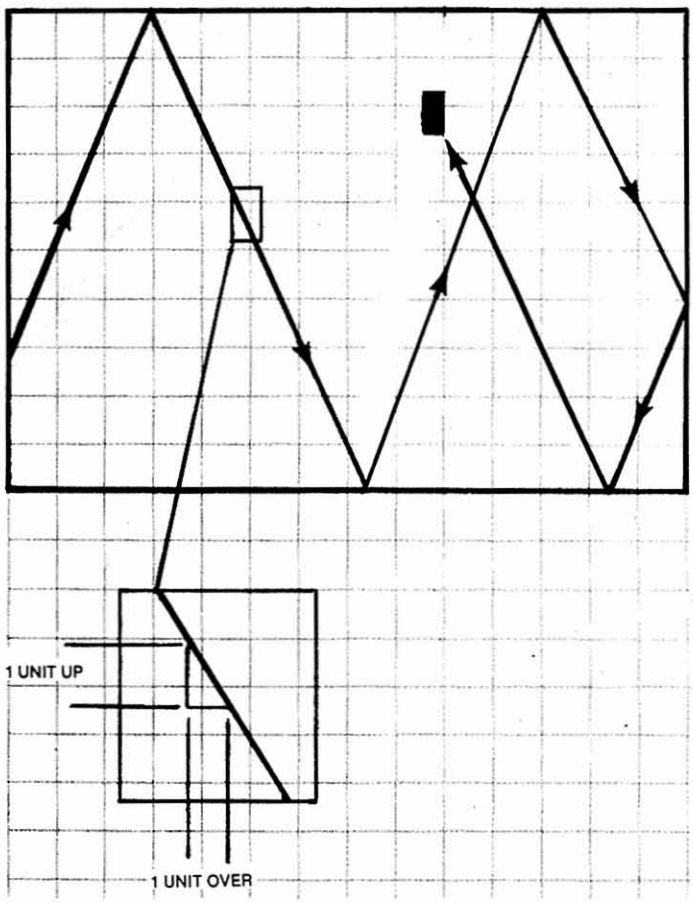


Fig. 1.

How Fast Is This Subroutine

Let's approximate its speed by a method that you can use for other assembly language code.

Follow the path of SETRST for either function and count the number of instructions as if you were the TRS-80. Assume some nominal case for loops. Going through the code we have lines 740,50,60,70,80,90,800 and 810. Line 800 is executed in about one-half the time, and we'll add it in here. Lines 810 through 840 constitute a divide by three through successive subtraction. Assuming an average Y of 24, we have about 27 instructions. Seven lines plus 27 is 34; plus seven more through line 910 is 41.

At line 920 we have another loop of six iterations, making twelve more instructions for a total of 53. From here there are no more loops, and we can simply count the lines, assuming either a SET or REST path. I count 14 more for SET and 15 for RESET, for a grand total of 67 or 68. Let's call it 68 instructions to perform either a SET or RESET pixel.

Now, how do we convert the instructions to execution time? We know that the TRS-80 runs at 1.774 megahertz, and that the execution times in the Radio Shack or Zilog assembly manual are in terms of a 4-MHz clock. Consequently, the TRS-80 runs 4/1.774 times slower than a 4-MHz processor (except for you readers who have installed the 144-MHz clock speed-up kit, of course).

Let's assume an average instruction speed of 2.5 microseconds for 4 MHz. In TRS-80 terms, this is 2.5 * 4/1.774, or about 5.6 microseconds. The total execution time to set or reset one pixel in the SETRST subroutine, then, is about 68 * 5.6 microseconds or 380 microseconds, or .4 milliseconds (.4 thousandths of a second). Putting it another way, the number of pixels or points that can be processed by SETRST is about 2500 per second.

AL VS BASIC Graphics

How does this speed compare with BASIC? The SET,RESET commands in BASIC operate at about 122 pixels per second. Setting or resetting random pixels by POKEing values at best is about 800 pixels per second for truly random data. Strings are great for contiguous data on the same line, but too inefficient for random data. (For a discussion of these methods and their use see Radio Shack's new book *Program-*

ming Techniques for Level II BASIC by William Barden, Jr. Uh...no relation.)

A speed of 2500 points per second sounds very fast, and for some applications it is. As a matter of fact, for some applications, it's simply much too fast! An example is shown in the driver code below. A driver program, by the way, is generally main line code that is the primary code of an application. In this case, the driver produces a ping pong ball that bounces between the limits of the screen.

The driver is shown in Listing 2. We'll explain the algorithm and then go part-by-part through the driver program so that you can see how it works.

The algorithm for the ping-pong simulation is fairly simple, at least for this specialized case. We've defined the angle to be used as "one unit up for one unit over" as shown in Fig. 1. As each pixel is rectangular, this amounts to a rather acute angle with the top and bottom boundaries, as shown in the figure.

As the angle after the impact equals the angle before impact, we can always work with "one unit up for one unit over." The current position is given by X and Y. In standard TRS-80 notation: X = 0 through 127, left to right and Y = 0 through 47, top to bottom. The next position is calculated by adding increments, or "deltas" to both X and Y. These deltas will always be a plus one or a minus one to give the next X or Y value.

Whenever the ping-pong ball pixel hits a boundary, the current delta associated with that boundary is reversed. Boundaries occur at X = 0 or 127 and Y = 0 or 47. Suppose that the ball (pixel) is traveling towards the Y = 0 boundary as shown in Fig. 2. The delta X value is + 1 and the delta Y value is − 1. If the next Y value will be 0, the new deltas will be X = + 1 (unchanged) and Y = + 1 (negated).

The algorithm may be stated as follows:

1. If current X is 0 or 127, negate delta X. Leave delta Y.

2. If current Y is 0 or 47, negate delta Y. Leave delta X.

```
                00690 ;* SUBROUTINE TO SET OR RESET A PIXEL GIVEN X (0-127)   *
                00700 ;* IN H REGISTER AND Y (0-47) IN L REGISTER.             *
                00710 ;* (A)=0 FOR SET, 1 FOR RESET.                          *
                00720 ;*************************************************
                00730 ;
805D F5         00740 SETRST  PUSH   AF              ;SAVE SET/RESET FLAG
805E 5C         00750         LD     E,H             ;X
805F 7D         00760         LD     A,L             ;Y
8060 CB3B       00770         SRL    E               ;GET CHAR POSITION (0-63) IN E
8062 1600       00780         LD     D,0             ;SET COL# TO 0
8064 3001       00790         JR     NC,SET10        ;GO IF COL#=0
8066 14         00800         INC    D               ;COL#=1
8067 06FF       00810 SET10   LD     B,0FFH          ;-1 TO B
8069 04         00820 SET20   INC    B               ;BUMP QUOTIENT IN B=LINE#
806A D603       00830         SUB    3               ;SUCCESSIVE SUBT FOR /3
806C F26980     00840         JP     P,SET20         ;GO IF NOT NEGATIVE
806F C603       00850 SET25   ADD    A,3             ;ADD BACK FOR REMAINDER=ROW#
8071 07         00860         RLCA                   ;(ROW#)*2
8072 82         00870         ADD    A,D             ;(ROW#)*2+COL#=BIT POS
8073 4F         00880 SET27   LD     C,A             ;SAVE BIT POS IN C
8074 68         00890         LD     L,B             ;LINE #
8075 2600       00900         LD     H,0             ;NOW IN HL
8077 0606       00910         LD     B,6             ;SHIFT COUNT
8079 29         00920 SET30   ADD    HL,HL           ;MULTIPLY LINE#*64
807A 10FD       00930         DJNZ   SET30           ;LOOP TIL DONE
807C 1600       00940 SET32   LD     D,0             ;DE NOW HAS CHAR POS
807E 19         00950         ADD    HL,DE           ;(LINE#)*64+CHAR POS IN HL
807F 11003C     00960         LD     DE,3C00H        ;START OF VIDEO
8082 19         00970 SET34   ADD    HL,DE           ;(LINE#)*64+CHAR POS+3C00H
8083 0600       00980         LD     B,0             ;BC NOW HAS BIT POS
8085 F1         00990         POP    AF              ;GET SET/RESET FLAG
8086 B7         01000         OR     A               ;TEST FLAG
8087 200C       01010         JR     NZ,RESET        ;GO IF RESET
8089 DD21A180   01020         LD     IX,MASK         ;START OF MASK TABLE
808D DD09       01030         ADD    IX,BC           ;POINT TO MASK
808F 7E         01040         LD     A,(HL)          ;LOAD PIXEL
8090 DDB600     01050         OR     (IX)            ;SET PIXEL
8093 77         01060 SET36   LD     (HL),A          ;STORE IN VIDEO
8094 C9         01070         RET                    ;RETURN
8095 DD21A780   01080 RESET   LD     IX,MASK1        ;RESET MASK TABLE
8099 DD09       01090         ADD    IX,BC           ;POINT TO MASK
809B 7E         01100         LD     A,(HL)          ;LOAD PIXEL
809C DDA600     01110         AND    (IX)            ;RESET PIXEL
809F 18F2       01120         JR     SET36           ;GO TO STORE, RETURN
80A1 81         01130 MASK    DEFB   81H             ;MASK TABLE
80A2 82         01140         DEFB   82H
80A3 84         01150         DEFB   84H
80A4 88         01160         DEFB   88H
80A5 90         01170         DEFB   90H
80A6 A0         01180         DEFB   0A0H
80A7 FE         01190 MASK1   DEFB   0FEH
80A8 FD         01200         DEFB   0FDH
80A9 FB         01210         DEFB   0FBH
80AA F7         01220         DEFB   0F7H
80AB EF         01230         DEFB   0EFH
80AC DF         01240         DEFB   0DFH
0000            01250         END
00000 TOTAL ERRORS
```

Listing 1.

Simulating Motion

To simulate motion of a dot, the next pixel must be turned on, and the previous pixel must be turned off rapidly. (There are some aesthetics to this that are not easily defined, such as the length of time between turning on the next pixel before turning off the old, but we'll plunge ahead without regarding them.) The driver program in Listing 2 first calls SETRST to set the new pixel, and then calls SETRST to reset the old pixel.

The section of code from line 160 through line 230 clears the screen by storing an 80H value in all 1024 character positions. The value 80H sets the graphics mode (bit 7 is a one) and sets the six pixels of each character position to 0. An interesting point: A blank character position may be made up of an 80H character, or an ASCII blank, 20H. Setting all character positions to 80H initializes all character positions to graphics mode. A count value of 1023 is decremented down to − 1 by adding − 1 to the value in HL. A "no carry" is produced only when the contents of HL goes from 0 to − 1.

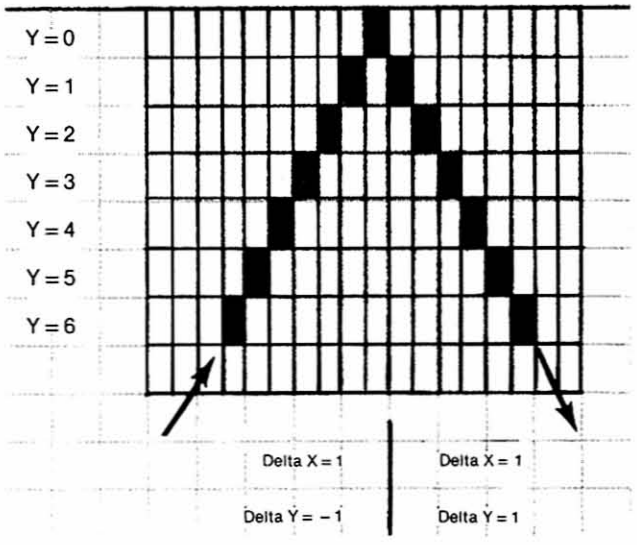


Fig. 2.

```
8000            00100          ORG     8000H           ;CHANGE AS REQUIRED
                00110 ;*****************************************************
                00120 ;* TEST DRIVER FOR SETRST SUBROUTINE, SIMULATES A PING- *
                00130 ;* PONG TYPE COMPUTER GAME BY MOVING A SINGLE PIXEL.    *
                00140 ;*****************************************************
                00150 ;
8000 3E80       00160 DRVR     LD      A,80H           ;GRAPHICS ALL OFF
8002 DD21003C   00170          LD      IX,3C00H        ;SCREEN START
8006 11FFFF     00180          LD      DE,-1           ;INCREMENT
8009 21FF03     00190          LD      HL,1023         ;# OF BYTES
800C DD7700     00200 LOOP     LD      (IX),A          ;STORE CHARACTER
800F DD23       00210          INC     IX              ;BUMP POINTER
8011 19         00220          ADD     HL,DE           ;DECREMENT COUNT
8012 DA0C80     00230          JP      C,LOOP          ;GO IF NOT 1024
8015 211010     00240          LD      HL,1010H        ;X=16, Y=16
8018 01FF01     00250          LD      BC,01FFH        ;DELTA X=1, DELTA Y=-1
801B 7C         00260 LOOP1    LD      A,H             ;GET CURRENT X
801C 80         00270          ADD     A,B             ;ADD DELTA X
801D 67         00280          LD      H,A             ;RESTORE
801E 7D         00290          LD      A,L             ;GET CURRENT Y
801F 81         00300          ADD     A,C             ;ADD DELTA Y
8020 6F         00310          LD      L,A             ;RESTORE
8021 225B80     00320          LD      (LAST),HL       ;SAVE SET POSITION
8024 E5         00330          PUSH    HL              ;SAVE CURRENT POSITION
8025 C5         00340          PUSH    BC              ;SAVE DELTAS
8026 AF         00350          XOR     A               ;FOR SET
8027 CD5D80     00360          CALL    SETRST          ;SET PIXEL
802A C1         00370          POP     BC              ;RESTORE DELTAS
802B E1         00380          POP     HL              ;RESTORE CURRENT POSITION
802C 7C         00390          LD      A,H             ;GET CURRENT X
802D B7         00400          OR      A               ;TEST FOR ZERO
802E 2804       00410          JR      Z,JMP1          ;GO IF 0
8030 FE7F       00420          CP      127             ;TEST FOR 127
8032 2004       00430          JR      NZ,JMP2         ;GO IF NOT 127
8034 78         00440 JMP1     LD      A,B             ;GET DELTA X
8035 ED44       00450          NEG                     ;NEGATE
8037 47         00460          LD      B,A             ;RESTORE IN B
8038 7D         00470 JMP2     LD      A,L             ;GET CURRENT Y
8039 B7         00480          OR      A               ;TEST FOR ZERO
803A 2804       00490          JR      Z,JMP3          ;GO IF 0
803C FE2F       00500          CP      47              ;TEST FOR 47
803E 2004       00510          JR      NZ,JMP4         ;GO IF NOT 127
8040 79         00520 JMP3     LD      A,C             ;GET DELTA Y
8041 ED44       00530          NEG                     ;NEGATE
8043 4F         00540          LD      C,A             ;RESTORE IN C
8044 E5         00550 JMP4     PUSH    HL              ;SAVE CURRENT POSITION
8045 C5         00560          PUSH    BC              ;SAVE DELTAS
8046 210005     00570          LD      HL,500H         ;FOR DELAY
8049 01FFFF     00580          LD      BC,-1           ;DECREMENT
804C 09         00590 LOOP2    ADD     HL,BC           ;DECREMENT COUNT
804D 38FD       00600          JR      C,LOOP2         ;DELAY HERE
804F 2A5B80     00610          LD      HL,(LAST)       ;GET LAST SET
8052 3E01       00620          LD      A,1             ;FOR RESET
8054 CD5D80     00630          CALL    SETRST          ;RESET PIXEL
8057 C1         00640          POP     BC              ;RESTORE DELTAS
8058 E1         00650          POP     HL              ;RESTORE CURRENT POSITION
8059 18C0       00660          JR      LOOP1           ;CONTINUE
805B 0000       00670 LAST     DEFW    0               ;LAST POSITION
                00680 ;*****************************************************
```

Listing 2.

Line 240 initializes the current X,Y and delta values. A delta X of 1 means that the dot moves to the right; a delta of −1 means that the dot moves upward.

The code from line 260 through 660 is the main loop of the driver program. The code flows from top to bottom with only one imbedded loop from line 590 through line 600.

The code at LOOP1 adds the current delta X to the current value of X and the current delta Y to the current value of Y. This produces the new X,Y position. This position is saved in variable LAST for later use. After the new X,Y position is computed, a call is made to SETRST for setting the pixel. The HL and BC register pairs are saved in the stack before the call and restored after the call as SETRST destroys the contents of both.

The code from line 390 through 550 performs the boundary test. If the dot has just been written to a screen border (X = 0 or 127, Y = 0 or 47), the delta X or Y is negated, changing the direction away from the border on the next computation of X,Y.

The code from line 570 through 600 is simply a time delay that delays by decrementing the initial value in HL by one each time through the loop. A minimum delay occurs with a LD HL,0, and a maximum delay occurs with a LD HL,65535.

The last action in the driver is to CALL SETRST to reset the pixel set previously before the time delay. The position of the pixel is in variable LAST, and this is loaded into HL with a subsequent call to SETRST.

The program loops continuously, moving the dot forever.

If you will enter the code into your Editor/Assembler, assemble and execute it, you will see a moving dot virtually identical to a electronic ping-pong game that bounces back and forth at angles to the boundary. It is not difficult to see how an actual ping-pong or other action game could be programmed this way.

One of the most interesting things about the method is that the speed of the dot is much too fast when the minimum delay is used in the loop at 570. The dot moves so rapidly through the screen that it looks like a random pattern! A delay count of 500H slows it down to acceptable levels. Try experimenting with various delay counts and observe the effects.

Is complicated animation possible using SETRST? Yes, with some limitations. One of the first considerations is speed. Even though the dot moved (and having moved, wrote on) and had to be slowed down considerably, writing a series of dots for the frame of an animated picture is a different matter.

If the number of pixels that change per frame is "sparse," then the old pixels can be reset and a new group written. Suppose that one third of the pixels are on in a frame and that roughly the same number are to be on in subsequent frames. If one-third are reset, and a new one-third are then set, about 4096 calls are made to SETRST. It requires slightly under two seconds to process the sets and resets, making the updating process about one-half frame per second, which is certainly no Fantasia.

Taking a different analysis, ask yourself the question: How many pixels can be updated for a frame rate of 10 frames per second? If 2500 pixels can be processed per second, then about 125 pixels can be processed per frame, not counting the overhead of grabbing the data representing the pixels to be set and reset. This is still a fast enough rate to merit some experimentation in animation. It will be left up to the reader as a study assignment...

Another factor in animation, of course, is the method of digitizing the data. How are a series of drawings converted, easily and rapidly, into a set of X,Y points for SETRST to use? There appears to be no answer to this question, at least with existing I/O devices. What is required is some kind of scanning digitizer.

A third problem is accessing the data. Certainly disk storage is fast enough to keep up with the data for display. If the data is arranged in table form, then it can be scanned sequentially and rapidly by using some of the techniques discussed in last month's column. A possible scheme for storing the data is to use three bytes for each data entry in a table. The first byte represents the SET/REST code (0 or 1), and the next two bytes represent the X and Y values respectively. Other bells and whistles, such as a function code (such as 2) for time delay are also feasible. The actual overhead in accessing tables of data for SETRST would be minimal compared to the processing time of the set and reset.

```
TABLE DEFB 0       ;SET
      DEFW 0607H   ;X=6,Y=7
      DEFB 1       ;RESET
      DEFB 0508H   ;X=5,Y=8
```

Next month we'll have the results of the second Assembly Line Programming Contest in which readers strive to write a multiply subroutine. (Would you believe a reader discovered a multiply instruction among the hitherto undiscovered Z-80 superset of 8123 instructions?) ■

For those of you who would like to contact me directly with problems or contest entries, write:

William Barden
28182 Palmada
Mission Viejo, CA 92692

MEMORY EXPANSION FOR TRS-80*

All you have to remember is to plug it in

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MEMORY TRANSPLANT

80 APPLICATIONS

by Dennis Kitsz

"When BASIC executes, it is regularly sweeping through parts of the Level II reserved RAM, a section of memory inaccessible to the user. . .

"Execution dashes madly hither and yon; the TRON function gives a good picture of the execution path, but lines scroll wildly up and out before I can begin to see what any of them are."

Indeed, anyone trying to find out which line just executed a clear-screen command would agree with Mr. McRae. "Do you know any procedure for single-stepping in BASIC?"

When BASIC executes, it is regularly sweeping through parts of the Level II reserved RAM, a section of memory inaccessible to the user because of the BASIC program itself. In this area, calculations are stored, data moves in and out from tape, and much other vital, but variable information is held.

The authors of the language anticipated future expansions of many kinds, and so also provided a "telephone switchboard" arrangement, whereby every major ROM activity first loops through some RAM to find its next electronic pathway. We can intercept any loop at its RAM switchboard, patching in various routines such as key debounce, upper/lowercase software, time/date, and so on. For example, the keyboard scan sweeps through hex locations 4016 to 4017; video passes through 401E to 401F; a line printer would use 4026 and 4027.

Single Stepping

To single-step BASIC, we intercept the BASIC "interpreter", which can be collared at locations 4004 and 4005. The entire process is but three steps:

1. Grab hold of the interpreter loop and divert it to the single-stepper.
2. Before it can continue to interpret the next step, have it wait for a human go-ahead signal.

"Pat rang me up at bargain rate time, only he lives in California."

3. Delay it slightly before letting it move on to its original destination, in order to follow it better.

Program Listing 1 presents the 28-byte program, the first part of which is devoted simply to setting up the program. Line 10 assigns the start of our intercept routine to the HL register, line 20 patches it into the interpreter at 4004/4005 hex, and line 30 jumps back to a BASIC "ready" at 06CC.

The actual stepping routine is a mere 19 bytes. It first saves the two active register pairs (AF and BC). At line 60, the accumulator is told to obtain the value present at address 3880 hex—the keyboard row containing only the shift key (and a control key if you've modified your unit). By itself, Shift offers a BASIC program no information, thus making it an ideal "single-stepper" key.

If Shift is not depressed, there will be no data present at address 3880H. Thus, zero AND zero (the accumulator ANDed with itself) sets a "zero flag," and line 80 is forced to loop back and check again. When at last Shift is depressed, the loop falls through, and the program continues to line 90.

At that point, register pair BC is assigned a hex value of 2000 (This is an arbitrary value, and may be lengthened.), and next CALLs a delay routine available in ROM at address 0060. At the end of the delay, both registers are restored, and the program proceeds with a jump to 1D78 . . . the original value found in locations 4004 and 4005.

It's just about as simple a utility as can be found, and the machine version loads from tape in one-half second. Two cautions should be noted: First, load this program only after the BASIC program you wish to step through is in place, because this routine single steps CLOAD as well! If you use the BASIC version (Listing 2), key it in at the end of your BASIC program under scrutiny, and run it separately; the lines may then be deleted. Secondly, remember to protect memory at 32739 for your 16K machine.

With the given delay, execution is slowed to about five BASIC actions per second; a measure of that rate is the short stepper program itself, which takes six seconds to list five lines. Reducing the delay to 0001 will bring program operation closer to normal speed.

```
                00000              ORG     7FE4H          ;32740 DECIMAL
21 ED 7F        00010    SETUP     LD      HL,START       ;ADDRESS TO PATCH
22 04 40        00020              LD      (4004H),HL     ;THIS IS PATCH TO BASIC
C3 CC 06        00030              JP      06CCH          ;"READY" WHEN DONE
F5              00040    START     PUSH    AF             ;SAVE ACCUM. & FLAGS
C5              00050              PUSH    BC             ;SAVE COUNTER IN USE
3A 80 38        00060    LOOP      LD      A,(3880H)      ;SHIFT KEYBOARD ROW
A7              00070              AND     A              ;TEST FOR ZERO
28 FA           00080              JR      Z,LOOP         ;GO BACK IF NO KEY
01 00 20        00090              LD      BC,2000H       ;LOAD UP DELAY VALUE
CD 60 00        00100              CALL    0060H          ;DELAY ROUTINE IN ROM
C1              00110              POP     BC             ;RESTORE B & C REGISTERS
F1              00120              POP     AF             ;RESTORE A & F, TOO
C3 78 1D        00130              JP      1D78H          ;BACK WHERE YA SHUDDA BEEN
                00140              END     SETUP          ;SET SLASH (/) ENTRY
```

Program Listing 1.

```
10  POKE 16553,255 : REM * CORRECTS LEVEL II READ-DATA ERROR
20  FOR X = 32740 TO 32767 : READ A : POKE X,A : NEXT X
30  POKE 16526,228 : POKE 16527,127 : MZ = USR (0)
40  DATA 33,237,127,34,4,64,195,204,6,245,197,58,128,56
50  DATA 167,40,250,1,0,32,205,96,0,193,241,195,120,29
                        delay
```

Program Listing 2.

Readers Respond

Many more readers have written or called than need to; here are a few suggestions before you dial my number:

- Daniel from Utah was the fourteenth person to call about "typos" in Babyroot. Never trust your own proofreading; have a friend, preferably one who knows nothing about computers, read the program aloud to you. Dan's 12-year-old son caught the mistake.
- Roy phoned from Illinois angrily demanding to know why a program wouldn't work on his disk-based system. This column is biased toward the "standard" TRS-80, which is 16K Level II. If you've got the luxury of extras, it means you've also got a bit of conversion work to do. Disk users, please read your manuals instead of sending

"corrections" of my failure to include DEFUSR statements. Level II has but one USR command.

- Dave wrote from New York asking why his control key wouldn't function. It is vital to understand the operation of any published modification. Minor inconsistencies are almost inevitable, but understanding the theory of operation will assist your diagnosis. Dave's problem was an incorrectly routed wire which was easily eked out by running a one-line BASIC program.
- From Maine, Rick called with a computer buzzing angrily after he attempted a reverse-video alteration. If you do call, have your computer, tech manual, soldering iron, wire, paper, pencil, and telephone sharing the same desk. When Rick's son called back (Dad had left for a school board meeting.) with everything at hand, a successful repair—a wayward solder ball—was ten minutes away.
- Pat rang me up at bargain rate time, only he lives in California. I am not alert at 2:45 a.m.

Anecdotes Too

It's lazy summer anecdote time . . . how about this one? John from New York State is a TRS-80 enthusiast, and was attempting some hardware modifications. The local Radio Shack begged ignorance over wire-wrap wire ("But that's got no insulation," said the clerk.), so John used 18-gauge solid copper.

Well, that's good for light bulbs and power tools, so I need not detail the mess in which John shortly found himself. A desperate voice greeted me late one evening, relating the grim escapade. The computer had failed to exhibit normal signs of life, so John took it to Radio Shack for a repair estimate. It was returned with a quote of $460. *Four-hundred-sixty dollars!*

Radio Shack does not take kindly to modifications, and discourages repairs by giving unreasonably high estimates.

John, soon to be an electrical engineering student, was mortified. Mom didn't know, and he was loathe to break the news. What could he do?

A bit of telephonic diagnosis narrowed his options. During our conversation, John also revealed that, faced with the potential Radio Shack repair ticket, he had tried to remove and replace the integrated circuit which he believed to be the culprit. His TRS-80 was, it seemed, a bit messy. He had lifted traces and burned the board with an overheated soldering iron; the desperation grew in his voice.

I agreed to take on the repair, if he shipped the unit and all the bits and pieces that were left over from his attempts. All ye weary who labor, take heart. John's TRS-80 was in about the worst condition I had seen since a buddy's PDP-11 had been zapped by lightning during a very macho game of "chicken," played while an electrical storm raged over a meeting of the Vermont Computer Guild.

I bridged the traces on John's 80, cleaned the board and discovered the problem in a fried buffer chip—a 75-cent item. It was little more than an hour's work . . . four-hundred-sixty dollars indeed! I installed the modifications John wanted and shipped the unit clean and sparkling back to New York.

Two days later, another phone call. The voice had the same hard edge of panic. The postal service had delivered the box—crushed, gashed and not working. The postmaster said he'd have to have the unit for eight weeks—(for "examination"—while a claim was being processed.

John took it apart instead. He found the difficulty in the ROM board's connections, shaken loose by its ordeal.

The TRS-80 is working again, three weeks and much anguish later. The moral? No moral. It's summer. Just watch that 18-gauge wire. ■

For readers who'd like to contact Dennis directly, try writing: Roxbury, VT 05669.

9999 PRINT#-1," " : A$ = INKEY$: IF A$ = "" THEN 9999 ELSE RETURN
Plug your computer's cassette output into an audio amp, and insert a GOSUB 9999 at any place in a program that needs your attention. It will call you; press a key and the program continues.

9999 A$ = INKEY$: IF A$ = "" THEN 9999 ELSE LPRINT A$: GOTO 9999
Here's a quick electronic typewriter. It's non-correcting, for sure, but beats loading a word processing program to add a few comments to a printout.

9999 FOR X = 17129 TO 32767 : PRINT CHR$ (PEEK (X)); : NEXT X
Put this one in at the end of a program and have a look at how a BASIC program and its variables are stored in memory. If you run X from zero to 12288, you can take a peek into ROM as well.

9999 FOR X = 1 TO 50 : OUT 255,0 : OUT 255,15 : NEXT X : OUT 255,PEEK(16445) : RETURN
This is a subroutine that rattles the relay and jitters the screen; great for some dull games that might need some life.

Finally, poke your 80 in the ribs with these:
POKE 16405,0 and kill the keyboard; POKE 16405,1 to get it back. Don't do that from command level.
POKE 16413,0 kills video; get it back with POKE 16413,7.

One Liners

↙Reader Service index—see page 194

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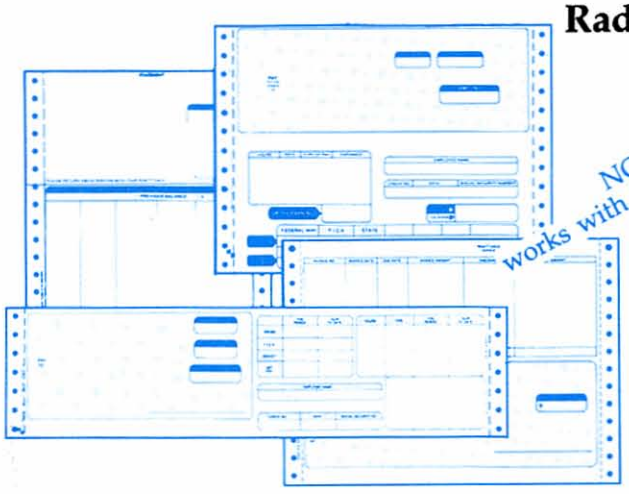
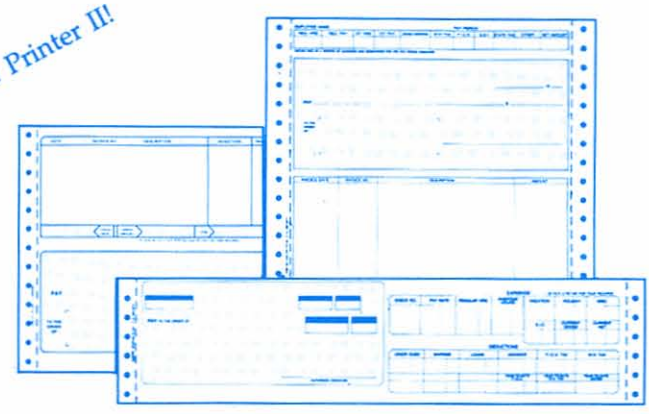
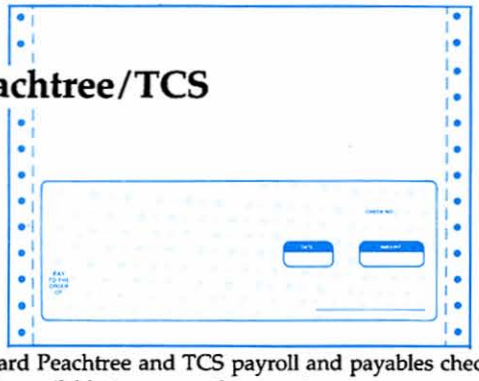


Standard Radio Shack payroll checks, payables check, and statement. These forms are designed for use on fixed and adjustable pin-feed printers. Also, a 20% first order discount is available for these forms only.

Osborne



Peachtree/TCS



Standard Peachtree and TCS payroll and payables check. This form is available in one or three part.

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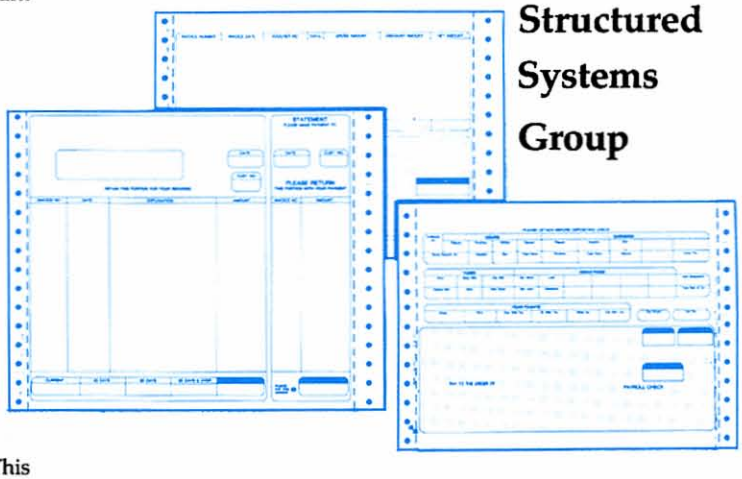

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TRS-80 FORMS

80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

"If this is an example of financial software. . . in the future, businessmen and professionals may rejoice."

In the January issue of *80 Microcomputing*, I described basic requirements for automated accounting recordkeeping systems and discussed in detail some of the currently available financial software. The introduction of the Model II, and the development of more advanced software has increased the range of recordkeeping alternatives available to microcomputer users. With this in mind, I think it is now appropriate to discuss some financial reporting concepts before reviewing the latest software available.

Recordkeeping at Fault

In our practice my partners and I visit many clients who complain about their financial reports. Frequent complaints include, "my income statement is always late," or, "when it arrives I don't understand what it is trying to tell me." When the facts are probed, the accounting recordkeeping system is usually at fault. Often it is full of extraneous detail and too complicated to be practical for preparing management reports.

In a more compact system data does not have to subdivided, and the chance of misclassification is significantly reduced.

If you are installing a microcomputer accounting system, take the opportunity to review your chart of accounts with the help of your accountant.

Consider how you plan to use a system such as Radio Shack's General Ledger II and its reports to control your business. For example, how do you look at sales? Do you sell only one commodity or many? If you sell many different types of items, do you need to know sales, sales returns and net sales by type?

If you sell only three items, such as nails, screws, and bolts, your recordkeeping system will have to keep track of the dollar value of all sales and related transactions for each of these categories. This includes sales, sales returns, purchases and inventory categories. Thus, to determine the net profit contribution for each category, you must keep 12 different accounting records.

The general ledger recordkeeping system is not the best place to analyze gross profit by item. Radio Shack has provided another system for this purpose called the Inventory Management System. This system could be used with the accounting system as a control.

The same concepts of simplified recordkeeping should govern the choice of operating expenses. If your business is run from one office, then all you need is one cost center. However, if there is a warehouse and a sales office, each facility should have its own cost center, and each will have its own group expenses. Although there are some benefits with this approach there are also problems. For example, if each of these facilities are located under the same roof, you must allocate common services, such as light, telephone and power to each cost center.

Model I to Model II

Let's take a look at Radio Shack's General Ledger II and see how it compares to the Model I General Ledger previously reviewed. There are many similarities. Like its predecessor, General Ledger II has categories to group accounts to facilitate analysis on the income statement and balance sheet.

Ledger II, provides ten categories for the income statement and six for the balance sheet. The first three expense categories are pre-defined as gross sales, sales returns and allowances and cost of goods sold. If you don't use sales returns and allowances or cost of sales, as in a service business, these categories shouldn't be used according to the documentation.

Like the Model I, there are categories available for the balance sheet. However the Model II allows six different categories, current assets, fixed assets, current liabilities, long term liabilities and capital. You define the balance sheet during data entry.

As with the Model I, the posting procedure requires the assignment of the document name. The machine generates a serial number for each document entered. Like the Model I, the Model II posting procedures are very slow. However, documentation supports the posting procedure and an audit trail is generated.

The General Ledger II program represents a usable tool for the average businessman. In addition, the greater data on the balance sheets allows the professional accountant to calculate solvency ratios, fund management ratios and return on investment ratios which were impossible in the earlier version.

The level of documentation that accompanies the General Ledger II represents a significant improvement from that furnished for the Model I. Radio Shack has provided a sample session to be performed prior to initializing your own accounts. This session covers enough different types of transactions to familiarize an operator with the responses required.

I would like to commend Radio Shack on the interactive screen displays used on the General Ledger. Account maintenance and updates are quite easy. If this is an example of financial software which Radio Shack will be presenting in the future, businessmen and professionals may rejoice. Since the output reports have a place to indicate source, there may be some attempt in the future to intergrate accounts payable and receivable modules into the General Ledger. ■

EDIT 80

by Jim Perry

The subtitle for this month's column could be "A Parting Shot," as I am leaving the hills of New Hampshire, and *80*, for the hills and volcanoes of the West Coast. The response to *80* has been overwhelming. Everybody seems to love it—except for Tandy. But times change, and I'm glad to say that Tandy has now asked Ed Juge to write a regular column for *80* beginning this month. The corporate structure in Fort Worth seems to have realized the folly of its ways.

But, to mix a metaphor or two, an old leapard learns new tricks. Tandy's latest trick is their introduction of a new "improved" two-chip ROM set for Level II. (Previous versions used three chips.)

At first this seems like a simple enough change, and it does away with the messy ribbon cable inside your machine. However, there are a couple of catches in the new version. First, the shift-down arrow combination is not recognized by the computer. A great deal of software uses this combination as a control key, but, of course, this software is not "approved" by Radio Shack. Such software will now need reworking to be compatible with all TRS-80s.

The second (unannounced) nasty is a different memory size. A two-byte difference may not seem important to Fort Worth, but it can mean a hell of a lot to beginners—all instructions, for example, now give the wrong figure —and assembly language programmers—by not reserving enough memory.

Though Tandy says it is trying, the corporation still seems to be up to the same "new" tricks. Time will tell. ■

REMARKS

From page 10

unit at the factory for finding problems in the CPU boards. Something along this line would be helpful at their service centers. With this unit the board is set into a slot and sucked into contact with probes by a vacuum. A computer in the test unit then checks out everything in a flash and prints out a ticket showing which chip or part must be replaced.

Naturally, I was busy counting the number of systems being tested with an eye to checking up on the reports from outside sources on the production at present. I was satisfied to find that my sources were accurate. The number of sets in test for their 24-hour burn-in corresponded to the quantities I'd heard projected for the first year's production of the Model II.

I was surprised to learn that about one third of the Model I systems are Level I. Our sales of Instant Software programs have been under 10 percent for the Level I. I suspect that most Level I owners buying software are looking for programs which will run on both Level I and II, since they intend to upgrade. ■

Finished units are then put into a further burn-in test.

Any unit showing any problems or instability is rejected and sent back for further checking and repairs. They are very picky.

INSIDE 80

by Ed Juge, director of computer merchandising. Tandy Radio Shack

We at Radio Shack's home office are pleased to be offered a monthly column in *80 Microcomputing*. From a personal viewpoint, I'm looking forward to writing it—I knew my reputation for overwriting everything would eventually pay off!

This first effort will be short, since Wayne's offer preceded his copy deadline by only two days. I'll try to keep you current on happenings, bugs, fixes, new products, and those things which might not appear elsewhere in print. I'll try to answer a few often-asked questions. But if you send questions, please, understand, that the time required by my primary Radio Shack duties just won't permit individual replies to mail.

Trying to Respond

Unfortunately, the growth of the TRS-80 marketplace has exceeded our ability to communicate effectively with our owners. Some of you have decided we don't care about your problems and desires. At Radio Shack we all believe this column can improve that situation. The column will help us understand your desires and help you understand how we're trying to respond to them, or, in some cases—unfortunately—why we can't.

I'll promise you honestly. I'm also going to try to convince you that most of us are real guys and gals, just like you. Our ranks include electronic hobbyists, "gadget freaks," and a few ham radio operators—myself included. We know our future depends on your satisfaction.

Every request, every suggestion and, yes, every complaint is taken very seriously. Even though in a mass market environment we can't respond to the individual desires of every owner, your requests tell us when there is enough interest to justify a product. So, if you can pardon us for not being able to answer every single one... "keep those cards and letters coming!"

This month, I'll tell you about something we introduced in May, called TRS-80 Videotex. It's a concept, it's software, and it will soon be hardware too.

TRS-80 Videotex allows you to access information with your own computer or terminal—in color or black and white. A 32 by 16 screen format, compatible with the popular color computers will alleviate wrapped-around information transmitted for 80 × 24 screens.

We first introduced the Videotex to a group of information suppliers. We suggested the benefits of making their information available to the general public, especially in one universally usable format.

At the same time, we announced an exclusive agreement between Radio Shack and CompuServe, a major computer time sharing service to business, industry, and government. They will provide a new "CompuServe Information Service" in TRS-80 Videotex format. Radio Shack will market the software for TRS-80s AND other popular microcomputers. Target data for the service and TRS-80 software is this month. Software for other computers will follow as soon as it can be completed.

(Now, something you gotta' learn about me is that I'll try to be accurate about dates, but Murphy's Law has taken its toll on enough of my predications so as to keep me from becoming nationally known for uncanny accuracy. Please, give me room for a bit of error. As a matter of policy, I suggest you don't order anything from your local Radio Shack store before they receive a catalog number. Our data processing system throws unknown items into a bit bucket designed to emulate a black hole, and your order may never be heard from again!)

Anyway, back to my story. The CompuServe Information Service will initially be available between 6 PM and 5 AM EST weekdays, all day Saturday, Sundays and holidays. For the nominal fee of $5 per hour—plus $2 per hour, if you must access them through Tymnet in your city—you will have available the Associated Press news, weather and sports, local news from some 10 or 11 papers yet to be announced, an electronic mail system, a number of MicroNet personal computing services and Radio Shack Users News. Four or five more services are awaiting final negotiation, but I can't be specific until they're sewed up.

Some services will be available at a surcharge, such as the current MicroQuote service that provides historical stock market data over the past six years. You'll always be warned of extra charges when you select such a service.

CompuServe tells me that their Information Service and the TRS-80 Videotex concept have caused an unprecedented interest.

Time Sharing Without Delay

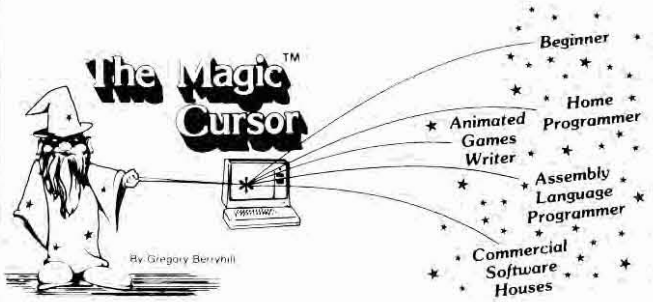
If you've tried time sharing systems where the delays were excessive, you'll be pleased to know that CompuServe plans a response time of five seconds or less, 95 percent of the time! I've seen one of their CPUs manage 150 simultaneous jobs with a response time far less than one second.

The TRS-80 Videotex software package will cost less than $30 and will include your own ID number and password. According to CompuServe, you'll have one free hour of time on their Information Service before billing, normally through your Mastercard or Visa.

I'll bet you're wondering about the hardware I mentioned. Well, we will be offering, an intelligent Videotex terminal. The price will be $399. The terminal will include a built-in direct-connect modem and RF output for your existing color TV receiver. Look for further information in two or three months. ■

TRS-80* OWNERS:

- **Let the computer write your "Basic" program for you!**
- **Draw pictures, animated figures, data forms!**
- **Create a library of display forms!**
- **Produce "Commercial" grade software!**



The **Magic Cursor** is a Revolutionary Family of Products which provides a dramatic new method of reproducing drawings and displays that you create on your screen. It makes both simple displays and complex interactive data input forms. It stores a "BASIC PROGRAM" on disk (or tape) ready for you to execute alone or as a subroutine. It produces screens in both standard or wide screen.

It is available for any level 2, 16K or larger system with tape or disk. An optional version is now available which creates an assembly language program.

Be sure to pick out the system that fits your present needs and order it today. you may upgrade your original copy by paying the difference and a moderate service charge.

MAGIC CURSOR PROGRAMS

THE MAGIC CURSOR allows you to easily create screens (including graphics) on your video. A powerful command then generates the BASIC instructions to recreate the screen. For the first time, a program for automatic generation of video display forms. (16K Tape or Disk)**$24.95**

THE MAGIC CURSOR I additionally makes sophisticated Data Entry and Display easy. With magic Cursor I you define the Data Entry or Display fields directly on your screen. The definition commands generate the BASIC instructions to implement the Data Entry and Display. The magic Cursor I has commands which move, center, and duplicate blocks of graphical or alpha/numeric displays. You can even justify text. (16K Tape Only) **$79.95**

THE MAGIC CURSOR II adds the power to write animated games easily in BASIC. The Magic Cursor II allows you to reload previous screens either from memory or from Disk. You can then modify them and store either the modified screen or only the changes. (32K Disk Only)**$99.95**

THE MAGIC CURSOR III will be available soon for the new Model II Computer (32K One or more Disks) **$149.95**

THE MAGIC CURSOR IV provides the features of Magic Cursor II but stores an assembly language program. (32K Disk Only) **$99.95**

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NEW RELEASES FROM CCC!!!

The Supply Room

A sophisticated program that is easy to operate. This unique system helps you manage your retail or wholesale inventory of up to 1000 line items. Cost may be fractions of a cent, item quantities may be decimal values. Automatic cost averaging of updated items and suggested sales prices based on gross profit. Transaction reports produced during posting functions. Printed reports include:

1. Transaction Listings
2. Complete Inventory Listing
3. Listings by Prefix
4. Items on Order
5. Items Out of Stock
6. Suggested P.O.'s

Requires Mod 1, 32K, 2 Disk **$250.00**

The Filing Cabinet

Take that collection of Job Orders, Personnel Records, Reports, etc. and get them organized. You define up to 14 data input fields specifying field type - alpha/numeric or $$$, field length and field separators - such as slashes, etc. During data input, the cursor provides for character input and skips over the field separators.

But that's only half the story. Output reports are automatic formated and program automatically requests column headings.

This means you can customize your own data base manager, complete with rapid data input and selective output reports. Comes complete with documentation.

Requires Mod 1, 32K, Disk & Printer **$100.00**
Or Mod2, 64K, 1 Disk & Printer **$150.00**

The Restauranteur's Consultant

By Ty Halderman

This food and beverage management tool dramatically reduces the human factors in food cost analysis. Those tasks required to effectively operate any restaurant or food service business. Over a half dozen reports give uniform, accurate and up to the minute information for profitability. And, handling of daily cost changes requires only minutes per week instead of hours, because the Consultant makes all the necessary conversions from your case prices. Reports include:

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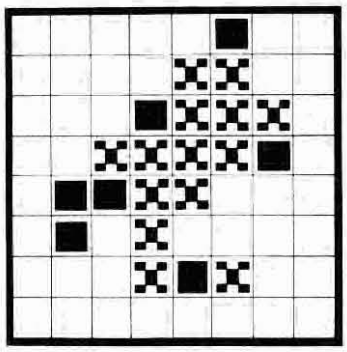
Reader Service index—see page 194

Instant Software™ New Releases



OTHELLO

In the game of Othello, there is no such thing as a lucky move. The game is a constant test of concentration and tactics.

The object of the game is to capture all the pieces on the board by bracketing your opponent's pieces. The score can fluctuate wildly as you plan your moves.

Your opponent can be another player or you can play the computer. You can even watch the computer play itself.

Don't think that just because you are either a hot-shot player or a complete tyro that Othello is not for you. The program allows you to adjust its IQ. An IQ of one will give you an easy opponent, but an IQ of seven will have the program playing a no-holds barred game.

The Othello program is a gracious opponent and, if you ask, it will suggest the best move for you to make. It will even allow you to set up special end games to sharpen your strategy.

The Othello program, a maddening, frustrating, and thoroughly engrossing game from Instant Software.

For the TRS-80 Level II 16K. **Order no. 0046R. $9.95.**

OTHER PROGRAMS AVAILABLE FROM INSTANT SOFTWARE

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0001R	Basic and Intermediate Lunar Lander	$7.95
0002R	Space Trek II	$7.95
0004R	Beginner's Backgammon/Keno	$7.95
0007R	Ham Package I	$7.95
0008R	Electronics I	$7.95
0009R	Golf/Cross-Out	$7.95
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0023R	Oil Tycoon	$7.95
0033R	Bowling	$7.95
0043R	Santa Paravia and Fiumaccio	$7.95
0046R	Othello	$9.95
0050R	Grade Book	$7.95
0057R	Chessmate-80	$19.95
0099R	Typing Teacher	$7.95

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0034R	Space Trek IV	$7.95
0047R	Who-Dun-It?	$7.95
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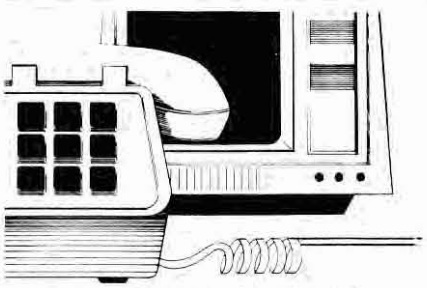
0135R	Executive Expense Report Generator	$9.95
0136R	Beginner's Russian	$9.95
0137R	Everyday Russian	$9.95
0156R	Money Madness	$9.95



THE COMMUNICATOR

This program offers you the fast way to transfer data from one location to another, using the telephone lines. The full "ORIGINATE/ANSWER" capability allows your TRS-80 to be controlled from a remote-based terminal, or allows two TRS-80 computers to "talk" to each other.

You will be able to pass all kinds of data, or programs, from home base to a remote terminal, or between computers, at the speed of light—or at 9600 baud, anyway.

Operation is simple. You dial the telephone number at the location of the TRS-80 at your home base. After the connection has been established, each telephone handset is placed upon the modem at both locations and the "hook-up" is completed. You will be able to control the home-based TRS-80 (if you called from a remote based terminal) and the transmission of data back and forth can proceed. This procedure can be reversed, allowing the home-based TRS-80 computer to control the remote-based terminal.

You'll see a simultaneous display of information on both the home-based and the remote-based monitors which facilitates the requests for specific information to be transmitted. This program is available to police, schools, stockbrokers, and many others who will find it to be invaluable.

The versatility of the Communicator program is enormous, and you can take advantage of this technology right now. **Order No. 0126R $9.95.**

0171R	Flight Path	$9.95
0250R	IRV	$24.95

TRS-80* DISKS

0052RD	Energy Audit	$75.00
0075RD	Accounts Receivable/ Payable	$199.95
0123RD	The One-D Mailing List	$24.95
0139RD	Disk-Scope	$19.95
0147RD	Check Management System	$39.95
0180RD	Disk Editor	$39.95
0212RD	The Russian Disk	$24.95

PROGRAMS IN GERMAN:

The programs listed here can be purchased through:
MicroShop Bodensee
Markstrasse 3,
7778 Markdorf, West Germany

TRS-80*

6004R	Beginner's Backgammon/Keno
6007R	Ham Package I
6008R	Electronics I
6009R	Golf/Cross-Out
6017R	Air Flight Simulation
6028R	RamRom Patrol
6031R	Space Trek III
6034R	Space Trek IV
6043R	Santa Paravia and Fiumaccio
6065R	Teacher
6069R	Household Accountant
6072R	Financial Assistant
6076R	Utility II
6081R	Utility I

PROGRAMS IN ITALIAN:

The programs listed here can be purchased through:
HOMIC s.r.l.
Piazza De Angeli 1,
20146 Milano, Italy

TRS-80*

9043R	Acquaviva e Montefalcone
9065R	Professore
9107R	Guerre Stellari
9108R	Volo Aereo/Space Trek

TO ORDER: Look for these programs at the dealer nearest you. If your store does not stock Instant Software send your order with payment to: Instant Software Inc., Order Dept., Peterborough, N.H. 03458 (Add $1.00 for handling) or call toll-free 1-800-258-5473 (VISA, Master Charge and American Express accepted).

Prices subject to change without notice.

*A trademark of Tandy Corporation

Instant Software™

PETERBOROUGH, N.H. 03458
603-924-7296

Ask for Instant Software at a computer store near you.

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Anderson Computers
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Computerland of Huntsville
3020 University Dr., Huntsville

Olensky Bros.
3763 Airport Blvd., Mobile

Arizona

Professional Data Systems
4506-A N. 16th St., Phoenix

Millets TV & Radio
621 East Broadway, Mesa

California

AMCO Elect. Supply
635 E. Arrow Hwy., Azusa

Byte Shop
8038 Clairmont Mesa Blvd.,
San Diego

Byte Shop
123 E. Yorba Linda, Placentia

Byte Shop of Mt. View
1415 West El Camino Real, Mt. View

Byte Shop of Sacramento
6041 Greenback Ln., Citrus Heights

Byte Shop of San Francisco
1032 Irving St., San Francisco

Capital Computer Systems
3396 El Camino Ave., Sacramento

Computers Made Easy
819 East Ave. Q-9, Palmdale

Computer Store of San Leandro
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6791 Westminster Ave., Westminster

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Computerland of W. LA
6840 La Cienega Blvd., Inglewood

Coast Electronics
3118 No. Main St., Morro Bay

Computerland
24001 via Fabricante No 904,
Mission Viejo

Hobbi tronics
1378 So. Bascom Ave., San Jose

Hobby World
19511 Business Ctr. Dr., Unit 6
Borthridge

Huntington Computing
2020 Charles St., Corcoran

I.C.E. House Inc.
398 North E. St., San Bernardino

Jade Computer Products
4901 W. Rosecrans, Hawthorne

Malibu Microcomputing
23910A Deville Way, Malibu

Marlam Co.
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Opamp/Technical Books
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PC Computers
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Q.I. Computers, Inc.
15818 Hawthorne Blvd., Lawndale

Radio Shack Dealer
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Radio Shack Dealer
50 N. Cabrillo Hwy., Half Moon Bay

Santa Rosa Computer Center
604 7th St., Santa Rosa

Silver Spur Elect. Comm.
13552 Central Ave., Chino

The Computer Store
820 Broadway, Santa Monica

Colorado

Byte Shop
3484 S. Acoma St., Englewood

Colorado Computer Systems
311 W. 74th Ave., Westminster

Computerland of North Denver
8749 Wadsworth Blvd., Arvada

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1635 South Prairie, Pueblo

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2300 Welton St., Denver

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American Business Computers
454 Thames St., Groton

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130 Jefferson, New London

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Computerland
60 Skiff St., Hamden

Computer Works
1439 Post Rd. E., Liberty Plaza,
Westport

D.C.

The Program Store
4200 Wisconsin Ave., N.W.,
Washington, D.C.

Florida

Al Personal Computer
178 Oxford Rd., Fern Park

AMF Electronics
11146 N. 30th St., Tampa

Boyd-Ebert Corporation
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6578 Central Ave., St. Petersburg

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1295 Cypress Ave., Melbourne

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Williams Radio & TV Inc.
2062 Liberty St., Jacksonville

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Atlanta Computer Mart
Atlanta

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2423 Cobb Parkway, Smyrna

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Computerland of Hawaii
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Electronic Specialists
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Midwest Micro Computers, Inc.
708 S. Main St., Lombard

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51591 US 31 North, South Bend

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Fall Creek Electronics Store
732 Center St., Pendleton

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Computer Shoppe Inc.
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ComputerCity
50 Worcester Rd., Framingham

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Computer Packages Unlimited
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14 Fall River Ave., Rehobath

Mark Gordon Computers
15 Kenwood St., Cambridge

New England Electronics Co.
679 Highland Ave., Needham

Small Business System Group
Main St., Dunstable

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120 Cambridge St., Burlington

Tufts Radio & Electronics
206 Mystic Ave., Medford

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28251 Ford Rd., Garden City

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29673 Northwestern Hwy., Southfield

Computer Mart
560 W. 14 Mile Rd., Clawson

Computer Room
455 E. Michigan Ave., Kalamazoo

Computronix Corp.
423 S. Saginaw Rd., Midland

Hobby House
1035 W. Territorial Rd., Battle Creek

Main Systems Inc.
1161 No. Ballenger Hwy., Flint

The Alternate Source
1806 Ada, Lansing

The Eight Bit Corner
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Ye Olde Teacher Shoppe
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Computerland of Hopkins
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Burnsville Center

Minnesota Software Inc.
5422 Fisher St., White Bear Lake

Zim Computers
5717 Xerxes Ave., N. Brooklin Center

Mississippi

Dyer's, Inc.
200 E. Main St., West Point

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816 Foley St., Jackson

W. Vernon Foster Inc.
816 Foley St., Jackson

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Century Next Computers
1001 E. Walnut, Columbia

Comp-U-Trs Software Center
51 Florissant Oaks Shopping Center
Florissant

Software Shack
16501 Greenwald Court, Belton

Montana

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529 So. 9th St., Livingston

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121 Red Oak Dr., Carl Junction

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Computerland of Omaha
11031 Elm St., Omaha

Midwest Computer Co. Inc.
8625 I St., Omaha

Midwest Computer Co. Inc.
4442 S. 84th St., Omaha

Midwest Computer Co. Inc.
4403 S. 87th St., Omaha

Scottsbluff Typewriters Inc.
1824 Broadway, Scottsbluff

Nevada

Century 23
4566 Spring Mountain Rd., Las Vegas

New Hampshire

Bitsnbytes Computer Center
568 Pleasant St., Concord

ComputerCity
1525 S. Willow, Manchester

Paul's TV
Main St., Fremont

Portsmouth Computer Center
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Radio Shack Assoc. Store
Fairbanks Plaza, Keene

New Jersey

Computer Corner of NJ
439 Rte. #23, Pompton Plains

Computer Encounter
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Computerland
35 Plaza Rte. #4, W. Paramus

Computer Mart of NJ
501 Rte. 27, Iselin

Crowley's
Rd. #3, Whitehouse Station

Dave's Electronics
Pennsville Shopping Ctr., Pennsville

GHB Enterprises Inc.
Rte. 38, Rudderaw Ave., Mapleshade

Lashen Electronics Inc.
21 Broadway, Denville

Personal Computing Inc.
51 Central Sq., Linwood

Radio Shack/J&J Electronic
Mansfield Shopping Ctr.
Rt. 57 Allen Rd., Hackettstown

The Bargain Brothers
Glen Roc Shopping Center
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The Computer Emporium
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Autel Electronics Co.
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South West Computer Center
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Thomas E. Carr Jeweler
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Computerland of Nassau
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Computerland of New York City
58 W. 44th St., New York

Computer World
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Comtek Electronics, Inc.
2666 Coney Island Ave., Brooklyn

Comtek Electronics, Inc.
Staten Island Mall
Store 220A, Staten Island

Digibyte Systems Corp.
31E. 31st St., New York

80-Microcomputer Services
118 Masten Ave., Cohoes

Home Computer Center
671 Monroe Ave., Rochester

Mr. Computer
Imp. Plaza, Rte. 9, Wappingers Falls

Soffron Systems
308 Columbia Turnpike, Rensselaer

The Computer Tree Inc.
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Upstate Computer Shop
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New Hartford

North Carolina

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Sound Mill
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Altair Business Systems, Inc.
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Astro Video Electronics
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Mighty Byte Computer Center
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Personal Computer Corp.
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Personal Computer Corp.
Frazer Mall, Lancaster Ave., Frazer

Rhode Island

Computer City
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329 Bald Hill Rd., Warwick

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Tennessee

ACS
1100 8th Ave. So., Nashville

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H & H Electronics Inc.
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5313 Bissonet, Bellarie

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21969 Katy Freeway, Katy

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6353 Camp Bowie Blvd., Ft. Worth

Waghalter Books Inc.
3 Greenway Plaza E., Houston

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DC Computer Co.
1911 West 70 South, Provo

Quality Technology
470 E. 2nd So., Salt Lake City

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Washington

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Federal Way

Personal Computers
S 104 Freva, Spokane

Ye Old Computer Shop
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West Virginia

The Computer Corner Inc.
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The Computer Store
Municipal Parking Bldg., Charleston

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Byte Shop Of Milwaukee
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Computerland
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Computerworld
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Petted Microsystems
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Wyoming

Computer Concepts
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The Microcomputer Store
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Caparra Terrace

Canada

CANADIAN DISTRIBUTORS:
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M5V 2A5

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715 Portage Ave., Winnipeg, Man.

Compumart
411 Roosevelt Ave., Ottawa, Ontario

Micromatic Systems Inc.
101 8136 Park Rd., Richmond, B.C.

Micro Shack of W. Canada
333 Park Street, Regina, Sask.

Orthon Holdings Ltd.
12411 Stony Plain Road
Edmonton, Alberta

Total Computer Systems
Ajax, Ontario

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✓Reader Service index—see page 194

80 NEWS

edited by Nancy Robertson

14-year-old Is Professional Programmer

He's just like other 14 year-old boys growing up in New England. He likes model trains, bubble gum and baseball games. He worries about what his friends will think if someone writes about him in a national magazine.

But, if you go upstairs at Greg Hassett's house, you'll find a 48K dual disk drive TRS-80, complete with line printer and everything it takes to keep them running. Very likely, you'll find Greg hard at work on a new program or tuning up an old one. At this young age, he is indeed a programmer.

When he was 12, Greg sold a program for $150 and became the youngest professionally published adventure programmer in the county. The $150 covered the original, non-exclusive rights for Journey to the Center of the Earth which were sold to The Software Exchange in Milford, NH. The updated version netted many times that amount through its distribution by Mad Hatter Software in Dracut, MA.

Sorcerer's Castle, Atlantis and Enchanted Island followed. Greg's style and ability to stick to a story increased along with his revenues. The personal combat in Castle and Atlantis was an interesting addition to the familiar GO, GET, PUSH, PULL routines of most computer adventures. The thematic orientation and colorful description that popularized Scott Adams' adventures became more and more apparent in Greg's work, too. In contrast to Adams' sophisticated, brain-puzzlers, Greg's adventures are light, witty and solvable.

Greg's M-Treck was a departure from his dedication to adventures. It is a graphic game of cosmic engines and scanning devices with sound effects. The object, like all Star Trek games, is to track down and kill Klingons.

Greg wrote all of these early programs in BASIC. Frustrated by the limitations of speed and space, he took a crash course in machine code.

After writing Enchanted Island Plus, his first machine language adventure, Greg started his own company named Adventure World. It is now the sole source of his several machine language adventures. Both Mad Hatter and Adventure World are distributors of Greg's BASIC programs.

At 14 Greg is not only a programmer, but a businessman. He serves both individuals and retailers. He contracts for mass production of his programs, then packages and mails the orders himself.

Greg is also thinking about broadening the base of Adventure World to include distribution of programs by other authors. "But, if that happens at all," he says, "it will be a year or two in the future." According to Hassett, his software outlets are currently netting him "about $800 a month."

Greg has just finished writing The World's Edge. It follows on the heals of Mystery Mansion, and is also in machine code. "I'm just beginning to think about what I'll write next. I don't know what it will be."

In the fall he'll be entering the tenth grade at Philips Academy where he was recently accepted. When he is finished with school, Greg wants to work as a programmer for Digital or another large corporation, switching from adventures to the challenges of technical-applications software.

But a 14-year-old boy might have better things to do with his time than create and market his own software and deal with production contracts and bookkeeping. Not so says Greg. His business "sometimes gets in the way of school, but it doesn't interfere with my social life." Like most kids his age, he says he wants "to loaf around" during his summer break. ■

By Bob Liddil

Fourteen-year-old Greg Hassett at work.

Finding Made in Electric Pencil II Copyright Lawsuit

May 23, 1980 Judge S. S. Schwartz of the Los Angeles Superior Court ruled in favor of the defendent in the complaint brought by Michael Shrayer Software, Inc., Palm Springs, CA against Vector Graphic, Inc., Westlake Village, CA. The complaint was brought for "breech of contract, wrongful copying and injunction" in August of 1979 in regard to Electric Pencil II.

Michael Shrayer Software, Inc. is expected to appeal the decision.

The issues involved revolve around the application of copyright laws to programming. The final wording of Judge Schwartz's decision is likely to be signed and available sometime this month.

Vector Graphic, Inc. has already filed a cross-complaint charging Shrayer's company with libel and business interference, plus a suit against Shrayer, personally, along with several other individuals, for libel. ■

National VTOS Users Group

TCUG, Inc., a nonprofit computer club located in the Washington, DC. metropolitan area, is organizing and chairing a national users group for TRS-80 owners operating under the Virtual Technology Operating System (VTOS).

The purpose of this group is to improve upon the lack of documentation of VTOS, an excellent operating system for the TRS-80, by sharing the knowledge derived through investigation of VTOS, how it behaves, how best to utilize its many features, and how to make it work best for you.

Anyone interested may join the VTOS Users Group (VUG) for an annual fee of $15 which

entitles the member to the bi-monthly VUG Journal and monthly TCUG Newsletter.

Contact Bill Beall, TCUG, Inc., VTOS Subgroup, PO Box 2235, Reston, VA 22090.

The TCUG bulletin board, which is intended to be a focal point for TRS-80 and VTOS items, is available 24 hours by phone at (703) 620-4990. ■

Business Week Article Incorrect?

An article printed in *Business Week*, June 16 stated that, "Over the next six weeks Tandy plans a barrage of new products to follow up its initial foray into the small business market with its TRS-80 Model II."

It goes on to say that a desktop computer for scientists and engineers, a word processor based on the Model II and small computers that will automate inventory controls are to be expected.

At Tandy Corp., both H. L. Seigel, National Publicity and Promotion Manager, and Senior Vice President of Operations, Charles Phillips, deny the thrust of the *Business Week* article. They both say no new computers that they know of will be marketed by the company before the end of the year.

Videotex, another product mentioned in the *Business Week* article, will be available this fall, according to Phillips. The software product will link TRS-80s and other micros to television and telephone lines for network information retreival from Compuserve, Inc., Columbus, OH.

While Tandy denies the thrust of the article, the question is why do well-informed sources in the industry persist in their belief that new models will be announced by Tandy in August. ■

Mid-Atlantic Micro Show

The Mid-Atlantic Personal and Business Computer Show will be at the Philadelphia Civic Center from Thursday, Sept. 25 through Sunday, Sept. 28, 1980.

The show hours are 11:00 A.M. to 9:30 P.M. Thursday through Saturday, and 11:00 A.M. to 6:00 P.M. Sunday. General Admission for adults will be $5.

For further information, contact National Computer Shows, P.O. Box 678, Brookline Village, MA 02147. ■

Science and Research Management Software

Software Engineering Systems, Inc. is releasing three software modules for management science and operations research. Written for the TRS-80, these modules are interactive. They are the Decision System, the Mathematical Programming System and the Simulation System.

The Decision System consists of a break-even algorithm, a decision analysis algorithm, a lottery-insurance analysis algorithm, an element-ordering algorithm and a game-theory algorithm.

The Mathematical Programming System consists of three algorithms: one for linear programming, one for transportation and another for optimizing network flow.

The Simulation System is a program which helps simulate continuous dynamic systems described by differential or difference equations. It provides for integration, printing and plotting of the output on video screen or on a printer.

All modules are sold for $25 from Software Engineering Systems, Inc., 3214 75th St., Lubbock, TX 79423.

Reader Service ↙ 176.

TRS-80 Replica Marketed

Personal Micro Computers, Inc. (PMC) has made an exclusive marketing agreement with the Hong Kong manufacturer, EACA International Limited to offer a software and hardware compatible equivalent of the Radio Shack Model I, Level II TRS-80.

The PMC-80, as the new computer is called, has a cassette tape recorder, 16K memory, Level II Microsoft BASIC interpreter in ROM, power supply, computer and keyboard in one cabinet. It will display on either a video monitor like the TRS-80 or on a standard TV set using a built-in VHF channel 3 modulator.

All software that is available for the TRS-80 Level II 16K system will operate in the PMC-80. Level II BASIC or SYSTEM will load in the PMC-80 50-pin bus through a 40-pin interface adapter available from Personal Micro Computers, Inc.

Disc based programs can be run on the PMC-80 using the Radio Shack expansion interface or other commercially available equivalents. With the expansion interface, all peripherals designed for the TRS-80 are compatible with the PMC-80. This includes Winchester disks, speech recognition, printers, RS232 adapters, etc.

EACA already has established markets in Australia and Europe for the PMC-80. Initially, however, it is only going to be available by mail order in the U.S.A. and Canada.

To facilitate mail order marketing, the company offers a 30-day money back guarantee. Service on the equipment will be performed by PMC at its Mountain View, CA factory. (Warranties will be voided if modifications are made to the internal system.)

For further information, contact Personal Micro Computers, Inc., 475 Ellis St., Mountain View, CA 94043.

Reader Service ↙ 325.

Complex & Custom Software

Occupational Computing Company is a group of computer analysts, programmers and engineers specializing in Radio Shack computers. The new company is offering services in systems analysis, site evaluation and training. They are also selling standard and custom software.

The company is currently marketing Magic Wand, Restaurant Accounting Control System and Business Accounting Control System. Each is a complex software system.

Magic Wand is a word processor including automatic word break, flexible line length, pagination, block movement, fill-in-the-blank documents, etc. The software costs $400 plus approximately $200 for a CP/M license. It is written for a TRS-80 Model II plus Daisywheel printer.

Restaurant Accounting Control System is designed to serve the restaurant owner's accounting and management control needs. Software costs $4,000.

Business Accounting Control System consists of accounts receivable, billing inventory control, accounts payable, payroll and general ledger programs. It costs $350 to $7,500 depending on the number of modules desired.

Occupational Computing Co., Inc. is located at 22311 Ventura Blvd., Suite 123, Woodland Hills, CA 91364.

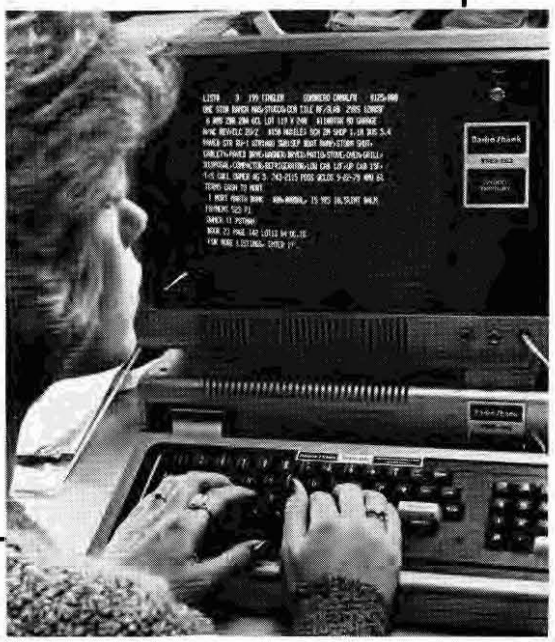
Reader Service ↙ 177.

Realty Management System

The Key Realty Management System is a software package available for TRS-80 and CP/M based computers.

It is comprised of five control subsystems, in-

Realty Management System



cluding listing control, escrow control, sales controls, general ledger and property management. Optional subsystems for accounts payable and payroll are available.

Since no special codes, abbreviations or "computerese" appear to the user, no data processing expertise is necessary to use the system.

The minimum system provides for up to 300 listings, 100 sales associates and 10 offices or sub-offices. Priced at $2,500 for the whole system and $500 for each subsystem, the package is sold by Key Systems, Inc., 16 Ocean E., Marathon, FL 33050.

Reader Service ↙ 184.

Programs Can Share Data

Percom Data is marketing a TRS-80 Disk BASIC utility that allows programmers to save, restore and otherwise manipulate one set of data that may be common to two or more programs.

Called Varkeep, this machine language utility works with all TRS-80 computer disk operating systems.

Varkeep adds four BASIC commands: NAME SAVE, NAME RESTORE, NAME DELETE and NAME CLEAR. They protect variables from being erased by LOAD, RUN, NEW and CLEAR commands. They delete variables that are no longer needed to reclaim memory space and redimension arrays.

Varkeep is sold on a minidisk with instructions for $19.95. It may be purchased from Percom Data Co., 221 N. Kirby, Garland, TX 75042.

Reader Service ↙ 171.

Hardcopy from Typewriters

The I/O Pak and a new typewriter interface, are designed to generate hard computer copy through any electric typewriter with powered carriage return. The combination gives computer users the benefit of typewriters' print quality.

The I/O Pak, which fits over the keyboard, is easy to install. No modification to the typewriter is required. The interface board can be modified by jumper selection, to operate on TRS-80 Level I or II or Apple II.

The I/O Pak alone costs $469. The interface board and power supply required for package system operation cost $145. They are available from Rochester Data, Inc., 3100 Monroe Ave., Rochester, NY 14618.

Reader Service ↙ 162.

Labyrinth Racing Game

Labyrinth Run, Manhattan Software's latest release, is a fast-action game, running through a labyrinth with sharp turns, reverses and slaloms, racing for a record time. Each labyrinth has sprint and full courses, and there are three levels of skill.

A timer starts automatically when the run begins, and record times are retained and displayed for each labyrinth, course and skill level.

The game is for Level II 16K machines. It costs $9.95 from Manhattan Software, Inc., P.O. Box 5200 Grand Central Station, NY, NY 10017.

Reader Service ↙ 179

Interactive Sharing

A multiplexer has been announced by Corvus Systems which can transform two to 64 microcomputers into an interactive multi-user network. The multiplexer network can share high speed access to up to 40 million bytes of hard disk capacity. It is called the constellation. Computers in a Constellation network can also share peripherals and communicate in a fully interactive mode.

The Constellation is a back-end local network in which multiple computers are connected in a star configuration. To insure compatibility, each computer interface uses the standard Corvus bus. This central node contains hardware that polls up to eight computers in round robin fashion.

Any computer compatible with the standard Corvus disk system is compatible with the Constellation. These include the Apple, TRS-80 Models I and II, S-100 Bus, Altos, and LSI-11.

The computer interface hardware is the same as that used by the single-user disk system. The Constellation operating system software is the unmodified operating system provided with the host computer, assuring application compatibility.

The price of the multiplexer is $750. Interfaces for the computers in the network begin at $235 each from Corvus Systems, 2029 O'Toole Ave., San Jose, CA 95131.

Reader Service ↙ 165.

Cassette Peripheral

Zoom 3.6 is an electronic black-box that connects a Level II TRS-80 (or expansion interface) and a CTR-41 or CTR-80 cassette recorder. With the software supplied with it, tapes can be written and read in a special format at 3600 bits per second—over seven times faster than Radio Shack's 500. At that speed, 2K of RAM loads in under five seconds, and 16K loads in just 36 seconds—instead of almost four-and-a-half minutes.

No soldering and no modifications are needed. Zoom 3.6 is transparent to all the XRX mods, and to the CLOAD, CSAVE, SYSTEM, and PUNCH functions. A built-in relay and a toggle-switch on the front panel bypass the Radio Shack reed relay.

The computer will not crash if it finds a read error or if it is made to start or stop reading in the middle of a recording. The system will not hang-up while searching for a file. BREAK causes a return to the menu during reads and writes.

Users can also purchase the commented source-code for ZMBug, so that it may be adapted, or relocated. Written instructions plus a sample of assembly language source-code necessary to patch Zoom 3.6 drivers into The Electric Pencil, are also sold.

The manufacturer believes Zoom 3.6 is the fastest CTR-41/CTR-80 device available. With ZMBug V1.0 object code and the manual, it costs $119 and is sold by Zoom!, P.O. Box 3766, Nashua, NH 03061.

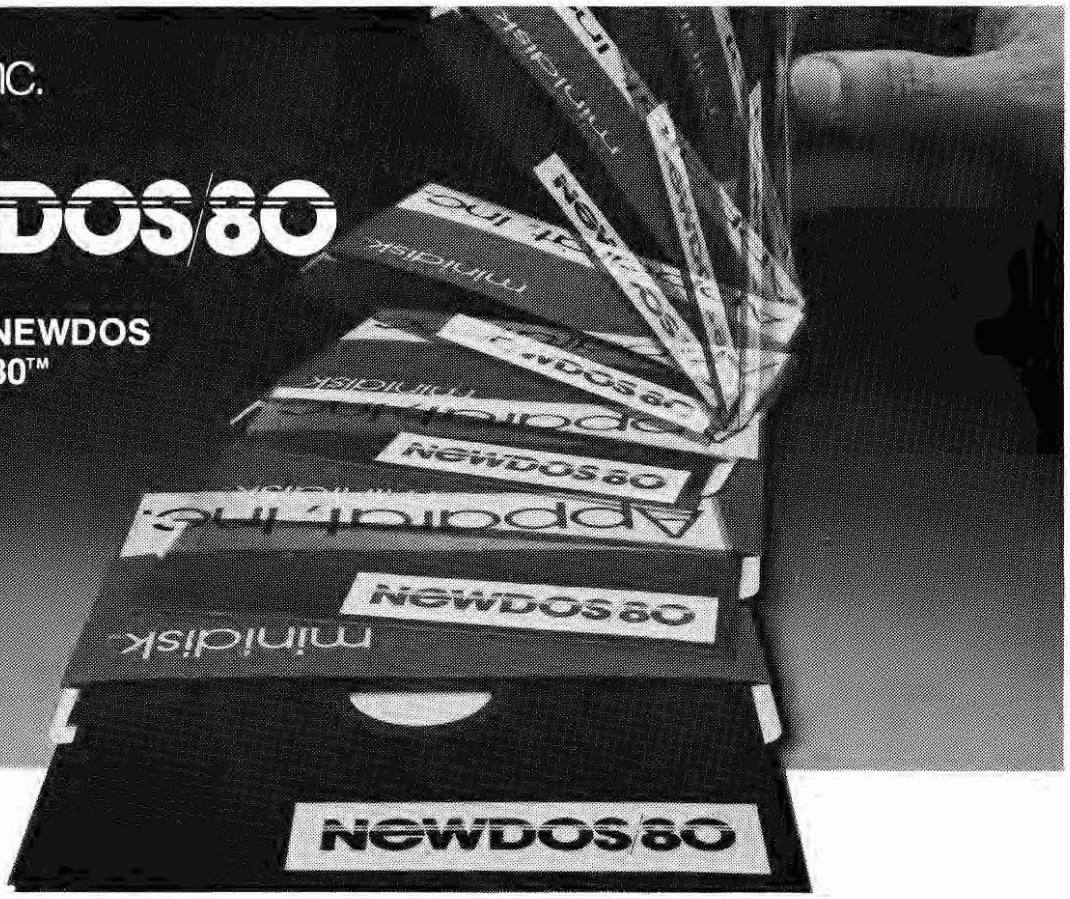
Reader Service ↙ 163.

The I/O Pak

Zoom 3.6 and ZMBug

Apparat, Inc. introduces NEWDOS/80

For the 80's— an enhanced NEWDOS for your TRS-80™ Model 1.



Apparat, Inc., announces the most powerful Disk Operating System for the TRS-80®. It has been designed for the sophisticated user and professional programmer who demands the ultimate in disk operating systems.

NEWDOS/80 is not meant to replace the present version of NEWDOS 2.1 which satisfies most users, but is a carefully planned upward enhancement, which significantly extends NEWDOS 2.1's capabilities. This new member to the Apparat NEWDOS' family is upward compatible with present NEWDOS 2.1 and is supplied on Diskette, complete with enhanced NEWDOS + utility programs and documentation. Some of the NEWDOS/80 features are:

- New BASIC commands that supports files with variable record lengths up to 4095 Bytes long.
- Mix or match disk drives. Supports any track count from 18 to 80. Use 35, 40 or 77 track 5" mini disks drives or 8" disk drives, or any combination.
- A security boot-up for BASIC or machine code application programs. User never sees "DOS READY" or ">READY" and is unable to "BREAK", clear screen, or issue any direct BASIC statement including "LIST".
- New editing commands that allow program lines to be deleted from one location and moved to another or to allow the duplication of a program line with the deletion of the original.
- Enhanced and improved RENUMBER that allows relocation of subroutines.
- Powerful chaining commands.
- Print Spooler.
- DFG function; simultaneous striking of the D, F and G keys will allow the user to enter a mini-DOS to perform some DOS commands without disturbing the resident program. (e.g. dir while in scripsit.)
- Upward compatible with NEWDOS 2.1 and TRSDOS 2.3.
- Includes machine language Superzap/80 and all Apparat 2.1 utilities.
- Enter debug any time by pressing 123 keys. Also allows disk I/O.
- Diskette "Purge" command.
- Specifiable system options (limited sysgen type commands).
- Increased directory capacity.
- Copy by file commands.

NEWDOS/80 with all of the NEWDOS + utility programs, many of which have been enhanced, is priced at just $149.00 and is available at most TRS-80 dealers.

As with 2.1, NEWDOS/80 relies on the TRSDOS and Disk Basic Reference Manual published by Radio Shack. NEWDOS/80 documentation supports its enhancements and upgrades only.

VISA master charge

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Apparat, Inc.

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0/1A

✓Reader Service Index—see page 194

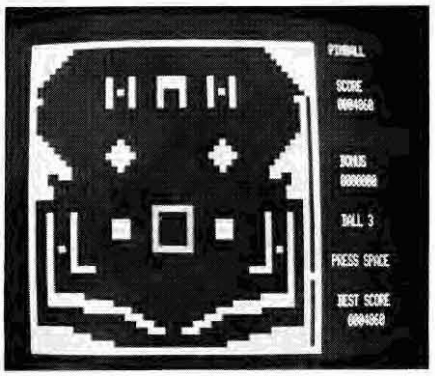
TRS-80 Pinball

Acorn Software Products, Inc. is offering Pinball, a real-time, arcade game for Level II TRS-80.

The video display includes flippers, bumpers, rollovers, runs and bonus points. The space bar releases the ball. As with any pinball games, the player must develop skill with the flippers to get maximum points and playing time.

Pinball is priced at $14.95 on cassette, or $20.95 on disk from Acorn Software Products Inc., 634 North Carolina Avenue, S.E. Washington, D.C. 20003.

Reader Service ↙ 161.



Pinball Display

Educational Program and Model II COBOL Package

The new COBOL Development System software package from Radio Shack makes it possible to write and use programs in COBOL (COmmon Business Oriented Language) on the TRS-80 Model II. Tandy believes it is the only COBOL package for a microcomputer that offers multi-key ISAM (Index Sequential Access Method) files.

The COBOL package includes a one-pass compiler, screen formatting, ANSI Level 2 I/O, program linkage and segmentation.

The Model II COBOL Development System, with reference manual, user's guide, sample program and disk is priced at $299.

The K-8 (kindergarten through eighth grade) Math Program, designed to supplement regular instruction, is another new release from Radio Shack. It is supplied on five cassettes and three disks in a binder with a teacher's manual containing complete instructions and sample record-keeping forms. It requires a 16K Level II.

Part one of the program is a series of computer programs containing skill building exercises in numeration, addition and subtraction concepts for use in kindergarten through third grade. Part two contains skill building exercises, a testing mode, and a placement mode for addition, subtraction, multiplication and division, appropriate for use in grades one through eight.

A comprehensive reporting function is also provided. At the end of a student session, the screen displays the total number of problems attempted, the number correct, the percent correct, promotions or demotions and average response time. It is priced at $199.

Reader Service ↙ 166.

Two Utility Programs

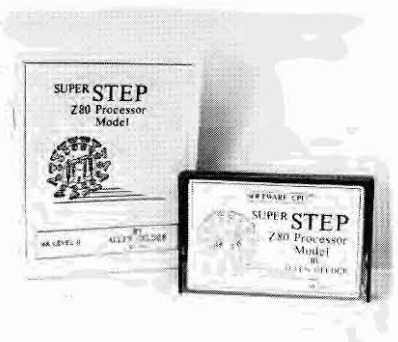
Two new TRS-80 programs from Allen Gelder Software are Super Step and Accel. Super Step is both a trace program and a disassembler link with T-BUG, the Radio Shack Z-80 monitor program.

Super Step displays a pair of Z-80 processor models including CPU registers, stack elements, flag expansion and an intelligent RAM window. The trace mode has a skip key and keyboard interrupt plus foreground breakpointing for user control during operation. It is sold for $19.95.

Accel is a compiler for the integer subset of Level II BASIC that increases the speed of program execution. Programs are built, modified and debugged using the BASIC interpreter, then compiled by Accel to Z-80 machine code.

Accel is a product of Southern Software of England. It is now sold in this country for $44.95 from Allen Gelder Software, Box 11721, San Francisco, CA 94101.

Reader Service ↙ 170.



Super Step

Word Processor Update

MPS Software (formerly Microphase Systems) is selling Wordscribe, a full-feature word processing system for Model I and Model II systems. Wordscribe 1.2 includes the full editing features of 1.1 and adds some new formatting capabilities to the system.

Wordscribe's new features include document chaining which allows the user to load more than one document at a time for merging documents and inserting standard blocks of text. New formatting commands to change line lengths, force page breaks and change line spacing are also included.

The minimum system requirements to run Wordscribe 1.2 are Model I 48K with expansion interface and one disk; or Model II 64K with one disk.

Wordscribe is priced at $79.95 for Model I, $129.95 for Model II and is available from MPS Software, 11223 E. 45th St. So., No. 314, Tulsa, OK 74145.

Reader Service ↙ 180.

Software Typewriter

Computer Simulations Company has announced its newest product for microcomputers, the TRS-80 Typewriter. It is a basic program offering built-in lowercase, line by line editing, video review and copy printing.

The program is designed to handle a full page of text neatly and efficiently. It sells for $19.95 and requires a printer.

The TRS-80 Typewriter is available from Computer Simulations Company, 305 Hammes Ave., Joliet, IL 60436.

Reader Service ↙ 183.

Keyboard Remote Control

Omni Automation is releasing a wireless keyboard for the TRS-80. The RX-10 includes a hand held, ultrasonic remote control. BASIC programs can read ultrasonic input with a few minor changes.

The system also permits control of remote devices located anywhere within the home or office. A flexible scheduling program can activate the remotes automatically using cyclic, time of day, or future date schedules.

The RX-10 system includes all necessary cables, interfaces, a cordless controller, a command console, appliance and lamp control modules. Software is provided on diskette. It is priced at $285 from Omni Automation, P.O. Box 7716, Atlanta, GA 30357.

Reader Service ↙ 178.

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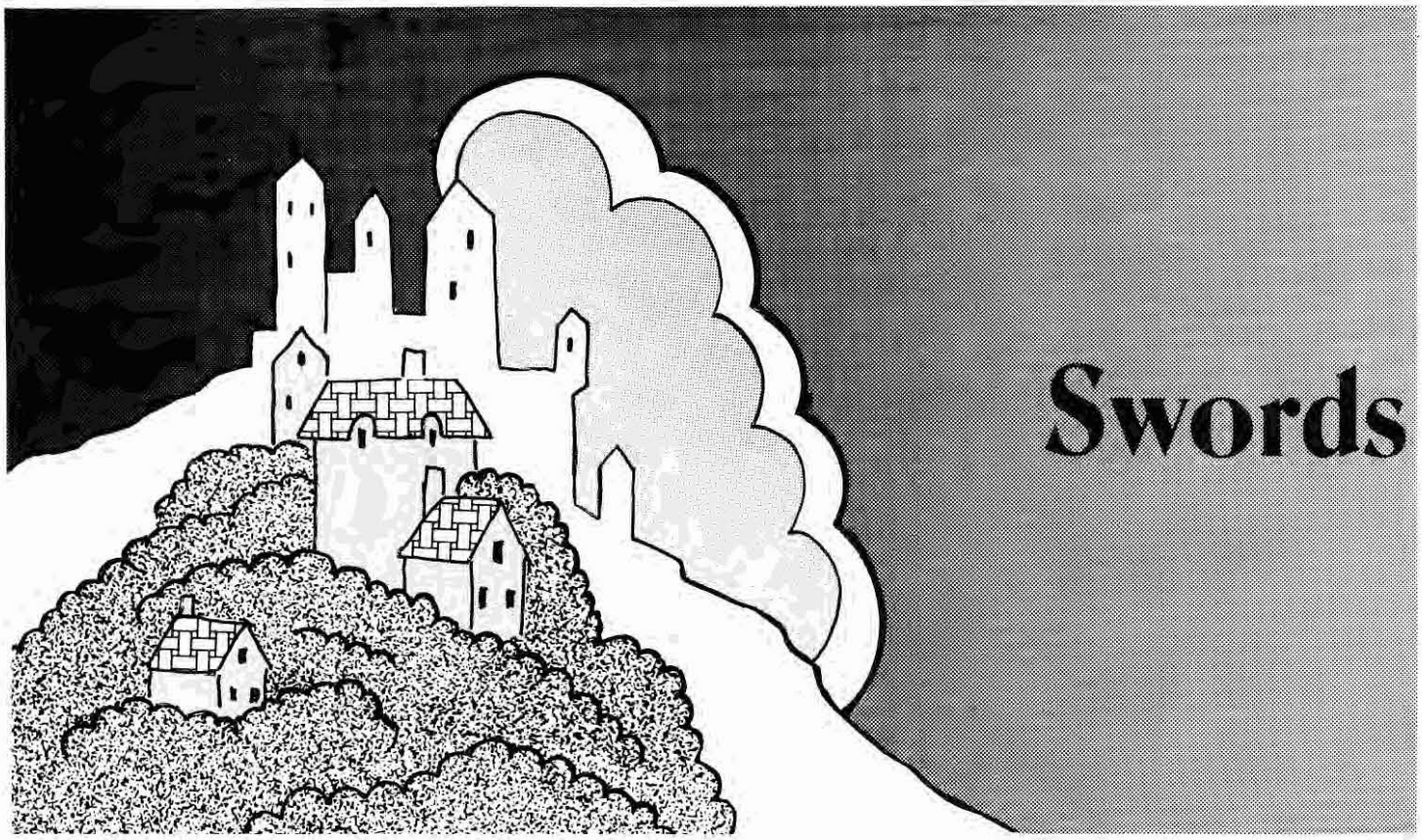
↙Reader Service index—see page 194



Swords

Barry L. Adams
109 Valley Place
Greenville, NC 27834

The August 1978 issue of *Kilobaud Microcomputing* magazine carried a game program entitled Swords and Sorcery. The program was written on an SWTP 6800 machine using an 8K BASIC interpreter. The game involves you in a search and rescue of a princess held in an evil captor's dungeon. During the quest, the player encountered a variety of creatures – some good, some bad.

I immediately fell in love with the program and soon adapted it to my Level II, 16K machine. As written, the listing required less than 8.5K of memory. When it comes to writing game programs, I generally followed the advice of my old art teacher: When you're painting a picture fill up the entire canvas, after all, you're paying for it.

Armed with this bit of philosophy and a great deal of unused space in my 16K memory, I set out to paint my canvas.

New Dimensions

The revised program still follows the overall theme of the original, but adds more dimension to the encounters that pop up during play. The program uses TRS-80 graphics and includes a few new adversaries. Whereas the original program is primarily random based, the revised program also includes the elements of skill, strategy and awareness.

The scenario of the game is familiar. In typical fairy tale fashion, you are an impoverished, rather inept hero, attempting to rescue an elfin princess who has been imprisoned in a dungeon located deep within the Old Forest. When you begin your quest, you are equipped with only a small sword and some provisions.

Prior to entering the Old Forest you may be offered assistance from a dryad, as well as the counseling of the Great Oracle. The nymph is a real plus as she makes an excellent guide and can be helpful in combat with the trolls. However, be careful not to offend her, because she can turn that magical power on you with a curse.

The oracle, on the other hand, appears to be more interested in the maidens you're bringing rather than helping. Nevertheless, once appeased, he can point you in the right direction.

Before you start your journey, familiarize yourself with two units of measure in this little magical world: the Yerb and the Farbble Warfer. Both are measures of distance. Legend has it that the measure was defined as the distance between Ezekiel Yerb's house and that of Hansel Farbble Warfer. One man was short and the other rather tall, and as a result the two could never agree on the number of steps between the two houses. The sense of the whole thing has long since been lost, and, today, all we know is that 1 Yerb is equal to ¾ of a Farrble Warfer.

While on your journey, you will meet a number of different critters. The full cast of characters is as follows:

Nymph: She knows the Old Forest like the back of her hand and is very good in fights with trolls.

Hot dog salesman: Ha! You thought that you could get away from them, yet here they are. Don't laugh! One of these gastronomical marvels can keep you going long after your provisions have given out.

The Great Oracle: Generally, he has more interest in what you can do for him, rather than what he can do for you. However, he may tell you the correct path to take.

Slave girls: They provide conversation and something for the satyrs to look at; otherwise, they do little but cut into your provisions.

Rats: They will give you the willies and make you run, but otherwise are of little consequence.

Snakes: A snake bite will lay you up for a day.

Spiders: They will attack, unless you can outrun them.

Dragons: Dragon slaying is still big news with big rewards, but be careful, because these guys have been known to flick their Bics.

Goblins: You can be startled by them and run, otherwise, they will enslave you, sell you to the satyrs or let you go free for ransom.

Trolls: There are two kinds of trolls – your everyday run of the mill troll and the dreaded warrior trolls. The common trolls are

and Sorcery II

"Once you have rescued the princess, you no longer have the choice to fight or not fight. . . . To make it to safety, you have to fight your way out."

pesky fighters, particularly dangerous in the early going, while the warrior trolls are bad news all of the time.

The Necromancer: The chief heavy and captor of the princess, as well as the all-around bad egg.

Elements of the Fantasy

The other elements of the fantasy consist of the pits into which one occasionally tumbles, gold coins and an enchanted sword. As you might have guessed, the pits are an obstacle from which you must escape either by climbing or yelling for help. The gold that you pick up along the way is used to buy food, pay ransom and provide you with a little bank roll should you be lucky enough to complete your quest.

Of course, there is a "Catch 22." The weight of all that gold is somewhat of an encumbrance to combat and inhibits your fighting ability. The enchanted sword, on the other hand, enhances your fighting ability. In fact, you are usually in big trouble if you don't have it.

A player's fighting skill develops as he is successful in combat. A player increases his fighting ability in combat with common trolls, satyrs and dragons. But there are degrees of improvement. More fighting ability is acquired by slaying dragons than trolls. However, a similar gain is made when either a troll or a satyr runs from you.

In like fashion, your own fighting ability is diminished when you run from combat. Dragon fighting is the only exception. It's your choice. You can walk away from it any time.

Considerable fighting ability is usually necessary to defeat a warrior troll. But after fighting one of the super trolls, you are usually so frazzled that your fighting ability has been reduced.

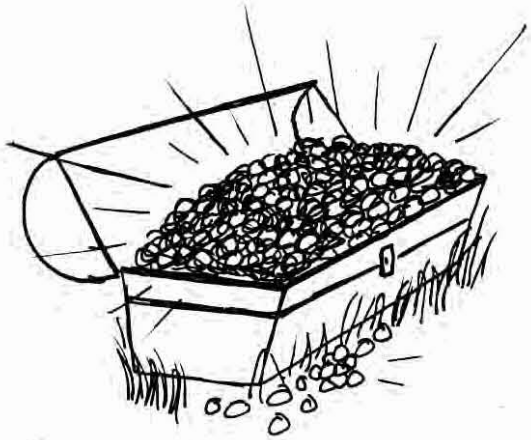
The playing instructions are simple. Prior to loading the program from cassette, set the memory size to 32697 in order to reserve room for the dragon's graphics code. If you are already up and running you can get back to MEMORY-SIZE? without powering down by entering the SYSTEM command followed by a '/ENTER'.

Initially, entering RUN will get the introductory title and the familiar READY. At that point the first five lines of the program are automatically deleted. Entering RUN thereafter initiates the main program. This is done to conserve memory, providing an additional 600 or so bytes.

The INKEY$ command is used to eliminate the repeated use of the ENTER key where possible.

There are questions which require word answers: RUN, YES, NO, CLIMB and YELL. Only the first letter of the word need be typed. In two cases a prompt answer is important – encounters with either the spiders or the dragons. To avoid attack from a spider, the player must strike the R key as quickly as he can. In the case of the dragon, the rescuer is moved toward and away from the dragon by using the less than and greater than keys, respectively. Any other key will stop the rescuer where he is.

Once you have rescued the princess, you no longer have the choice to fight or not fight common trolls. To make it to safety, you have to fight your way out.



The Listing

There are several lines that contain IF statements like IF F PRINT"THE NYMPH GOES MAD" (line 900). This is not a mistake, but a memory-saver and is permissible because numerical IF statements test for a non-zero value. F, in this case, can only be a 1 or a 0.

The revised program requires nearly all of your 16K memory. To further conserve memory, no REM statements are used except for the listing title. However, the program has been written in, more or less, block format with a PRINT statement introducing each block. Table 1 lists those blocks. That should be enough to start you on your search for the dungeon, the princess and a typical fairy tale ending.

Have fun, but watch out for the onions on those hot dogs – they are murder. ■

LINE NUMBERS	DESCRIPTION
1-11	introductory title; set up dragon's graphics code
14-30	Initialize variables; main program entry point
65-70	random number seed
85-105	timer gallery
110-115	question routines
120	set up for nymph
125-170	Great Oracle
180-195	set up of main program loop
200	main loop entry point
220-240	nymph guidance and lot casting
250-270	path choosing
280	enchanted sword
290	snake in the grass
300	check for dungeon and trolls
310	check for rats
320	check for dragons
330	check for pit
335	check for the dungeon
340-360	something is in the bushes
370	check for Necromancer and satyrs
390-400	gold
410	slave girl
420	check for dungeon
430	check for pit
440	dead end
500	nymph's mad
530-540	travel advisory
550-556	check on provisions
570-600	captured by goblins
610-695	dungeon
700-745	run of the mill troll
750-790	Satyrs
800-885	the pits
900-910	Necromancer
950	rats
960-1095	Warrior Troll
2000	something is in the bushes
2100-2120	spider
2300-2350	surprise goblin
2400-2430	the hot dog salesman
3000-4200	dateline: news story

Table 1. Block format for Swords and Sorcery II.

```
1 CLS:PRINT@278,"SWORDS AND SORCERY II":PRINT@408,"BY B
    ARRY L. ADAMS":PRINT@467,"GREENVILLE , NORTH CAROL
    INA":PRINT@586,"BASED UPON A PROGRAM  WRITTEN BY B
    RUCE TURRIE"
3 PRINT@656,"PUBLISHED IN THE AUGUST 1978 ISSUE":PRINT@
    735,"OF":PRINT@791,"KILOBAUD MAGAZINE":PRINT
5 FOR X=32767 TO 32709 STEP-1:READ Z:POKE X,Z:NEXT:FOR
    X=32708 TO 32697 STEP-1:READ Z:POKE X,Z:NEXT:DELET
    E 1-11
10 DATA 160,190,191,180,184,191,191,191,191,191,188,144
    ,160,186,191,191,191,191,191,191,191,191,191,191,1
    91,191,188,188,144,160,190,191,147,175,191,191,191
    1,191,191,191,191,191,191,159,131,179,191,181,160,190,
    191,151,160,191,191,168,191,186,170
11 DATA 188,188,191,190,189,131,131,131,170,191,170,191
14 REM
                    SWORDS AND SORCERY II

15 CLS:
    CLEAR 250:DEFINT L:XX=458:GOSUB 65:FOR X=1TO9:READ
     Y,Z:A(X)=Y:B(X)=Z:NEXT:DATA 15898,3,15961,7,16023
    3,16,16086,17,15969,4,15907,2,15844,1,15781,0,1571
    R$=" OUR BUNGLING HERO "
20 RANDOM:PA=2:B$(1)="CLANK ":B$(2)="SLASH ":B$(3)="WOO
    SH ":B$(4)="BONG ":B$(5)="CRASH ":B$(6)="BING ":B$
    (7)="CLANK ":S$(1)=CHR$(160)+CHR$(183)+CHR$(181)+C
    CHR$(183)+CHR$(181)+STRING$(60,32)+STRING$(4,149):
    HR$(149):K$=CHR$(132)
25 S$(2)=CHR$(176)+CHR$(144)+CHR$(176)+CHR$(144)+STRING
    $(59,32)+CHR$(162)+CHR$(135)+CHR$(151)+CHR$(151)+C
    HR$(167):FOR Y=1TO5:FORX=1TO5:READ Z:E$(Y)=E$(Y)+C
    HR$(Z):NEXTX,Y
30 E$(6)=CHR$(156)+" "+CHR$(156):E$(8)="       ":E$(7)=C
    HR$(135)+" "+CHR$(135):E1$="-  -":E2$="     ":FOR X
    =1TO7:READ Y:E3$=E3$+CHR$(Y):NEXT:FOR X=1TO7:READ
    Y:E4$=E4$+CHR$(Y):NEXT:GOTO70
65 CLS:PRINT@XX,CHR$(23);"SWORDS AND SORCERY II":PRINT:
    RETURN
70 PA=10:PRINT"ENTER A NUMBER BETWEEN 1 AND 9":GOSUB115
    :A=AN:PA=0:FOR X=1TOA:PN=RND(A+5):NEXT:PA=0:GOSUB9
    0:CLS:GOTO120
80 RETURN
85 FOR T9=1TO50:NEXT:RETURN
90 FOR T9=1TO100:NEXT:RETURN
95 FOR T9=1TO300:NEXT:RETURN
100 FOR T9=1TO500:NEXT:RETURN
105 FOR T9=1TO1000:NEXT:RETURN
110 A$=INKEY$:IF A$="",110 ELSE AN=ASC(A$):IF AN=89 OR
    AN=78 RETURN ELSE 110
115 A$=INKEY$:IF A$="",115 ELSE AN=VAL(A$):IF AN>PA,115
     ELSE PA=2:RETURN
120 IF RND(PN)*2<=RND(PN)*RND(2) GOSUB65:PRINT"A DRYAD
    HAS OFFERED TO BE YOUR":PRINTTAB(12);"GUIDE":PRINT
    TAB(6);" DO YOU WISH IT ?":GOSUB110:GOSUB90:IF AN=
    =89,F=1 ELSE IF RND(0)>.2 GOSUB65:GOSUB 500:GOSUB1
    HR$(149):K$=CHR$(132)
125 CLS:XX=266:GOSUB65
130 W=F:PRINT" THERE ARE THREE PATHS INTO THE OLD FORES
    T, HOWEVER , ONLY ONE  IS TRUE THE OTHERS ARE FOUL
     AND";PRINTTAB(4);"REEK OF MISERIES UNTOLD":PRINT:
    C=RND(3):Y=RND(3):IF RND(0)>.4,Y=C
140 PRINT"DO YOU WISH TO CONSULT THE GREAT";:PRINTTAB(1
    2);"ORACLE ?":GOSUB110:IF AN=78,180 ELSE CLS:XX=20
    2:GOSUB 65:PRINT:PRINT"AHA! TO GAIN FAVOR WITH THE
    E FAT  ONE AND GET THE POOP YOU NEED    YOU MUST F
     APPEASE HIM.":PRINT
150 PRINTTAB(2);"HOW MANY MAIDENS SHOULD BE":PRINTTAB(1
    0);"SACRIFICED";:INPUTMD:IF RND(MD)<RND(PN) PRINTT
    AB(1);"OH OH THE ORACLE IS OFFENDED":K=K-1:GOTO160
155 IF RND(0)>.4-(MD/10),165
160 PRINT"THE SIGNS ARE UNCLEAR - YOU MUST ";:GOTO170
165 PRINT:PRINTTAB(5);"THE ORACLE SAYS PATH";Y:PRINTTAB
    (5);"IS THE PATH OF TRUTH":P=1
170 IF F AND RND(MD)>RND(PN)*RND(PN) GOSUB500
180 PRINT:PA=3:PRINTTAB(5);"CHOOSE PATH 1,2 OR 3":GOSUB
    115:X=AN:L=RND(100)+100:IFX<>C,K=K-1:L=L+50 ELSE K
    =K+1
190 K=K+.5*RND(0)+F+P+.2*M*SGN(5.1-M):DT=L
195 CLS:PRINTTAB(21);"SWORDS AND SORCERY II":PRINT
200 PRINT:PRINT"YOU HAVE COME TO A FORK IN THE PATH":C=
    RND(2):Z=W-F:S=8-Z-G/(1+Z):IF S<4,S=4
210 IF RND(3)>K,L=L+1
220 L2=7+RND(20):LO=L2:IF F PRINT"PERHAPS YOU WOULD LIK
    E TO ASK THE NYMPH ?":GOSUB110:IF AN=78,250 ELSE I
    F RND(0)>.5+K/50 PRINT"SHE DOESN'T KNOW":GOTO 250:
    ELSE PRINT"SHE SAYS PATH ";C:GOTO250
230 PRINT"WILL YOU CAST LOTS TO DECIDE ?":GOSUB110:IF A
    N=78,250 ELSE PRINT"THE LOTS SAY YOU SHOULD TAKE P
    ATH";:IF RND(0)>.5+K/10 X=3-C ELSE X=C
240 PRINTX
250 PRINT"WHICH WAY DO YOU WISH TO PROCEED  PATH 1 OR 2
     ?":GOSUB115:B=0:IF X=C,K=K+RND(0)*SGN(.5-RND(0)):
    D=0:GOTO270
260 K=K-.2:D=-1
270 L2=L2-S
280 I=I+1:IF E=0 AND RND(0)<.15+.2*F PRINT:PRINT"  WHAT
     LUCK ! YOU HAVE HAPPENED UPON ONE OF THE ENCHANTE
    D SWORDS OF THE OLD ONES":K=K+.2:E=1:PRINT
290 IF RND(0)-.5*(F+D)>.95 PRINT:PRINT" S N A K E !!!!!
```

```
     !!!!!!!!!!!!":PRINT:GOSUB530
300 T=T+1:IF RND(0)<.15,420 ELSE IF RND(0)>.8+(K+D)/30
     GOSUB700:GOSUB95
310 IF RND(0)>.95 GOSUB950:GOSUB95
320 IF RND(0)>.92 GOSUB2200
330 IF RND(0)<.03 GOSUB800:GOSUB95
335 IF RND(0)<.4,420
340 PT=0:IFRND(0)>.97 GOSUB2000
350 IF RND(0)<.2 GOSUB2000:GOSUB95
360 IF RND(0)>.96 IF M<=0 GOSUB2000 ELSE GOSUB2400
370 IF RND(0)>.98+(K-I/10)/100 GOSUB900
380 IF W<>0 AND RND(0)>.95+(K+D)/50 GOSUB750:GOSUB95
390 IF RND(0)>.75 PRINT:PRINT"WHAT'S THIS BESIDE THE PA
    TH":PRINT"A CHEST":PRINT"GOLD !":GC=RND(PN)*RND(PN
    ):PRINT"THERE ARE ";GC;"COINS":G=G+GC:DS=DS-GC*.00
    01
400 IF T>10-2*F GOSUB540
410 IF RND(0)<.05 PRINT" YOU MEET A SLAVE GIRL":W=W+1:M
    =M+1
420 IF L2>0,270 ELSE L=L-LO*.85:IF L<20 GOSUB610
430 IF D<>-1 OR RND(0)<.9,200 ELSE IF RND(0)>.6 GOSUB80
    0
440 PRINT"OOPS THIS PATH IS A DEAD END":L2=L2+LO:L=L+LO
    :D=0:GOTO270
500 PRINTTAB(3);"THE NYMPH IS MOST PERTURBED":PRINTTAB(
    2);"SHE CURSES YOU AND DISAPPEARS":PRINTTAB(8);"IN
    TO THE FOREST":F=0:W=0:K=K-1:RETURN
530 PRINT"YOU HAVE BEEN HURT !"
540 PRINT"YOU MUST STOP AND REST BEFORE GOING ON.":IF F
     PRINT"THE NYMPH THINKS THAT THE DUNGEON IS LESS T
    HAN";ABS(L-20);"YERBS AWAY":ELSE PRINT"YOU HAVE TR
    AVELED";INT(ABS(DT-L)*.75);"FARBBLE WARFERS"
550 T=0:GOSUB105:H=H+1+W-F:IF H<4-W+F,560 ELSE IF J=0 P
    RINT:PRINT"YOU HAVE JUST EATEN THE LAST OF YOUR FO
    OD":PRINT:J=1:K=K-RND(0):ELSE M=M+1:K=K-RND(0)+.2*
    F
560 IF RND(0)<1-(I+N)/100 PRINT"TIME TO PUSH ON"
565 IF M<14 RETURN ELSE R4=7:GOTO3000
570 PRINT:PRINT"YOU HAVE BEEN CAPTURED BY GOBLINS":IF E
    <>1,600 ELSE PRINT"THEY WANT THE SWORD THAT ONCE B
    ELONGED TO THE OLD ONES -":PRINT"WILL YOU TRADE IT
    T FOR YOUR FREEDOM ?":GOSUB110:IF AN=78,600 ELSE E
    :PRINT"IT IS THEN AGREED":GOSUB100
580 IF PT FOR T=1TO 50:PRINT"HA,HA,HA,HA,HA,HA,HA,HA,HA
    ,HA,HA,HA,HA,HA,HA,HA,HA,HA,HA,HA":NEXT:PRINT"T
    HEY TOSS YOU BACK INTO THE PIT WHERE ";
590 IF M<14 RETURN ELSE R4=7:GOTO3000
600 Q=RND(30):IFG>=Q PRINT"THE GOBLIN LORD FREES YOU FO
    R";Q;"GOLD COINS":G=G-Q:GOTO580:ELSE IF W<=0,R4=8:
    PRINT"YOU ARE ENSLAVED":GOTO3000:ELSE PRINT"YOU AR
    RE SOLD TO THE SATYRS BY THE GOBLINS":GOSUB760:GOT
    :PRINT"IT IS THEN AGREED":GOSUB100
610 IF R=0 PRINT:PRINT"LOOK! THERE IS THE ENTRANCE TO T
    HE DUNGEON":GOSUB105:PRINT"H";:FOR EX=1TO61:PRINT"
    M";:GOSUB80:NEXT:PRINT" !":PRINT"THERE APPEARS TO
     BE A GUARD":GOSUB105:PRINT"IT'S TOO DARK TO SEE F
    HERE - MUST GET CLOSER ":GOSUB105:GOTO650
620 IFL>0 RETURN ELSE IF R=-2,R4=9 ELSE R4=10
630 GOTO3000
650 CLS:DX=80:FOR DY=41TO18 STEP -1:SET(DX,DY):NEXT:FOR
     DY=17TO12 STEP -1:DX=DX+1:SET(DX,DY):NEXT:FOR DX=
    86TO94:SET(DX,12):NEXT:DX=94:FOR DY=12TO19:DX=DX+1
    :SET(DX,DY):NEXT:FORDY=19TO44:SET(102,DY):NEXT
655 DX=70:FOR DY=39TO1 STEP -1:SET(DX,DY):NEXT:FOR DY=2
    TO47:SET(120,DY):NEXT:WX=6:LZ=448:FOR EZ=1TO3:GOSU
    B685:NEXT EZ
660 X=1:GOSUB695:GOSUB95:X=3:GOSUB695:GOSUB95:X=1:GOSUB
    695:GOSUB90:X=4:GOSUB695:GOSUB95:X=1:GOSUB695:GOSU
    B90:X=3:GOSUB695:GOSUB90:X=1:GOSUB695:GOSUB90:X=8:
    GOSUB695:IF LZ>448,RETURN
680 VA=448:VB=462:FOR V3=1TO2:FOR LZ=VA TO VB:PRINT@LZ,
    E$(WX);:GOSUB90:PRINT@LZ,E$(8);:WX=(3-(WX-5))+5:NE
    XT:GOSUB 660:VA=462:VB=476:NEXT V3:PRINT@VB,E$(4);
    ;:GOSUB685:PRINT@VB,E$(5);:GOSUB685:PRINT@VB,E$(5)
    INT@VB,E$(4);:FOR X=1TO3:PRINT@492,E1$;:GOSUB10
0
683 PRINT@492,E2$;:GOSUB90:NEXT:GOTO690
685 PRINT@492,E1$;:PRINT@145,"Z";:FOR EX=1TO15:PRINT"Z"
    ;:GOSUB85:NEXT EX:FOR EX=1TORND(500):NEXT EX:PRINT
    @492,E2$;:GOSUB95:PRINT@145,STRING$(16," ");:PRINT
    @492,E1$;:RETURN
690 PRINT@490,E3$;:GOSUB100:PRINT@490,STRING$(8," ");:G
    OSUB90:PRINT@490,E3$;:GOSUB100:PRINT@490,E4$;:GOSU
    B100:PRINT@VB,E$(2);:GOSUB100:CLS:ON RND(4)GOSUB70
    00,960,960,700:R=1:W=W+1:PRINT:PRINT"OK,YOU'VE FOU
    HE PRINCESS":PRINT"LET'S GET OUT OF HERE !":GOT
0620
695 PRINT@LZ,E$(X);:RETURN
700 PRINT:PRINT"UGH ! A TROLL !!!!          YOUR FIGHTI
    NG ABILITY IS";DS*1000;"%":PRINT:IF LZ>0,710 ELSE
    PRINT"ARE YOU GOING TO FIGHT HIM":GOSUB110:IF AN=8
    9,710 ELSE IF RND(3)=1,DS=DS-.01
705 GOSUB740:RETURN
710 TB=0:IF E=1 AND RND(0)<.2+DS PRINT:PRINT"THE TROLL
    RUNS !":PRINT:DS=DS+.01:RETURN:ELSE PRINT"THE FIGH
    T BEGINS . . . ";:GOSUB100:FOR Z7=1TO RND(PN)*3
715 R4=3:PRINT B$(RND(7));:GOSUB90:NEXT Z7:PRINT:IF RND
    (0)+DS+(DS*(E+F*10))>.5 PRINT:PRINT"THE TROLL HAS
    BEEN DEFEATED AND LIMPS OFF";PRINT:DS=DS+.0036:GOT
    O725:ELSE SF=.3:IF E=1,SF=.5
720 IF RND(0)>SF+(DS*(E+F)) PRINT"OOOOF !":GOTO3000:ELS
    E PRINT:PRINT"YOU BOTH ARE TOO TIRED TO CONTINUE T
    HE FIGHT !":PRINT:TB=1:IF RND(3)<>2,DS=DS-.002
725 IF LZ=0 GOSUB540:RETURN:ELSE IF TB=1 PRINT"YOU MUST
     REST":GOSUB100:FOR EX=1TO RND(40):PRINT"REST ,";:
    GOSUB85:NEXT:PRINT" - AGAIN !":GOSUB85:GOTO710
730 IF LZ>0 GOSUB100:RETURN:ELSE IF RND(0)+.05*E<.4 GOS
    UB540
735 RETURN
740 PRINT:PRINT"R";:FOR T8=1TO PN*5:PRINT"U";:GOSUB80:N
    EXTT8:PRINT"N !!!!!!!":PRINT:L=L+4*S*(RND(0)-.7):T
    =T+1:IF RND(0)>.7 GOSUB800
745 RETURN
750 PRINT:PRINT"OH NO! SATYRS.":IF E AND RND(0)<.5 PRIN
    T" HA, THEY RUN FROM YOUR SWORD":DS=DS+.025:RETURN
760 PRINT"THEY WILL LET YOU GO FREE IS IF YOU WILL FIGH
    T THEIR CHAMPION - WHAT IS YOUR DECISION ?":GOSUB1
    10:IF AN=89 GOSUB960:IFRND(0)>.2 RETURN:ELSE DS=DS
    -.002
770 PRINT"THE SATYRS WANT THE FEMALES OF YOUR GROUP":W=
    0:F=0:IF R=1,R=-2
780 PRINT"WILL YOU AGREE TO THESE TERMS ?":GOSUB110:IF
     AN=78 PRINT"OH DID YOU MAKE THEM MAD - THEY DO YOU
     IN AND TAKE THE WOMEN":R4=6:GOSUB100:GOTO3000:ELS
     SE PRINT"THEY TAKE THE WOMEM":IF RND(0)>.03 PRINT"
     CURSE YOU":K=-5
790 IF RND(0)>.3 RETURN ELSE R4=5:PRINT"THE SATYRS CAN
    NEVER BE TRUSTED - THEY DO YOU IN ANYWAY":GOSUB100
    :GOTO3000
800 PRINT:PRINT"YOU HAVE FALLEN INTO A DARK PIT"
810 PT=1:IF RND(0)>.5 GOSUB540
820 PRINT"YOU MUST ESCAPE":PRINT"DO YOU WANT TO TRY AND
     CLIMB OUT OR YELL FOR HELP ?"
830 A$="":A$=INKEY$:IF A$="",830 ELSE A=ASC(A$):IF A=67
     OR A=89 ZX=0 ELSE 830
835 IF A=67 PRINT"OK LET'S GIVE IT A TRY !":GOSUB105: E
    LSE 860
840 IF RND(0)<.5-ZX/10 PRINT"YOU'VE MADE IT - YOU ARE O
    UT":RETURN:ELSE PRINT"YOU FALL WHILE TRYING TO CLI
    MB !":PRINT:PRINT:IF RND(0)<.2 GOSUB540
850 ZX=ZX+1:IF ZX <5,840 ELSE PRINT:PRINT"PUFF PUFF! TO
    O DAMN DEEP GOT TO YELL FOR HELP!":GOSUB105
860 CLS:SP=540:FOR X3=1TO RND(3):X6=1:GOSUB885:FOR X4=1
    TORND(50)*10:NEXT X4:CLS:GOSUB85:NEXTX3:X6=3:GOSUB
    885:GOSUB100:X6=1:GOSUB885:GOSUB100:X6=4:GOSUB885:
    :GOSUB105:CLS:GOSUB85:X6=2:GOSUB885:GOSUB95:CLS:X6
    OSUB885:PRINT@287,Q$:PRINT@351,K$:GOSUB90
865 PRINT@722,"GEE ,  IT'S DARK DOWN HERE":GOSUB100:CLS
    :X6=2:GOSUB885:PRINT@283,"H E L P !":GOSUB95:X6=5:
    GOSUB885:X4=10:PRINT@X4,"*":FOR X3=1TO6:X4=X4-1+(R
    ND(3)-1):PRINTTAB(X4);"*":GOSUB85:NEXTX3
870 PRINT@660,"A ROPE HAS BEEN LOWERED":X6=1:GOSUB885:G
    OSUB105:PT=0:Y=RND(4):PRINT@724,"YOU HAVE BEEN RES
    QUED BY ":IF Y=1 GOSUB 700 ELSE IF Y=2 PRINT"OH NO
    O !":GOSUB570 ELSE IF F PRINT"THE NYMPH" ELSE PRIN
     OLD LADY":W=W+1
880 PRINT"YOU MUST START OUT":GOSUB100:GOTO290
885 PRINT@SP,E$(X6):RETURN
900 PRINT:PRINT"IT'S THE NECROMANCER . . . . !":IF RND(
    0)>.6 GOSUB740:RETURN:ELSE IF F PRINT"THE NYMPH GO
    ES MAD":W=W-1:F=0
905 IF R>0 PRINT"HE TAKES THE PRINCESS":R=-2
910 IF E=1 PRINT"HE TAKES YOUR SWORD":E=-1.5:PRINT"YOU
     ARE CAST INTO A DEEP PIT":PRINT:GOSUB810:RETURN:EL
    SE R4=11:GOTO3000
950 PRINT:PRINT"UGH! RATS, MILLONS OF THEM":GOSUB740:RE
    TURN
960 W3=2:H1=1+DS:H2=1+DS:W2=1+.3*RND(0):H3=2+SGN(E):CLS
    :PRINT@458,CHR$(23);"IT'S A WARRIOR TROLL":R4=4:GO
    SUB105:CLS:PRINTTAB(22);"THE BATTLE BEGINS"
980 FORZ2=1TO200:X=RND(7):NEXTZ2:PRINT:PRINT"YOU CIRCLE
     FOR POSITION";:FOR X2=1TO5:PRINT" . ";:GOSUB90:NE
    XTX2:PRINT
990 H1=H1-.05:H2=H2-.05:PRINT"HE ATTACKS WITH BOTH SWOR
    D AND MACE SWINGING !":IF X=1 PRINT"HE SLASHES WIL
    DLY WITH HIS SWORD !":FOR T7=1TORND(6):PRINT"SLASH
     !";:GOSUB90:NEXT:PRINT:GOTO1030
1000 IF X=2 PRINT"HE THRUST HIS SWORD STRAIGHT FOR THE
    BODY !":GOTO1030:ELSE IF X=3 PRINT"HE ATTEMPS TO S
    EVER YOUR HEAD IN A SINGLE BLOW !":GOTO1030:ELSE I
    IF X=4 PRINT"HE TWIRLS THE MACE DIRECTLY TOWARD YO
    EAD !":GOTO1030
1010 IF X=5 PRINT"HE SWINGS HIS MACE SAVAGELY AT YOUR B
    ODY !":GOTO1030:ELSE IF X=6 PRINT"HE GLANCES YOUR
    BLOW AND LAYS ON WITH HIS SWORD !":GOTO1030:ELSE P
    PRINT"HE KICKS SAND IN YOUR FACE AND SWINGS HIS SW
    TO CLEAVE THE   AIR AND YOUR HEAD ALONG WITH IT
"
1020 PRINT"S";:GOSUB80:PRINT"W";:GOSUB80:FOR X=1TO 50:P
    RINT"O";:GOSUB80:NEXT:PRINT"I";:GOSUB80:PRINT"S";:
    GOSUB80:PRINT"H !"
1030 IF RND(0)<=.5+.3*H2/W2,1050 ELSE PRINT"YOU'RE HIT
    !":H1=H1-.2:H2=H2-.2:GOSUB100:PRINTTAB(15);"OOOOF
    !!":GOSUB95:IF H1>=.05 PRINTTAB(30);"YOU STAGGER A
    AWAY . . . . . .":GOTO980:ELSE PRINTTAB(30);"YOU'R
    WN !!!":GOSUB100
1035 PRINT:PRINT"HE SLOWLY CLOSES FOR THE FINAL BLOW !"
    :FOR X=1 TO RND(16):PRINT" STEP !";:GOSUB95:NEXT:P
    RINT:IF RND(0)>.1+E/20,1045
1040 PRINT:PRINTTAB(13);"YOU DESPERATELY MAKE A FINAL T
    HRUST !!":GOSUB105:IF RND(0)>.9+DS PRINTTAB(22);"S
```

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```
ORRY, YOU BLEW IT !":ELSE PRINTTAB(28);" OOOF !":G
GOSUB 105:PRINTTAB(19);"YOU DID IT !  HE'S DOWN !!
SUB105:RETURN
1045 PRINT:PRINTTAB(23);"YOU'RE FINISHED !!":GOSUB105:G
OTO3000
1050 X=RND(6):IF X=1 PRINT"YOU STOP HIS BLOW WITH YOUR
SWORD AND BACK AWAY !!":GOTO1085:ELSE IF X=2 PRINT
"YOU DUCK UNDER HIS SWORD - VEER FROM HIS MACE AND
D ATTACK !":GOTO1070:ELSE IF X=3 PRINT"YOU PARRY T
ATTACK !":GOTO1070
1060 IF X=4 PRINT"YOU KICK HIM IN THE SHINS AND SCAMPER
 AWAY !":GOTO 1095:ELSE IF X=5 PRINT"YOU STOMP HIS
 TOES WITH YOUR BOOT !":GOTO1095:ELSE PRINT"YOU SL
LASH LEFT !";:IF RND(3)=1 PRINT:ELSE PRINT"YOU SLA
IGHT !"
1065 PRINT"THEN THRUST STRAIGHT FOR HIS KNEES"
1070 FORX3=1TOH3:IF RND(0)<=.1 PRINT"YOU MISSED HIM !!!
!":ELSE X=RND(H3):IF X=1 PRINT"YOU GOT HIS LEG !":
W2=W2-(DS+H2/5):W3=W3-(DS+H2/5):ELSE IF X=2 PRINT"
"YOU'VE SLASHED HIS ARM":W2=W2-(DS+H2/3):W3=W3-(DS
5)
1075 IF X=3 PRINT"YOU SCORE TO HIS BODY !":W2=W2-DS:W3=
W3-(.05+DS)
1080 NEXTX3
1085 IF W2<.1,W2=.1
1090 IF W3>.05,980 ELSE PRINT"HE'S DOWN !!!!!":PRINT"YO
U'VE FINISHED HIM OFF!!":GOSUB105:DS=DS*RND(0):RET
URN
1095 W2=W2-(DS*RND(0)):W3=W3-(DS*RND(0)):GOTO1085
2000 PRINT"HOLD IT !";:GOSUB90:PRINT"   THERE'S SOMETHI
NG MOVING BEHIND THAT BUSH !?!":GOSUB90:R4=RND(5):
ON R4 GOSUB 700,2100,2200,2300,2400:RETURN
2100 CLS:PRINT@154,"GEEZE !!!!":GOSUB95:PRINT@279,"A HU
GH SPIDER !":PRINT@384,"QUICK !   R";:RN=RND(10)+P
N:U2=0
2110 A$=INKEY$:PRINT"U";:U2=U2+1:IF U2=RN,2120 ELSE IF
A$="",2110 ELSE IF A$<>"R",2110 ELSE PRINT"N":GOSU
B90:CLS:PRINT@478,"WHEW !!":RETURN
2120 PRINT@347,S$(1):GOSUB90:PRINT@347,"     ";:PRINT@4
12,S$(2);:GOSUB90:PRINT@412,S$(1):PRINT@604,"SLURP
 !":GOSUB90:PRINT@663,"BU";:FOR X=1TO10:PRINT"R";:
:NEXT:PRINT"P !!";:GOSUB100:PRINT"   HIC !":GOSUB1
4=2:GOTO3000
2200 PRINT"HMMMMMMMMM . . . . . SURE IS WARM ?!?":G
OSUB100:CLS:PRINT@468,CHR$(23);"YIEPE !!!!":GOSUB9
0:PRINT@524,"IT'S A DRAGON !!!!":GOSUB95:CLS
2210 W3=0:FOR X2=1TO9:GOSUB 2290:NEXT:W3=0:X6=32709:X4=
15704:X5=15708:GOSUB2280:X4=15768:X5=15772:GOSUB22
80:X4=15835:X5=15836:GOSUB2280:X7=16000+RND(18):GO
SUB2270:PRINT@768,;
2215 X$=INKEY$:IF X$<>"", Y2=ASC(X$):IF Y2=44,Y2=-1 ELS
E IF Y2=46,Y2=1 ELSE Y2=0
2220 GOSUB2260:X7=X7+Y2:IF X7>16018,DS=DS+.045:PRINT:PR
INT"YOU DID IT !  -  YOU SLAYED THE DRAGON !!!!":G
OSUB100:RETURN:ELSE IF X7>=16000 GOSUB2270 ELSE 22
95
2240 IF RND(4)<>1,2215 ELSE F2=18:FOR F1=46 TO 30 STEP-
1:F2=F2+1:IF POINT(F1,F2) IF E=1,R7=RND(2) ELSE R7
=RND(3) ELSE 2250
2245 IF R7=2 PRINT"SIZZLE - YOU'VE BEEN SCORCHED !";:DS
=DS-.002:ELSE PRINT"YE";:T6=X7:FOR X7=T6TO16000 ST
EP-1:GOSUB2270:PRINT"O";:GOSUB2260:NEXT:PRINT"W !"
:R4=1:GOTO3000
2250 SET(F1,F2):NEXT:GOSUB90:F2=18:FOR F1=46 TO 30 STEP
-1:F2=F2+1:RESET(F1,F2):NEXT:GOTO2215
2260 FOR X3=0TO3:POKE X7+X3,128:NEXT:POKE X7+65,128:POK
E X7+66,128:RETURN
2270 POKE X7,136:POKEX7+1,174:POKE X7+2,140:POKE X7+3,4
5:POKE X7+65,151:POKE X7+66,149:RETURN
2280 FOR X3=X4 TO X5:W3=W3+1:POKE X3,PEEK(X6-W3):NEXT:R
ETURN
2290 FOR Z1=0 TO B(X2):W3=W3+1:POKE A(X2)+Z1,PEEK(32768
-W3):NEXT Z1:RETURN
2295 PRINT"COWARD !":RETURN
2300 C3=30:PRINT:PRINT"IT'S A GOBLIN ";:FOR EX=1TO45:PR
INT"!";:GOSUB80:NEXT:GOSUB80:PRINT:FOR EX=1TO32:C3
=ABS(C3+(SGN(RND(3)-2)*5)):IF C3>56,C3=56
2350 PRINTTAB(C3);"R U N !!":NEXT:PRINTTAB(C3);"WHEW, S
AFE !":C=RND(2):L=L+RND(PN)*C:DS=DS-.01*(RND(PN+1)
-1):RETURN
2400 PRINT"GEE !":GOSUB95:PRINT"IT'S A KID SELLING HOT
DOGS !?!":IF J AND G>0,HD=RND(G+G/2) ELSE HD=G+1
2420 GOSUB100:PRINT"THE KID SAYS HE'LL SELL YOU ONE OF
HIS GASTRONOMIC DELIGHTS FOR";HD;"GOLD COINS":GOSU
B100:IF HD>G PRINT"SORRY, YOU'RE TOO POOR":RETURN:
ELSE G=G-HD
2430 M=M-RND(14):PRINT"GREAT !":RETURN
3000 GOSUB100:CLS:PRINT"DATELINE : THE OLD FOREST":PRIN
T:ON R4 GOTO 3100,3200,3300,3400,3500,3600,3700,38
00,3900,4000,4200
3100 PRINT" WOW! CAN";R$;"RUN. WHAT AN EXHIBITION OF BL
INDING SPEED. UNFORTUNATELY IT OCCURRED AS A RESUL
```


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```
     T OF A BLISTERING DISCOVERY CONCERNING DRAGONS AND
     D IN THE OPPOSITE DIRECTION OF THAT OF THE PRINCES
     GOTO4500
3200 PRINT"  WHILE SEARCHING FOR THE LOST PRINCESS";R$;
     "BECAMETHE MAIN COURSE OF A RAMBLING ARACHNID":GOT
     O4500
3300 PRINT" ";R$;"WAS ABLE TO HAVE A VERY CLOSE LOOK AT
      ONE OFTHOSE MUCH TALKED ABOUT TROLL SWORDS TODAY
      - UNFORTUNATELY IT WAS WHILE HE WAS BEING STABBE
     D WITH IT":GOTO4500
3400 PRINT"BLUNDER MAN STRIKES AGAIN":PRINTR$;"STUPEFIE
     S EVERYONE - MAKES TROLL'S SWORD     DISAPPEAR IN
     BODY - UNFORTUNELY HIS OWN":GOTO4500
3500 PRINT"AFTER REACHING FULL AGREEMENT WITH";R$;"THE
     SATYRS NOT ONLY THREW A GREAT FEAST IN HIS HONOR B
     UT MADE HIM THE MAIN DISH AS WELL":GOTO4500
3600 PRINT"  WHILE";R$;"WAS CONDUCTING VERY DELICATE NE
     GOTIA -TIONS WITH THE SATYRS - THEIR DIPLOMATIC CO
     RP ATE HIM FOR LUNCH":GOTO4500
3700 PRINT"  ";R$;"FOUND THAT WHILE ON HIS LOFTY EXCURS
     ION HE COULD DO WITHOUT MANY THINGS. UNFORTUNATELY
      FOOD WAS NOT ONE OF THEM - HE STARVED TO DEATH":G
     OTO4500
3800 PRINT"  YOU GUESSED IT !";R$;"HAS DONE IT AGAIN.":
     PRINT"HOPE HE LIKES DOING WINDOWS":GOTO4500
3900 PRINTR$;"MAKES IT TO DUNGEON AND BACK THROUGH MANY
          PERILS - HAS ONLY ONE PROBLEM - LOOSES PRINCES
     S":GOTO4500
4000 PRINTR$;"HAS PULLED IT OFF - THE PRINCESS HAS BEEN
          RESQUED";:IF G>RND(30) PRINT;"  - IS IMMEDIATE
     LY ACCEPTED INTO THE KING'S COURT AND IS ALLOWED T
     TO DO ALL THOSE NICE LITTLE THINGS THAT ONE DOES H
     LYEVER AFTER":GOTO4500
4100 PRINT"  -  UNFORTUNATELY HE IS TOO POOR TO BE ACCE
     PTED IN TO   ROYALTY - MUST KEEP UP THE IMAGE YOU
     KNOW":GOTO4500
4200 PRINTR$;"RAN INTO SLIGHT DIFFICULTY - THE NECROMAN
     CER.";:PRINT"INFORMED SOURCES SAY THAT OUR HERO NO
     W EATS HEY AND IS HEARD TO BREY OCCASSIONALLY"
4500 PRINT:INPUT"ENTER FOR ANOTHER ADVENTURE";A:RUN
5000 DATA 156,172,32,156,172,159,175,32,159,175,140,188
     ,32,140,188,188,140,32,188,140,176,188,32,176,188,
     138,156,172,32,168,140,158,138,140,188,32,140,188,
     133

DONE
```


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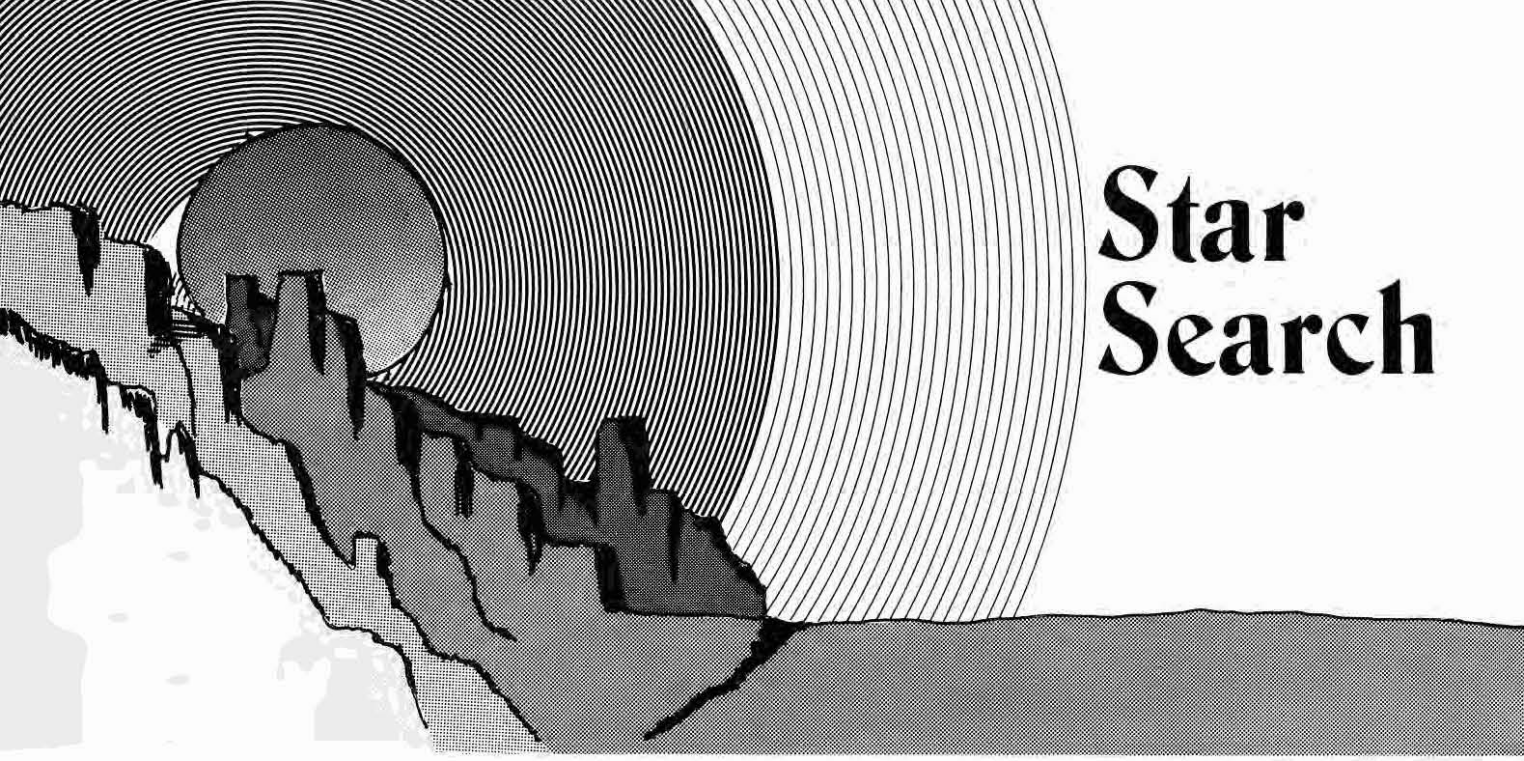

Star Search

Star Search
Level II 16K
Software Exchange
W. Bloomfield, MI
$12.95

Howard Berenbon
2681 Peterboro
W. Bloomfield, MI 48033

Robert F. Gentile
20156 N. Larkmoor
Southfield, MI 48076

Star Search is a program for a 16K TRS-80 Level II. It creates a real-time, Star Trek-type game.

As the Captain of the Enterprise, your mission is to protect the Galaxy from the Klingon threat. Your level of experience determines the number of Klingons that you must destroy and the amount of time, in star dates, that you have to complete your mission. A quadrant is displayed as in Example 1. The symbols are as follows:

B Base
E Enterprise
K Klingon
* Star
• Sector

A legend for all operations appears at the top of the display. Just enter the flashing letter for the desired function. There is no need to depress ENTER. Here are your options:

1) R Report
2) S Short Range Sensor
3) L Long Range Sensor
4) C Computer
5) P Phaser
6) G Galaxy Map
7) T Torpedoes (Photon)
8) E Engines
9) Z Self Destruct

Options

Typing an R displays the status of the Enterprise, including the power left and the number of Klingons left. See Example 2.

Typing an S activates the Short Range Sensor and displays the quadrant where you are currently located. The Y-coordinate is the vertical and the X-coordinate is the horizontal. It's also shown in Example 1.

The Long Range Sensor is activated by typing an L. It displays a number code for the eight quadrants that surround the Enterprise, plus its present location at the center. This is the format:

1) The hundreds digit indicates the number of Klingons (K) in the quadrant.

2) The tens digit indicates the number of Bases (B).

3) The ones digit indicates the number of Stars (*). A zero indicates that there are no objects in the quadrant (Example 3).

The computer can be used to calculate the angle for firing torpedoes and moving the Enterprise. Type a C to activate the computer. Enter the Y-coordinate and the X-coordinate of the object. After entering the numbers, depress ENTER. The sector distance and angle will be displayed as in Example 4.

The Phasers are activated by typing a P. Enter the unit amount of energy you wish to fire. The hit will be displayed graphically. If there is more than one Klingon in the quadrant, then the energy will be distributed evenly among them (Example 5).

Typing a G displays the Galaxy Map. It displays 64 quadrants with a similar notation, as in the Long Range Sensor. The only difference is, the code includes a minus sign (–) to indicate that the quadrant has already been charted. Here are some examples:

1) – 0 indicates already charted but empty
2) 0 indicates uncharted
3) – 102 indicates 1 Klingon, no Bases, and 2 Stars
4) – 12 indicates 1 Base and 2 Stars
5) – 1 indicates 1 Star

Example 6 displays a Galaxy Map.

Type a T to activate the torpedoes, and enter the direction in

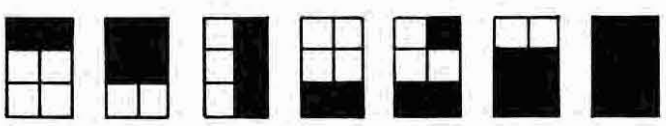

Fig. 1. Some graphic codes and their pattern.

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degrees from 0 to 360. Press ENTER to fire. If you've used the computer to calculate the angle of the target, then activate the torpedoes and type a C to fire. The torpedo will be displayed moving across the quadrant to the target.

You can destroy Stars, Klingons and even Star Bases. You have 10 torpedoes, illustrated in Example 7.

The Engines are activated by typing an E. You can move the Enterprise within a quadrant or to another quadrant. A sector distance and angle entry is required. The movement is displayed, with the ship starting slowly and then gathering speed.

To move to another quadrant, enter a sector distance which moves the Enterprise beyond the boundaries of the quadrant. Moving at angles other than 0, 90, 180, 270 or 360 requires a greater sector distance to reach your destination.

Finally, you can't move through Stars, Star Bases, or Klingons; you must maneuver around them. Example 8 illustrates this movement.

One final command used under extreme conditions is the Z command. Typing a Z destroys the Enterprise and ends the game.

```
(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 73.915
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  3977
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
SHORT RANGE SENSOR      1  .  .  .  .  .  .  .  .
                        2  *  .  .  .  .  .  E  *
                        3  .  .  .  .  .  .  .  .
                        4  .  .  .  .  .  .  *  .
                        5  .  .  .  .  .  .  .  .
                        6  .  *  .  .  .  .  .  *
                        7  .  *  .  .  .  .  .  .
                        8  .  .  .  .  .  .  .  .
                           1  2  3  4  5  6  7  8
                     ENTERPRISE IN QUADRANT 5  5 SECTOR 2  7
```

Example 1. Quadrant 5 5 and Short Range Sensor are displayed.

```
(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 73.681
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  3975
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
STATUS REPORT           1  .  .  .  .  .  .  .  .
 STARDATE 3733.28       2  *  .  .  .  .  .  E  *
 TIME LEFT 73.7153      3  .  .  .  .  .  .  .  .
 CONDITION  GREEN       4  .  .  .  .  .  .  *  .
 POSITION               5  .  .  .  .  .  .  .  .
  QUADRANT 5  5         6  .  *  .  .  .  .  .  *
  SECTOR 2  7           7  .  *  .  .  .  .  .  .
 ENERGY 3975            8  .  .  .  .  .  .  .  .
 TORPEDOES   10             1  2  3  4  5  6  7  8
 KLINGONS LEFT   25    ENTERPRISE IN QUADRANT 5  5 SECTOR 2  7
 STARBASES   7
```

Example 2. Status Report.

```
(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 72.130
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  3957
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
LONG RANGE SENSOR       1  .  .  .  .  .  .  .  .
  104  103  108         2  *  .  .  .  .  .  E  *
  107    6    1         3  .  .  .  .  .  .  .  .
   12  106  102         4  .  .  .  .  .  .  *  .
                        5  .  .  .  .  .  .  .  .
                        6  .  *  .  .  .  .  .  *
                        7  .  *  .  .  .  .  .  .
                        8  .  .  .  .  .  .  .  .
                           1  2  3  4  5  6  7  8
                     ENTERPRISE IN QUADRANT 5  5 SECTOR 2  7
```

Example 3. Long Range Sensor.

```
(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 68.079
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  3582
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
COMPUTER READY          1  .  .  .  .  .  .  .  .
                        2  .  *  .  .  .  .  .  .
                        3  .  .  .  .  .  .  *  .
                        4  .  .  .  .  .  .  .  K
                        5  .  .  .  .  *  .  .  .
                        6  .  .  .  .  .  .  E  *
                        7  .  .  .  .  .  .  .  .
                        8  .  *  .  .  .  .  .  .
ENTER DESIRED              1  2  3  4  5  6  7  8
TARGET LOCATION       ENTERPRISE IN QUADRANT 3  5 SECTOR 6  7
 SECTOR Y AXIS 4   ANGLE = 26
 SECTOR X AXIS 8   RANGE = 2
```

Example 4. Computer Display.

Special Subroutines

Here's a description of some of the special subroutines used in Star Search including the Enterprise graphics, the moving stars, active keyboard input, target impact, and timing. (Note: Up arrow appears as a left bracket in the listing.)

The Enterprise is drawn with program lines 2790 through 2910. It's drawn quickly, in large blocks, using the statement STRING$(X,Y), where X is the number of graphic blocks to be activated and Y is the pattern turned on.

The TRS-80 graphic block is divided into six smaller sub-blocks. Sixty-four different patterns can be created using code numbers 128 through 191 for Y. The instruction CHR$(Y) activates a single pattern as seen in lines 2890 and 2900. In line 2790 the statement PRINT@138,STRING$(23,191); activates 23 full display blocks, beginning at screen position 138.

Line 2800, PRINT@235,STRING$(13,176);, activates 13 partial blocks beginning at screen position 235. And so on. See Fig. 1 for some of the block patterns and their codes.

Program lines 2950 through 3080 create the moving stars, as seen when the Enterprise moves from one quadrant to another. This simulates movement through space.

Program lines 2950 through 3040 establish the moving star matrix B(11,11,2). It contains 121 sets of X and Y coordinates, for the 12 separate star paths. The data in line 3010 provide progressively increasing steps to simulate the visual effect of movement.

The active keyboard input routine uses the INKEY$ statement of Level II BASIC at program lines 670 through 760, 2760 and 2770.

```
(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 65.948
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  3561
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
PHASER   ENERGIZED.     1  .  .  .  .  .  .  .  .
                        2  .  *  .  .  .  .  .  .
                        3  .  .  .  .  .  .  *  .
                        4  .  .  .  .  .  .  .  K
                        5  .  .  .  .  *  .  .  .
                        6  .  .  .  .  .  .  E  *
                        7  .  .  .  .  .  .  .  .
                        8  .  *  .  .  .  .  .  *
                           1  2  3  4  5  6  7  8
                     ENTERPRISE IN QUADRANT 3  5 SECTOR 6  7
 UNITS TO FIRE 600


(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 65.541
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  2959
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
PHASER   ENERGIZED.     1  .  .  .  .  .  .  .  .
                        2  .  *  .  .  .  .  .  .
 515 UNITS HIT          3  .  .  .  .  .  .  *  .
    KLINGON AT          4  .  .  .  .  .  .  .  .
    SECTOR 4  8         5  .  .  .  .  *  .  .  .
**  DESTROYED  **       6  .  .  .  .  .  .  E  *
                        7  .  .  .  .  .  .  .  .
                        8  .  *  .  .  .  .  .  *
                           1  2  3  4  5  6  7  8
                     ENTERPRISE IN QUADRANT 3  5 SECTOR 6  7
 UNITS TO FIRE 600
 SPOCK: 'THERE ARE 24 KLINGONS REMAINING'
```

Example 5. Display of Phaser Operation.

```
(R)EPORT     (S)R. SENSOR    (L)R. SENSOR       DAYS LEFT 64.913
(P)HASER     (G)ALAXY MAP    (T)ORPEDOES 10     POWER LEFT  2952
(C)OMPUTER   (E)NGINES          COMMAND PLEASE  *** CAPTAIN ***
GALAXY MAP              :1  0   0   0   0   0   0   0   0
                        :2  0   0   0   0   0   0   0   0
                        :3  0   0   0 -101  -6 -108  0   0
                        :4  0   0   0 -104 -103 -108  0   0
                        :5  0   0   0 -107   -6   -1  0   0
                        :6  0   0   0  -12 -106 -102  0   0
                        :7  0   0   0   0   0   0   0   0
                        :8  0   0   0   0   0   0   0   0
                            1:  2:  3:  4:  5:  6:  7:  8:
                     ENTERPRISE IN QUADRANT 3  5 SECTOR 6  7
```

Example 6. Galaxy Map.

Word Processing HMCT Style

Using the best in word processing software **the Magic Wand™**, the best in letter quality printers **the NEC Spinwriter™**, and the well-known **TRS-80™ MOD II.** You have looked and looked for the best and now it is available from the **Complete Computer Company, HMCT.** Word Processing at its best from $7500.

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HMCT **The Complete Computer Company**
5313 Bissonnet Bellaire, Texas 77401 (713) 661-2005 13

Magic Wand is a trademark of Small Business Applications, Spinwriter is a trademark of NEC, and TRS-80 is a trademark of Radio Shack.

This allows the command entry at any time, since the keyboard is constantly being checked for input. It also serves as a keyboard debounce routine.

Program lines 3500 through 3600 are used for target impact during combat. Eighteen is the location of the target and A$ is the target type. When a Klingon, a Star, a Star Base, or the Enterprise is hit, program line 3530 displays the impact symbol (a cross) over the object. Line 3590 clears the symbol from the display.

The subroutine located at program line 3610 decrements the DAYS LEFT variable D by .002. This happens each time the program runs through the input routine at line 2760. This works out to be about one minute per STARDATE. ■

```
(R)EPORT      (S)R. SENSOR    (L)R. SENSOR        DAYS LEFT 45.442
(P)HASER      (G)ALAXY MAP    (T)ORPEDOES  9      POWER LEFT  3504
(C)OMPUTER    (E)NGINES           COMMAND PLEASE  ### CAPTAIN ###
PHOTON TORPEDO TUBES  1.    .    *    .    .    .    .    .    .
 LOADED               2     .    .    .    .    .    .    .    .
                      3     *    .    .    .    .    .    *    .
                      4     .    .    .    .    .    .    .    .
                      5     *    .    .    E    .    .    .    .
                      6     .    .    .    *    .    .    .    .
                      7     .    .    .    .    .    .    .    K
                      8     .    .    .    .    .    .    .    .
                            1    2    3    4    5    6    7    8
                      ENTERPRISE IN QUADRANT 6  5 SECTOR 5  4
 TORPEDO FIRED
 COURSE (0-360)  116
```

```
(R)EPORT      (S)R. SENSOR    (L)R. SENSOR        DAYS LEFT 44.298
(P)HASER      (G)ALAXY MAP    (T)ORPEDOES  8      POWER LEFT  3491
(C)OMPUTER    (E)NGINES           COMMAND PLEASE  ### CAPTAIN ###
PHOTON TORPEDO TUBES  1.    .    *    .    .    .    .    .    .
 LOADED               2     .    .    .    .    .    .    .    .
                      3     *    .    .    .    .    .    *    .
    KLINGON AT        4     .    .    .    .    .    .    .    .
    SECTOR 7  8       5     *    .    .    E    .    .    .    .
##  DESTROYED  ##     6     .    .    .    *    .    .    .    .
                      7     .    .    .    .    .    .    .    .
                      8     .    .    .    .    .    .    .    .
                            1    2    3    4    5    6    7    8
                      ENTERPRISE IN QUADRANT 6  5 SECTOR 5  4
 TORPEDO FIRED
 SPOCK: 'THERE ARE 20 KLINGONS REMAINING'
```

Example 7. Photon Torpedo Operation.

```
(R)EPORT      (S)R. SENSOR    (L)R. SENSOR        DAYS LEFT 16.676
(P)HASER      (G)ALAXY MAP    (T)ORPEDOES  7      POWER LEFT  2967
(C)OMPUTER    (E)NGINES           COMMAND PLEASE  ### CAPTAIN ###
ENGINES               1.    .    .    .    .    .    .    .    .
                      2     .    .    .    .    .    .    .    .
                      3     .    .    .    .    .    .    .    .
                      4     .    *    .    .    .    .    .    .
                      5     .    .    .    *    E    .    .    .
                      6     .    .    .    .    .    .    .    .
                      7     .    .    .    .    *    .    .    .
                      8     .    .    *    .    .    .    .    .
                            1    2    3    4    5    6    7    8
                      ENTERPRISE IN QUADRANT 4  4 SECTOR 5  5
 SECTOR DISTANCE  7
 COURSE (0-360)  0
```


```
KLINGON ATTACK
 330 UNITS HIT FROM KLINGON AT SECTOR 5  5
```

```
(R)EPORT      (S)R. SENSOR    (L)R. SENSOR        DAYS LEFT 15.124
(P)HASER      (G)ALAXY MAP    (T)ORPEDOES  7      POWER LEFT  2612
(C)OMPUTER    (E)NGINES           COMMAND PLEASE  ### CAPTAIN ###
SHORT RANGE SENSOR    1     .    .    .    .    .    .    .    .
                      2     .    .    .    .    .    .    .    .
                      3     .    .    .    .    .    .    .    .
                      4     .    .    .    .    .    .    .    .
                      5     .    .    .    .    K    .    .    .
                      6     .    .    *    .    E    .    .    .
                      7     .    .    .    .    .    .    .    .
                      8     .    .    .    .    .    .    .    .
                            1    2    3    4    5    6    7    8
                      ENTERPRISE IN QUADRANT 3  4 SECTOR 6  5
```

Example 8. Engine Operation.

Star Search Program Listing.

```
100 ONERRORGOTO3730:POKE16553,255:RANDOM:DEFINTA-C,F-Z:
     GOTO130
110 E1=40-Z9-40*(D=99):Z=0
120 FORR=0TOE1:IFR/4=INT(R/4)ANDD<90THENGOSUB3610:NEXTR
     :RETURNELSENEXTR:RETURN
130 CLS:PRINT@86,"COPYRIGHT   (C)  1980":PRINT@158,"BY"
     :D=99
140 PRINT@204,"R. G E N T I L E  &  H. B E R E N B O N"
150 G(1)=1:G(2)=14:G(3)=30:G(4)=65:G(5)=78:G(6)=94:G(7)
     =129:G(8)=142:B$(1)="R"
160 B$(2)="S":B$(3)="L":B$(4)="P":B$(5)="G":B$(6)="T":B
     $(7)="C":B$(8)="E"
170 PRINT@9,"*#*#*#*#*# S T A R   S E A R C H #*#*#*
     *#*#*";:E1=99:GOSUB120
180 DIMA(152),B(11,11,2),C(11),Z(11):Q=6:GOSUB2790
190 PRINT@896,"WELCOME ABOARD. PLEASE ENTER THE NUMBER
     OF YEARS YOU HAVE BEEN"
200 PRINT" A STAR SHIP CAPTAIN (0 TO 9)";
210 A$=INKEY$:IFA$=""THENGOSUB3310:GOTO210
220 Z9=VAL(A$):Y=6000/(Z9+2):GOTO3100
230 CLS:PRINT@12,"ACTION ALERT !! STANDBY FOR WARP DRIV
     E !!":GOSUB110
240 A=64:GOSUB3050:Z7=3000+1000*RND(0):D=60+RND(30-Z9)
250 PRINT@12,"   IN SUB-SPACE ON COURSE TO STATION
     ";
260 A=0:K=0:B=0:FORI=0TO63:J=-(RND(30)<4):IFI/10=INT(I/
     10)GOSUB3060
270 C=6/(RND(Y))[(1/3)
280 IFC>Z9+3THEN270ELSEK=K+C:B=B+J
290 A(I)=-100*C-10*J-RND(8):NEXTI:IF(B<2)OR(K<4)THEN260
300 PRINT@0,"STARDATE";Z7;"  WE ARE ON STATION - SCANNI
     NG AREA"
310 GOSUB3080
320 PRINT@64,"YOU HAVE";D;"DAYS";
330 PRINT"   TO DESTROY ";K;"KLINGONS"
340 PRINT"THERE ARE ";B;"STARBASES.":GOSUB970 :C=0:O=0:
     H=K:H1=K:SD=D
350 U=RND(8):V=RND(8):X=RND(8):Y=RND(8)
360 FORI=71TO152:A(I)=0:NEXTI:A(8*X+Y+62)=4:M=ABS(A(8*U
     +V-9)):GOSUB3610
370 N=M/100
380 I=1:IFNFORJ=1TON:GOSUB980 :A(J+134)=300:A(J+140)=S:
     A(J+146)=T:NEXTJ
390 M=M-100*N:I=2:IF(INT(M/10))GOSUB980
400 M=M-INT(M/10)*10:I=3
410 IFMFORJ=1TOM:GOSUB980 :NEXTJ
420 GOSUB920 :GOSUB1470:A=2:IFK=<0THEN490
430 IFD>0THEN460
440 A=-4.4:D=.3:GOSUB3700:PRINT@832,"IT'S TOO LATE, THE
      GALAXY HAS BEEN ";
450 PRINT"OVERRUN":GOSUB110:GOTO490
460 IFE>0THEN1140
470 C=400:E=0:A=0:CLS:PRINT"ENTERPRISE DESTROYED"
480 E1=50:GOSUB120:GOSUB2930
490 CLS:PRINT@128,"";:PRINT"FINAL REPORT":PRINT:PRINTD;
     "DAYS LEFT"
500 PRINTH-K;"KLINGONS DESTROYED"
510 PRINTC;"CASUALTIES":CR=1000*(H-K)[2/(H*(SD-D))-C
520 PRINTE;"UNITS OF ENERGY LEFT"
530 PRINTF;"TORPEDOES LEFT":B=1/3:PRINT:PRINT"COMMAND R
     ATING: ";CR
540 J=(1/H)*Z9*(H-K)+(D[B-C[B+F[B+(1/8)*E[B+A)/2:IFJ>10
     THENJ=10
550 IFJ<0THENJ=0
560 IFJ>Z9THENA$="PROMOTION TO FLEET ADMIRAL":A=1:GOTO6
     10
570 IFJ=Z9THENA$="CONTINUED ACTIVE DUTY":A=0:GOTO610
580 IFJ<1THENJ=1
590 A$="COMMAND OF A GARBAGE BARGE":A=-1:IFJ<Z9THENA=-Z
     9+J-1
610 PRINT:PRINT"YOU ARE ";:IFC=400PRINT"POSTHUMOUSLY ";
620 PRINT"RECOMMENDED FOR ";A$
630 PRINT:PRINT"NEW GAME ?":GOSUB110
640 A$=INKEY$:IFA$=""THEN640ELSEIF(A$="Y")THENRUNELSECL
     S
650 PRINT@990,"GOOD BYE.";
660 END
670 Z8=0:A$=INKEY$:IFA$=""THEN820
680 IFA$="S"THEN1140ELSEIFA$="Z"THEN490
690 IFA$="G"THEN1030
700 IFA$="L"THEN1090
710 IFA$="P"THEN1280
720 IFA$="R"THEN1750
730 IFA$="E"THEN1870
740 IFA$="T"THEN2200
750 IFA$="C"THEN2600ELSE820
760 PRINT@0,"(R)EPORT      (S)R. SENSOR    (L)R. SENSOR
         ";
770 PRINT"DAYS LEFT ";:GOSUB3610
780 PRINT@64,"(P)HASER      (G)ALAXY MAP    (T)ORPEDOES"
     ;
790 PRINT"          POWER LEFT ";:GOSUB3620:GOSUB3630
800 PRINT@128,"(C)OMPUTER   (E)NGINES            COMMAND
      PLEASE";
810 PRINT"  ### CAPTAIN ###";:I5=-20
820 IFE=<0ORD=<0THEN430
830 IFK=<0THEN490ELSEGOSUB3610
840 IFI5>20THENI5=-I5:E=E-1:I9=I9+1:GOTO880
850 IFI5<>0THEN670
```

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860 IFI9=10THENGOSUB2080
870 FORA=1TO8:PRINT@G(A)," ";:NEXTA:PRINT@181,"          "
    ;:GOTO820
880 FORA=1TO8:PRINT@G(A),B$(A);:NEXTA:PRINT@181,"CAPTAI
    N";
890 GOSUB3610
900 GOSUB3630910 GOSUB3620:I5=-20:GOTO820
920 FORI=X+(X<>1)TOX-(X<>8):FORJ=Y+(Y<>1)TOY-(Y<>8)
930 IFA(8*I+J+62)<>2THENNEXTJ,I:O=0:RETURNELSEGOSUB1250
940 IFO=0THENGOSUB2790:GOSUB3340
950 PRINT@833,"SULU:'CAPTAIN, ";:PRINT@897,"WE ARE DOCK
    ED  ";
960 PRINT@961,"AT STARBASE'    ";:GOSUB110:GOSUB1250
970 E=4000:F=10:O=1:FORI=64TO70:A(I)=0:NEXTI:GOSUB3610:
    RETURN
980 S=RND(8):T=RND(8):A=8*S+T+62:IFA(A)GOTO980
990 A(A)=I:GOSUB3610:RETURN
1000 GOSUB920 :GOSUB1470:IFZ8THEN1140ELSE880
1010 PRINTTAB(22)"ENTERPRISE IN QUADRANT";U;V;"SECTOR";
     X;Y;
1020 PRINTCHR$(30);:RETURN
1030 J=2:GOSUB1620:Q=213:IFITHEN880
1040 FORI=0TO7:Q=Q+64:PRINTTAB(21)"";:PRINT":";:PRINTUS
     ING"#";I+1;
1050 FORJ=0TO7:M=A(8*I+J)
1060 PRINTTAB(21)"";:PRINTUSING"#####";(M>0)*M;:NEXTJ:G
     OSUB3610:PRINT@Q,"";
1070 NEXTI:PRINTTAB(21)"    ";:FORI=1TO8:PRINTUSING"####
     ";I;
1080 PRINT";";:NEXTI:GOSUB1010:GOTO880
1090 Q=256:J=3:GOSUB1620:IFITHEN880
1100 FORI=U-1TOU+1:PRINT@Q,"";:FORJ=V-1TOV+1;M=8*I+J-9:
     A=0
1110 IF(I>0)AND(I<9)AND(J>0)AND(J<9)A=ABS(A(M)):A(M)=A
1120 PRINTUSING"#####";A;:NEXTJ:Q=Q+64:GOSUB3610:NEXTI
1130 GOTO880
1140 J=1:GOSUB1620:IFI2THENCLS:GOTO760
1150 M=8*U+V-9:A(M)=ABS(A(M)):Q=213
1160 FORI=1TO8:Q=Q+64:PRINTTAB(21)I;"  ";:FORJ=1TO8
1170 M=A(8*I+J+62):IFM=0PRINT" .";
1180 IFM=1PRINT" K";
1190 IFM=2PRINT" B";
1200 IFM=3PRINT" *";
1210 IFM=4PRINT" E";
1220 PRINT"   ";
1230 NEXTJ:GOSUB3610:PRINT@Q,"";:NEXTI:PRINTTAB(21)"
     ";:FORI=1TO8:PRINT"  ";I;
1240 NEXTI:GOSUB1010:GOTO760
1250 I=192:GOSUB3610
1260 PRINT@I,STRING$(21,32);:I=I+64:IFI<769THEN1260ELSE
     I=832:GOSUB3610
1270 PRINT@I,STRING$(1,30);:I=I+64:IFI<961THEN1270ELSEG
     OSUB3610:RETURN
1280 J=4:GOSUB1620:IFITHEN880
1290 PRINT@200," ENERGIZED.";:PRINT@832," UNITS TO FIRE
     ";
1300 Q=846:GOSUB2760:A=I:IFA<1THEN880
1310 IFA>EPRINT@320," SPOCK: 'WE HAVE ONLY ";:PRINT@388
     ,E;"UNITS.'";:GOTO880
1320 E=E-A:IFN>0THEN1340ELSEPRINT@320," PHASER FIRED AT
     ";
1330 PRINT@385,"EMPTY SPACE";:GOSUB110:M=135:GOSUB1370:
     GOTO880
1340 A=INT(A/N):FORM=135TO140:IFA(M)=0GOTO1360
1350 GOSUB1370:PRINT@320,"";S;"UNITS HIT ";:GOSUB1410
1360 NEXTM:GOTO1000
1370 IFA<1000THEN1390ELSEPRINT@256,"##  OVERLOADED  ##"
     ;
1380 J=4:A(67)=A(67)+1:GOSUB110:GOSUB1620
1390 I=A(M+6)-X:J=A(M+12)-Y:S=A*30/(30+I*I+J*J)*SQR(Z5*
     ABS(A(70))+1)+1
1400 RETURN
1410 GOSUB3510:PRINT@385,"   KLINGON AT";:PRINT@449,"
      SECTOR";
1420 PRINTA(M+6);A(M+12);:A(M)=A(M)-S
1430 IFA(M)>0PRINT@512,"**  DAMAGED  **";:GOSUB3570:RET
     URN
1440 A(M)=0:I=8*U+V-9:J=A(I)/ABS(A(I)):A(I)=A(I)-100*J:
     K=K-1
1450 I=8*A(M+6)+A(M+12)+62:A(I)=0:N=N-1
1460 PRINT@512,"##  DESTROYED  ##";:GOSUB3550:PRINT@896
     ," SPOCK: 'THERE ARE";K;"KLINGONS REMAINING'":RETU
     RN
1470 IFN=0RETURN
1480 GOSUB1250:PRINT@768,"KLINGON ATTACK";
1490 IFOPRINT@832,"STARBASE PROTECTS ENTERPRISE";:GOSUB
     110:RETURN
1500 Z5=1:T=0:FORM=135TO140:IFA(M)=0THEN1540
1510 IFO=0THENGOSUB3500
1520 A=(A(M)+RND(A(M)))/2:GOSUB1390:T=T+S:I=A(M+6):J=A(
     M+12)
1530 PRINT@832,S;"UNITS HIT FROM KLINGON AT SECTOR";I;J
     ;:PRINTCHR$(30):GOSUB3580
1540 NEXTM:Z5=0:E=E-T:GOSUB3620:IFE<=0THENRETURN
1550 FORJ=1TO7:IFA(J+63)GOSUB1620
1560 NEXTJ
1570 IFRND(INT(E/4))>TTHENRETURN
1580 IFA(70)=0:A(70)=RND(T/75):J=7:GOSUB1620:RETURN
1590 J=RND(6):A(J+63)=RND(T/99)+A(J+63):I=RND(8)+1:C=C+
     I
1600 PRINT@896,"MCCOY: 'SICKBAY TO BRIDGE,  WE SUFFERED
      ";
1610 PRINTI;"CASUALTIES";CHR$(34);:GOSUB3660:RETURN
1620 GOSUB1250
1630 PRINT@192,"";:I=A(J+63):IFJ=1PRINT"SHORT RANGE SEN
     SOR";:I2=-(I<>0)
1640 IFJ=2PRINT"GALAXY MAP";:IFI2=0THENI2=1+(I<>0)
1650 IFJ=3PRINT"LONG RANGE SENSOR";
1660 IFJ=4PRINT"PHASER";
1670 IFJ=5PRINT"ENGINES";:GOSUB3610
1680 IFJ=6PRINT"PHOTON TORPEDO TUBES";
1690 IFJ=7PRINT"SHIELD";
1700 IFJ=8PRINT"COMPUTER READY";:RETURN
1710 IFI=0RETURN
1720 PRINT@320," DAMAGED,";I;:PRINT@384," STARDATES";
1730 PRINT@449,"ESTIMATED";:PRINT@513,"FOR REPAIR";:GOS
     UB110
1740 IFJ=1I2=1:FORI=192TO960STEP64:PRINT@I,CHR$(30);:NE
     XTI:RETURNELSERETURN
1750 GOSUB1250:PRINT@192,"STATUS REPORT";:PRINT@257,"ST
     ARDATE";
1760 PRINTZ7-D;:PRINT@321,"TIME LEFT";D;
1770 PRINT@385,"CONDITION  ";:IFOPRINT"DOCKED";:GOTO181
     0
1780 IFNPRINT"RED";:GOTO1810
1790 IFE<999PRINT"YELLOW";:GOTO1810
1800 PRINT"GREEN";
1810 PRINT@449,"POSITION";:PRINT@514,"QUADRANT";U;V;:GO
     SUB3610
1820 PRINT@578,"SECTOR";X;Y;:PRINT@641,"ENERGY";E;
1830 PRINT@705,"TORPEDOES  ";F;:PRINT@768," KLINGONS LE
     FT  ";K;
1840 PRINT@833,"STARBASES  ";B;:GOSUB110
1850 FORJ=1TO7:IFA(J+63)GOSUB1620
1860 NEXTJ:GOTO880
1870 J=5:GOSUB1620
1880 PRINT@833,"SECTOR DISTANCE ";:Q=849:GOSUB2760:W=I
1890 IFW<1ANDW<>-1THEN880
1900 IFW=-1THENW=Z4:PRINT@848,"";:PRINTUSING"####";W;
1910 IF A(68)=0ORW<3THEN1930ELSEGOSUB1680:PRINT@320,"CH
     EKOV: 'WE CAN TRY";
1920 PRINT@384,"2 AT MOST, SIR'";:GOSUB110:GOSUB1250:GO
     TO1880
1930 IFW<99THEN1950ELSEW=99:PRINT@320,"SPOCK: 'ARE YOU
     SURE";
1940 PRINT@384,"CAPTAIN ?'";:GOSUB110
1950 IFE>W*INT(W/2)THEN1970ELSEPRINT@448,"SCOTTY:'CAPTA
     IN, WE";
1960 PRINT@512,"DON'T HAVE THE POWER";:GOSUB110:GOTO880

1970 GOSUB2500:IFI1=0THEN880
1980 D=D-1:E=E-W*INT(W/2):A(8*X+Y+62)=0
1990 Z6=0:P=45*X+22:G=45*Y+22:W=45*W:Z1=X:Z2=Y:M=0
2000 M=M+1:W=W-I1R:IFW<-22THEN2070
2010 P=P+S:G=G+T:I=P/45:J=G/45:IF(I<1)+(I>8)+(J<1)+(J>8
     )THEN2090
2020 IFA(8*I+J+62)=0THENX=I:Y=JELSE2050
2030 Z6=Z6+1:IFI2=0THENPRINT@(150+X*64+Y*5),"E";:PRINT@
     (150+Z1*64+Z2*5),".";
2040 E1=12/Z6[2+50000/(W+45)[2:Z1=X:Z2=Y:D=D-.006:GOSUB
     120:IFM<8GOTO2000
2050 PRINT@384,"**EMERGENCY STOP**";:PRINT@448,"SPOCK:
     'TO ERR IS";
2060 PRINT@512,"HUMAN'";:GOSUB110
2070 A(8*X+Y+62)=4:GOSUB2080:GOTO1000
2080 FORM=64TO70:A(M)=A(M)+(A(M)<>0):NEXTM:RETURN
2090 P=U*72+P/5+W/5*S/I1-9:U=P/72:IFI2=0THENPRINT@(150+
     Z1*64+Z2*5),".";
2100 G=V*72+G/5+W/5*T/I1-9:V=G/72
2110 GOSUB2080:IFRND(9)<2PRINT@384,"***SPACE STORM***";
     :T=100:GOSUB110:GOSUB1550
2120 IF(U>0)AND(U<9)AND(V>0)AND(V<9)X=(P+9-72*U)/9:GOTO
     2750
2130 A=0:CLS:GOSUB3050:GOSUB3080:PRINT@448,"## YOU WAND
     ERED";
2140 PRINT@512,"OUTSIDE THE GALAXY ##";
2150 M=RND(6):A=RND(400):E=E-A:D=D-M
2160 PRINT@576,"ON BOARD COMPUTER";:PRINT@640,"TOOK OVE
     R, AND";
2170 PRINT@704,"SAVED YOUR LIFE";
2180 PRINT@768,"YOU WERE LOST";M;:PRINT@832,"DAYS AND U
     SED";
2190 PRINT@895,STR$(A);" UNITS OF POWER";:GOSUB110:GOTO
     350
2200 J=6:GOSUB1620:A=0:Q=0:IFITHEN880
2210 IFF=0THENPRINT@256," EMPTY";:GOTO880
2220 PRINT@256," LOADED";:GOSUB2500:IFI1=0GOTO880
2230 PRINT@832," TORPEDO FIRED";:PRINT@848,"";:F=F-1:P=
     45*X+22:G=45*Y+22
2240 A=6:Q=3:I6=3:I7=-65:FORM=1TO8:GOSUB3610
2250 P=P+S:G=G+T:I4=P/15:I3=G/4.5:I=P/45:J=G/45
2260 IFI<1ORI>8ORJ<1ORJ>8THEN2350
2270 IFI3>86I3=86
2280 IFI4>41I4=41
2290 L=8*I+J+62:W=8*U+V-9:I1=A(W)/(ABS(A(W))-.1):IFI2<>
     0THEN2320
2300 SET((41+I3),(6+I4)):RESET((41+A),(6+Q)):A=I3:Q=I4
2310 IFA(L)=0THENGOSUB2390:GOTO2340
2320 IFA(L)>0THENGOSUB2390
2330 ONA(L)GOTO2370,2410,2440
2340 I6=I:I7=J:D=D-.004:NEXTM
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2350 IFI2=0THENRESET((41+A),(6+Q)):GOSUB2390
2360 PRINT@897,"---MISSED---          ";:GOSUB110:GOTO10
     00
2370 S=RND(99)+280:FORM=135TO140:IF(A(M+6)=I)AND(A(M+12
     )=J)GOSUB1410:GOTO1000
2380 NEXTM:GOTO1000
2390 IFI2=0THENPRINT@(150+I6*64+I7*5),".";
2400 RETURN
2410 GOSUB3520:B=B-1:O=0:A(L)=0:A(W)=A(W)-10*I1:PRINT@7
     68,"STARBASE DESTROYED"
2420 PRINT@832,"SPOCK: 'I OFTEN FIND HUMAN BEHAVIOR FAS
     CINATING.'";
2430 GOSUB3550:GOTO1000
2440 GOSUB3520:PRINT@897,"HIT A STAR";CHR$(30);
2450 IFRND(9)<3PRINT" TORPEDO ABSORBED":GOSUB3560:GOTO1
     000
2460 A(L)=0:A(W)=A(W)-I1:IFRND(9)<6PRINT@897,"STAR DEST
     ROYED";:GOSUB3550:GOTO1000
2470 T=300:PRINT@897,"IT'S A NOVA ***RADIATION ALARM***
     ";:GOSUB3550
2480 IFOTHENGOSUB1490ELSEGOO1000
2490 GOSUB110:GOTO1000
2500 PRINT@897,"COURSE (0-360) ";:Q=912:GOSUB2760
2510 IFI>360ORI<-1THENI1=0:RETURN
2520 IFI=-1THENI=Z3:PRINT@912,"";:PRINTUSING"####";I;
2530 S=(I+45)/90:I=I-S*90:I1=(45+I*I)/110+45
2540 IFI/45<>INT(I/45)THENI=I-SGN(I)*(3-(S=2))
2550 S=S+1:ONSGOTO2560,2570,2580,2590
2560 S=-45:T=I:RETURN
2570 S=I:T=45:RETURN
2580 S=45:T=-I:RETURN
2590 S=-I:T=-45:RETURN
2600 J=8:GOSUB1620:PRINT@704,"ENTER DESIRED";:PRINT@768
     ,"TARGET LOCATION";
2610 PRINT@833,"SECTOR Y AXIS";:Q=846:GOSUB2760:Z1=I
2620 PRINT@897,"SECTOR X AXIS";
2630 Q=910:GOSUB2760:Z2=I:IFZ1<1ORZ1>8ORZ2<1ORZ2>8THEN2
     600
2640 Z1=X-Z1: Z2=Z2-Y:IFZ1=0AND SGN(Z2)=1 THEN Z3=90:GO
     TO2690
2650 IFZ1=0AND SGN(Z2)=-1 THENZ3=270:GOTO2690
2660 IFZ2=0AND SGN(Z1)=1 THENZ3=0:GOTO2690ELSEIFZ1=0AND
     Z2=0THEN2600
2670 IFZ2=0AND SGN(Z1)=-1 THENZ3=180:GOTO2690
2680 Z3=57.295775*ATN(Z2/Z1):IF SGN(Z1)=1 AND SGN(Z2)=1
      THEN2720
2690 IF SGN(Z1)=-1 AND SGN(Z2)=1 THEN Z3=Z3+180:GOTO272
     0
2700 IF SGN(Z1)=-1 AND SGN(Z2)=-1 THEN Z3=Z3+180:GOTO27
     20
2710 IF SGN(Z1)=1 AND SGN(Z2)=-1 THEN Z3=Z3+360:GOTO272
     0
2720 Z4=SQR(Z1[2+Z2[2)+.5:PRINT@850," ANGLE =";Z3;
2730 PRINT@914," RANGE =";Z4;
2740 GOTO880
2750 CLS:A=6:GOSUB3050:GOSUB3080:Y=(G+9-72*V)/9:GOTO360
2760 PRINT@Q,Z:A$=INKEY$:IFA$=""THENGOSUB3610:GOTO2760
2770 IFASC(A$)=8THENZ=Z/10:GOTO2760ELSEIFA$="C"THENI=-1
     :RETURN
2780 IFASC(A$)=13THENI=Z:Z=0:RETURNELSEZ=Z*10+VAL(A$):G
     OTO2760
2790 A=0:CLS:GOSUB3050:PRINT@138,STRING$(23,191);
2800 PRINT@235,STRING$(13,176);
2810 PRINT@238,STRING$(7,188);
2820 PRINT@293,STRING$(24,191);
2830 PRINT@363,STRING$(13,131);
2840 PRINT@366,STRING$(7,143);
2850 PRINT@399,STRING$(26,191);
2860 PRINT@466,STRING$(26,191);
2870 PRINT@533,STRING$(26,191);
2880 FORZ1=50TO56STEP6:FORZ2=9TO18:SET(Z1,Z2):NEXTZ2,Z1
2890 PRINT@357,CHR$(170);:PRINT@360,CHR$(170);
2900 PRINT@425,CHR$(179);:PRINT@492,CHR$(179);:PRINT@55
     9,CHR$(179);
2910 PRINT@472," USS ENTERPRISE ";
2920 IFY=0THEN2950ELSERETURN
2930 FORJ=1TO150:B=RND(30):Q=64*RND(13)+B*2:G=32+B:PRIN
     T@Q,STRING$(B,G);
2940 NEXTJ:RETURN
2950 PRINT@897,"CAPTAIN'S LAUNCH APPROACHING ";
2960 PRINT"ENTERPRISE - STANDBY FOR ACTION";
2970 FORA=1TO12:READB,B:NEXTA:GOSUB3450
2980 FORA=0TO11:READC(A),Z(A):NEXTA:RESTORE:GOSUB3450
2990 FORA=0TO11:FORM=0TO11
3000 READB(M,A,1),B(M,A,2)
3010 DATA 0,0,1,0,2,1,3,1,6,2,9,3,12,4,18,6,27,9,42,14,
     63,21,63,21
3020 DATA -1,.5,1,-.5,-.5,-1,.5,-1,1,1,-1,-.5,.5,1,-.5,
     1,-1,-1,1,-1,-1,1,1,.5
3030 B(M,A,1)=B(M,A,1)*C(A)+64.5:B(M,A,2)=B(M,A,2)*Z(A)
     +24.5:NEXTM
3040 GOSUB3450:RESTORE:NEXTA:RETURN
3050 I2=1:I8=1:FORM=ATO1006STEP16:PRINT@(M+RND(16)),"."
     ;:NEXTM:RETURN
3060 FORM=1TO11:SET(B(M,A,1),B(M,A,2)):RESET(B(M-1,A,1)
     ,B(M-1,A,2)):NEXTM:A=A+1
3070 RETURN
3080 GOSUB3060:GOSUB3610:IFA<12THEN3080
3090 PRINT@544,"*";:RETURN
3100 PRINT@768,"DO YOU WANT INSTRUCTIONS ? ";
3110 A$=INKEY$:IFA$=""THEN3110ELSEB=-(A$="N")
3120 IFB=1THEN230
3130 CLS:PRINT"THIS IS AN ACTION TASK IN WHICH TIME IS
     AN IMPORTANT FACTOR"
3140 GOSUB110
3150 PRINT"LEGEND FOR ALL OPERATIONS APPEARS AT THE TOP
      OF THE SCREEN":GOSUB110
3160 PRINT"ENTER THE FLASHING LETTER FOR ACTION DESIRED
     ":GOSUB110
3170 PRINT"DIRECTION IS IN COMPASS ANGLES 0([) 90(";CHR
     $(94);") 180(";CHR$(92);
3180 PRINT") 270(";CHR$(93);")":GOSUB120:PRINT"THE COMP
     UTER CAN PROVIDE";
3190 PRINT" CONTROL FOR THE TORPEDO AND ENTERPRISE":GOS
     UB110
3200 PRINT"THE (Y) AXIS IS [ AND THE (X) AXIS IS -";CHR
     $(94):GOSUB110
3210 PRINT"ENTER (C)OMPUTER, SELECT (T)ORPEDO OR (E)NGI
     NE, AND ENTER (C)"
3220 GOSUB110:PRINT" ACTION IS AUTOMATIC":GOSUB110
3230 PRINT"THE LONG RANGE SENSOR DISPLAYS:":GOSUB110
3240 PRINTTAB(10)"THE HUNDRED DIGIT AS THE NO. OF KLING
     ONS":GOSUB110
3250 PRINTTAB(10)"THE TENS DIGIT AS THE NO. OF STARBASE
     S":GOSUB110
3260 PRINTTAB(10)"THE UNIT DIGIT AS THE NO. OF STARS":G
     OSUB110
3270 PRINT"WHEN YOU PRESS ENTER - THE ACTIVITIES WILL S
     TART":GOSUB110
3280 PRINT"THE ENTERPRISE WILL ENTER SUB-SPACE AND TRAV
     EL TO ";
3290 PRINT"YOUR STATION":GOSUB110:PRINT"GOOD LUCK ON YO
     UR EFFORT !!!":GOSUB110
3300 A$=INKEY$:IFA$=""THEN3300ELSE230
3310 PRINT@(137-Z),CHR$(132);:IFZ<>0THENPRINT" ";ELSEPR
     INT@128," ";
3320 Z=Z+1:IFZ=10THENZ=0
3330 RETURN
3340 FOR A=1TO7:FORM=1TO3:I=128-48*(M=1)-60*(M=2)-63*(M
     =3)
3350 E1=.2*A*(1-(A=7)*M[2):GOSUB120
3360 PRINT@(961-64*A),CHR$(I);:PRINT@(1022-64*A),CHR$(I
     );
3370 PRINT@(1025-64*A),CHR$(191);STRING$(30,1);
3380 PRINTSTRING$(30,1);CHR$(191);
3390 GOSUB3310:NEXTM,A
3400 PRINT@128,STRING$(10,32);
3410 FORM=1TO7:PRINT@(513-64*M),CHR$(191);
3420 PRINT@(574-64*M),CHR$(191);:NEXTM
3430 PRINT@66,STRING$(30,131);STRING$(30,131);
3440 PRINT@980," S T A R  B A S E";U+8*V;:GOSUB110:RETU
     RN
3450 Q=Q+1:IFQ<18THENPRINT@(510-Q),CHR$(140);CHR$(140);
     CHR$(32);:RETURN
3460 IFQ=18THENPRINT@896,CHR$(30);:PRINT@492,CHR$(191);
     CHR$(140);" ";
3470 IFQ=19PRINT@493," ";
3480 IFQ=20PRINT@492,CHR$(179);
3490 RETURN
3500 I8=149+64*X+5*Y:GOTO3530
3510 I8=149+64*A(M+6)+5*A(M+12):GOTO3530
3520 I8=149+64*I+5*J
3530 IFI2=0THENPRINT@I8,CHR$(136);CHR$(174);CHR$(140);
3540 RETURN
3550 A$=".":GOTO3590
3560 A$="*":GOTO3590
3570 A$="K":GOTO3590
3580 A$="E"
3590 GOSUB110:IFI2=0THENPRINT@(I8-2),"   ";A$;"   ";
3600 RETURN
3610 PRINT@58,"";:PRINTUSING"##.###";D;:I5=I5+1:D=D-.00
     2:IFD>0THENRETURNELSE440
3620 PRINT@123,"";:PRINTUSING"#####";E;:RETURN
3630 PRINT@104,"";:PRINTUSING"###";F;:RETURN
3640 Z=0:GOSUB2930:CLS:PRINT@512,"SIR !  WE HAD A COMPU
     TER OVER LOAD AND  LOST";
3650 PRINT" ALL GALAXY DATA":FORA=0TO63:A(A)=-ABS(A(A))
     :NEXTA:GOSUB120:CLS:RESUME360
3660 Z1=8*U+V-9:FORM=135TO140:IFA(M)<>0THENNEXTM:RETURN
3670 FORA=U+(U<>1)TOU-(U<>8):FORQ=V+(V<>1)TOV-(V<>8):Z2
     =8*A+Q-9:IFA(68)=4THEN3690
3680 IFABS(A(Z2))>99ANDZ2<>Z1THENA(Z2)=SGN(A(Z2))*(ABS(
     A(Z2))-100)ELSENEXTQ,A:RETURN
3690 A(Z1)=A(Z1)+100
3700 A=RND(8):Q=RND(8):Z1=8*A+Q+62:IFA(Z1)<>0THEN3700
3710 A(Z1)=1:N=N+1:IFI2=0:PRINT@(150+64*A+5*Q),"K";
3720 A(M)=300:A(M+12)=Q:A(M+6)=A:RETURN
3730 Z=0:RESUME 1250

DONE
```

THE TIME SAVER...

JPC Products Announces a New High Speed Cassette System
"The Poor Man's Floppy" for the TRS-80*
$90 Kit - $120.00 fully assembled.

The TRS-80* is a great small computer. But its cassette recording system can be very frustrating, particularly if you can't read an important cassette. JPC Products Company has developed an improved cassette system that uses your present cassette recorder but operates much faster with better reliability. The TC-8 plugs into the expansion connector on the back of the keyboard and saves and loads 5 times faster! Less than ONE BAD LOAD in a MILLION BYTES! With the VOLUME CONTROL ANYWHERE BETWEEN 1 AND 8. The TC-8 is available in an easy to assemble kit or fully assembled. JPC has an exclusive "can't fail" kit guarantee. If you build the TC-8 and for any reason it doesn't work, we will make it work at NO COST. All you have to pay is the shipping. We guarantee it. The TC-8 magic is partly done in software. So you have to load a small program in upper memory. It is usually out of the way there. We provide the software on a cassette that comes with the TC-8. Just load it in. Here's how you order. Send $90.00 for the kit ($120.00 fully assembled) plus $3.50 postage and handling to JPC Products Co., 12021 Paisano Court, Albuquerque, NM 87112 (N.M. Res. add 4% sales tax.) Credit card orders accepted by phone or mail.

JPC PRODUCTS CO.

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Phone: (505) 294-4623 12021 Paisano Ct. Albuquerque, N.M. 87112

Reader Service index—see page 194

★★★ A PERCOM BULLETIN ★★★

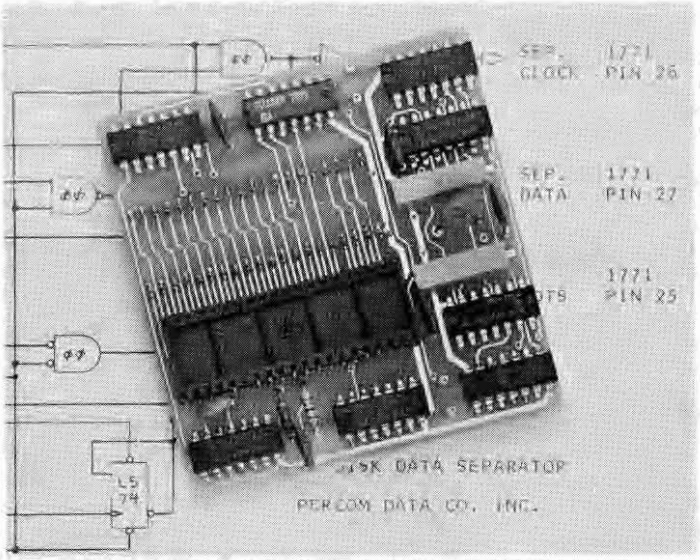
Adapter for TRS-80* computer eliminates disk read errors

Garland, Texas — Harold Mauch, president of Percom Data Company, announced that the company is marketing a simple plug-in adapter for TRS-80* computers that corrects a design deficiency in the disk controller circuit.

The problem, which causes disk read errors, has been traced to Tandy's reliance on a circuit internal to the FD1771 controller IC to perform the function of separating clock and data pulses.

As explained in the *Backgrounder,* use of the internal chip circuit for reliable data-clock separation is a design shortcut which the manufacturer of the controller IC warns against.

The Percom solution, a PC card adapter called the SEPARATOR™, eliminates the problem by substituting an explicit data separator circuit — one which has been used reliably in Percom disk controllers since 1977 — for the internal IC separator circuit.



Percom adapter fixes TRS-80 computer disk controller.*

The SEPARATOR™ is installed without modifying the host system. The user merely removes the FD1771 IC from the host controller, installs the IC in the DIP socket on the SEPARATOR™ card, and plugs the adapter into the vacated socket of the host controller.

Percom cautions that opening the Expansion Interface of the TRS-80* computer, which is required to install the SEPARATOR™, may void the computer's limited 90-day warranty.

The SEPARATOR™, which sells for $29.95, may be purchased from Percom dealers or ordered direct from the factory. The Percom toll-free order number is 1-800-527-1592.

Payment for mail orders may be made by certified check, cashier's check or money order, or charged to a Master Card or VISA account. Texas residents must add 5% sales tax.

Percom Mini-Disk Drives Store More, Cost Less.

Percom mini-disk drives store more data, are more reliable, yet a 40-track Percom drive costs **$100.00 less** than a 35-track Tandy drive.

You can store over 102 Kbytes per side on Percom TFD-100™ 40-track drives; 197 Kbytes on one side of a TFD-200™ 77-track drive. A patch — supplied free on minidiskette — upgrades TRSDOS* for operation with the newer 40- and 77-track drives.

Both TFD-100™ and TFD-200™ models are available in one-, two- and three-drive configurations.

Prices start at $399 for a single-drive TFD-100™, $675 for a single-drive TFD-200™. Drives are supplied with heavy-duty power supplies. Metal enclosure is finished in compatible silver enamel.

See your nearby Percom dealer or order direct by calling toll-free 1-800-527-1592.

Five-Inch Disks Store More Than Eight-Inch Disks!

Garland, Texas — June 25, 1980 — Percom Data Company has begun production of a double-density disk controller adapter for TRS-80* Model I computers.

Harold Mauch, president of Percom, made that announcement here today, saying that data storage capacity using the adapter and double-density disk operating system — which is included — can be increased to as much as 294 Kbytes per minidiskette.

By comparison, the maximum storage for larger eight-inch disk systems used with the TRS-80* Model I computer is about 290 Kbytes.

Mauch said the PC card adapter, which plugs into the controller chip socket of the computer Expansion Interface, works equally well for either single-density or double-density storage, and users may continue to run programs under TRSDOS*, OS-80™ and other single-density operating systems with the adapter installed.

Price, for the plug-in adapter, the TRSDOS*-like double-density DOS and a utility for converting files and programs from single- to double-density format is expected to be $219.95.

BACKGROUNDER

CRC ERROR! TRACK LOCKED OUT!

by the Technical Staff
Percom Data Company

This problem started while we were studying an annoying problem with the TRS-80* computer. Disk drives sold by Percom are realigned and tested before shipment. We noticed, however, that some disk drives would pass the Percom inspection but just would not work reliably on the inner tracks with a TRS-80* computer. These drives were within the manufacturer's specifications, and would function perfectly on other disk systems Percom manufactures — "perfectly" here meaning more than 50 million bytes read without error!

The disk read data separation arrangement in the TRS-80* computer Expansion Interface uses an internal data separator of the FD1771 disk formatter/controller IC. Use of the FD1771 internal data separator is not recommended by Western Digital, the IC manufacturer. The following note appears on page 17 of the FD1771 data sheet:

> Internal data separation may work for some applications. However, for applications requiring high data recovery reliability, WDC recommends external data separation be used.

We suspected the data separator because the problem was most severe on disk inner tracks where storage density is highest and data separation is most critical.

To prove our point, a technician breadboarded a standard Percom data separator circuit, and configured it to plug directly into the FD1771 IC socket of the TRS-80* computer controller.

When connected to the TRS-80* computer, a troublesome drive functioned perfectly! We ran a BACKUP utility many times and never got a track lockout. Before we added the external data separator circuit to the computer, this same drive would always lock out tracks, and would have difficulty reading from the inner (higher number) tracks.

The Percom data separator circuit fixes the mini-disk controller of the TRS-80* computer. The type of drives being used is irrelevant; the circuit eliminates disk read errors resulting from the inability of the Tandy controller design to reliably separate clock and data signals when reading high density inner tracks.

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✓258 PERCOM DATA COMPANY, INC. 211 N. Kirby Street Garland, Texas 75042 (214) 272-3421

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Destroy enemy spacecraft—with your 4K Level II.

Starfighter

Albert C. Ferrera
RD #2, Box 325
Oneonto, NY 13820

I am a dedicated amateur astronomer turned computerist. I wanted to design a space battle game that involved as much realism as possible within the rather severe limit of my 4K machine. The following program is what I came up with, including audio.

The program illustrates what a space pilot might see looking out his cockpit window on a real space battle. It creates a random constellation of five to fifteen stars for each game and maintains them through all the action. The distant suns must remain unaffected by foreground events.

Missile System

The object is to destroy a hostile fighter viewed through your ship's window. Your ship is armed with a missile system, but like real systems, the missiles are not perfect and your best bet is to fire a salvo that will form a cluster around your target coordinates. Hopefully, the cluster will include the hostile fighter.

You have to fire by feel to a considerable extent. After a number of games you will learn to control your fire and your score will improve.

The hostile fighter also has weapons and, if you do not score on your first salvo, its capabilities may well be demonstrated to you. He has two wingtip guns that can blaze back at you and can choose almost any moment (even during your salvo) to return your fire. If he scores, your little microcosm comes apart at the seams.

Since his weapons do not travel at light speed, you have a brief moment between his gun flashing and his missiles striking to contemplate your sins.

The hostile has several other tricks. On occasion he disappears through a stargate or space warp and leaves the field making quite a flash as he goes. (I admit it. I do watch Buck Rogers.) Sometimes, too, he leaves the view from your window. In a moment he returns to continue the encounter.

A stand-off results if you run out of missiles and disengage, or the hostile leaves through a stargate. The computer displays the number of missiles you have left. It also displays the coordinates of your last salvo.

If you run out of missiles and the fighter is still intact, he has the option of shooting at you before stargate takes him out of reach. If you damage his ship before your missiles are depleted, the hostile fighter escapes beyond the stargate, leaving you to contemplate the starry sky till the next game.

Direct Hit

In order to bag your opponent, you have to score a direct hit on his cockpit. This causes his fighter to come apart rather violently. It you hit him around the edges, your controls will indicate DAMAGE.

You can shoot up his wings and the computer will keep track of the missing pieces and print out what remains of your opponent after he moves. As long as his cockpit is intact he will survive.

A non-lethal hit gives you two advantages. First, you disable your opponent's weapons. Further, his mobility will be considerably reduced, making it easier for you to finish him.

As written, there is about an even split between wins, losses and draws. However, you can change the odds. Line 190 controls the missile supply, and you can increase it, if you wish.

Line 356 controls the chance that you will get fired at during

Variable	Program Function
A	Salvo size (1 to 4).
B	Row 1 star position. Also random variable and loop counter.
C	Horizontal set point of left hostile fighter gun.
D	Vertical set point of left hostile fighter gun.
E	Leftmost print position of hostile ship.
F	Array variable label (star position). Also array variable loop counter.
G	Random variable to determine E shift position. Also loop counter.
H	Horizontal aim point.
I	Salvo loop counter.
J	Number of stars.
K	Upper left set point of E (horizontal coordinate). Also used (line 334) as the print at position that includes the missile set point.
L	Upper left set point of E (horizontal coordinate). Also used (line 334) as the print at position that includes the missile set point.
M	Missile deflection random variable (horizontal coordinate).
N	Missile deflection random variable (vertical coordinate).
O	Number of missiles available.
P	Damage flag for hostile ship character < (location E).
Q	" " " " " " - (left).
R	" " " " " " 0.
S	" " " " " " - (right).
T	" " " " " " > (right).
U	Random variable to determine if GOS.2000 (hostile fighter fire routine). Also used in hostile fighter explode routine (lines 6000-6060) as a loop counter.
V	Vertical aim point.
W	Ship explosion reference print at point. There is one for each star on the playing field.
X	Set point coordinate. (horizontal)
Y	Set point coordinate. (vertical)
Z	Random variable to determine if enter Stargate routine.
A(F)	Star position print at point.

Table 1. List of Variables Used.

Reader Service index—see page 194

Lines	Program Function
10-35	Initialize system.
50-76	Establish playing field format.
100	Establish initial hostile fighter position-E.
105	Check field boundaries.
110	Print hostile fighter.
152	Choose number of stars (5 to 15).
154-164	Choose star positions. Check if hostile position interferes. If not, print star. If so, choose new star position and print star.
190	Choose number of missiles.
200-203	Erase old input.
205-225	Input new fire control data.
300-331	Set missile hit position.
334	Calculate the print point that includes missile set point.
338-342	Check for hit on hostile and set damage flags P,Q,R,S,T. Note: R is the kill flag.
350	Reset missile hit. Reprint each star unles hostile covers it.
356	Decide if hostile returns fire.
357	Update missiles remaining; print out.
362	If no missiles remain, print hostile damage status. If hostile is missed, give hostile a chance to return fire. If hostile misses, then Stargate.
363	If hostile is not missed or killed, print DAMAGED, then Stargate.
365	Loop to fire next missile.
370-380	Print hostile damage status, if missiles are remaining.
475-480	Determine whether hostile returns fire.
500-760	Determine new hostile position. Consider damage, if any, and print remaining parts of hostile at new position.
766-767	Determine whether hostile returns fire.
770-790	Choose, if Stargate. If not, return for another salvo.
800-920	Stargate routine ending.
1000-1180	Determine new hostile ship based on missile damage flags.
2000-2060	Hostile fighter gun fire routine.
2090	Choose, if hostile fire effective. If yes, branch to ship destruct routine.
2105	Replace stars removed by hostile fighter fire.
3000-3060	Ship destruct routine ending.
4000	Delay loop.
5000-5100	Star replace routine including check for hostile position.
6000-6060	Hostile fighter explodes, if cockpit is hit routine.

Table 2. Program Summary.

or after a salvo. If you increase U = RND(3) to a larger random number you get shot at less often.

Lines 766-767 determine if you will be fired on after the hostile fighter moves. Likewise increase U = RND(2) for a safer game.

Line 770 controls the chance of a stargate. Increase Z = RND(5) to make the hostile stick around longer.

Audio

Oh yes, I mentioned audio. For me it was easy, since my computer shares my cassette deck with my high fidelity system. However, you can hear your computer by placing a portable FM radio near it and picking up the digital noise at numerous places on the dial. The sound effects end with the 500 hz tone of FOR-NEXT loops being counted waiting for the next game.

One final suggestion. Turn down the screen brightness until a dark sky appears, as free of light pollution as possible. This makes the constellations look much more realistic. (I wonder what Orion would look like from a vantage point in Cygnus? Well, I admit the graphics aren't that good!)

I omitted instructions and used many abbreviations to make room for the program. However, the screen instructions are quite specific.

As written my computer returns a PRINT MEM. of 122 bytes. A maximum of 60 bytes are used when the star position array spins up. You have only 62 bytes to spare and cannot take too many liberties typing the program or adding features.

Also the program is not protected against illegal inputs, so if you enter bad input, you have to hit BREAK and then RUN again.

Also, on rare occasions the program crashes with a sorry statement: The sorry returns a ? after the FOR of a legal FOR-NEXT loop, usually line 2500. The problem has defied my analysis; there is no lack of user RAM. It may be because of some kind of overflow condition in the BASIC monitor or internal scratch pad. Whether peculiar to my series machine or not I cannot say. I hope someone solves it. It is my only problem with the program. ■

Program Listing

```
1  REM STARFIGHTER BY ALBERT C. FERRERA 11/4/79
10  CLS
35  P=0:Q=0:R=0:S=0:T=0
50  FORX=6TO119:SET(X,0):SET(X,36):NEXTX
60  FORY=0TO36:SET(6,Y):SET(119,Y):NEXTY
76  PRINT@189,"M";:PRINT@381,"H";:PRINT@573,"V";
100  B=RND(45)+7:E=64*RND(10)+B
105  IF(E<128)+(E>703)THEN100
110  PRINT@E,"<-O->";
152  J=5+RND(10)
154  FORF=1TOJ
156  B=RND(45)+7:A(F)=64*RND(10)+B
161  IF(A(F)=E)+(A(F)=E+1)+(A(F)=E+2)+(A(F)=E+3)+(A(F)=
     E+4)THEN156
162  IF(A(F)=E-1)THEN156
163  NEXTF
164  FORF=1TOJ:PRINT@A(F),"*";:NEXTF
190  O=RND(9)+9
200  PRINT@834,"                                        ";
202  PRINT@898,"                                        ";
203  PRINT@936,"                          ";
205  PRINT@252,O;
210  PRINT@834,"HORIZONTAL AIM POINT (0 TO 100)";:INPUT
     H
212  PRINT@444,H;
220  PRINT@898,"VERTICAL AIM POINT (0 TO 30)";:INPUTV
223  PRINT@636,V;
225  PRINT@936,"SALVO SIZE (1 TO 4)";:INPUTA:IFA>4A=4
300  FORI=1TOA
310  M=RND(10):N=RND(5)
330  X=H-M+18:Y=V-N+6
332  SET(X,Y)
334  K=INT(X/2)+64*INT(Y/3)
338  IFK=EP=1
339  IFK=E+1Q=1
340  IFK=E+2R=1
341  IFK=E+3S=1
342  IFK=E+4T=1
345  GOSUB4000
347  IFR=1GOTO6000
350  RESET(X,Y):GOSUB5000
356  U=RND(3):IFU+P+Q+S+T<2GOSUB2000
357  O=O-1:PRINT@252,O;
362  IFO+P+Q+S+T=0PRINT@886,"MISS";:GOSUB2000:GOTO800
363  IFO=0PRINT@886,"DAMAGED";:GOTO800
365  NEXTI
370  IFP+Q+R+S+T=0PRINT@886,"MISS";:GOTO475
375  IFP+Q+S+T>0PRINT@886,"DAMAGED";:GOTO475
380  PRINT@886,"KILL";
390  FORG=1.2000:NEXTG:GOTO10
475  U=RND(2)
480  IFU+P+Q+R+S+T<2GOSUB2000
500  PRINT@E,"     ";
510  G=RND(6)
515  IFP+Q+S+T>0THEN600
520  IFG=1E=E+RND(8)
530  IFG=2E=E-RND(8)
540  IFG=3E=E+64+RND(8)
550  IFG=4E=E+64-RND(8)
560  IFG=5E=E-64+RND(8)
570  IFG=6E=E-64-RND(8)
595  GOTO700
600  IFG=1E=E+RND(2)
610  IFG=2E=E-RND(2)
620  IFG=3E=E+64+RND(2)
630  IFG=4E=E+64-RND(2)
640  IFG=5E=E-64+RND(2)
650  IFG=6E=E-64-RND(2)
700  IFE<0E=E+64:IFE>767E=E-64
710  K=2*(E-64*INT(E/64)):L=3*INT(E/64)
720  IF(K<8)+(K>106)+(L<5)+(L>30)THEN510
760  GOSUB1000:GOSUB5000
766  U=RND(2)
767  IFU+P+Q+R+S+T<2GOSUB2000
770  Z=RND(6)
780  IF(Z=2)*(E>128)*(E<703)THEN800
790  GOTO200
800  GOSUB4000
810  PRINT@E-64,"*   *";:PRINT@E+64,"*   *";:GOSUB1000:
     GOSUB4000
820  PRINT@E-64,"  *  ";:PRINT@E,"* O *";:PRINT@E+64,"
      *  ";:GOSUB4000
830  PRINT@E-64,"*   *";:PRINT@E,"  *  ";:PRINT@E+64,"*
       *";:GOSUB4000
840  PRINT@E-64,"     ";:PRINT@E,"* O *";:PRINT@E+64,"
       ";:GOSUB4000
850  PRINT@E-64,"  *  ";:PRINT@E,"  *O*  ";:PRINT@E+64,"
      *  ";:GOSUB4000
860  PRINT@E-64,"  *  ";:PRINT@E,"  ***  ";:PRINT@E+64,"
      *  ";:GOSUB4000
870  PRINT@E-64,"     ";:PRINT@E,"*****";:PRINT@E+64,"
       ";:GOSUB5000
```

```
880  PRINT@E," *** ";:GOSUB4000
890  PRINT@E,"  *  ";:GOSUB4000:PRINT@E,"     ";:E=1
910  PRINT@898,"STARGATE : HOSTILE ESCAPED          "
920  GOSUB5000:GOTO390
1000  IFP=0PRINT@E,"<";
1020  IFP=1PRINT@E," ";
1040  IFQ=0PRINT@E+1,"-";
1060  IFQ=1PRINT@E,"  ";
1080  PRINT@E+2,"O";
1100  IFS=0PRINT@E+3,"-";
1120  IFT=0PRINT@E+4,">";
1140  IFT=1PRINT@E+4," ";
1160  IFS=1PRINT@E+3,"  ";
1180  RETURN
2000  C=2*(E-64*INT(E/64))-1:D=3*INT(E/64)+1
2010  FORG=1TORND(9)
2020  SET(C,D):GOSUB2500:RESET(C,D):GOSUB2500
2040  SET(C+11,D):GOSUB2500:RESET(C+11,D):GOSUB2500
2060  NEXTG
2090  B=RND(2):IFB=1GOSUB3000
2105  GOSUB5000:RETURN
2500  FORB=1TO10:NEXTB:RETURN
3000  FORF=1TOJ
3020  W=A(F)+RND(20)
3030  PRINT@W-128,"   !   ";:PRINT@W-64,"  XXX  ";:PRIN
    T@W,"-XXXXX-";
3040  PRINT@W+64,"  XXX  ";:PRINT@W+128,"   !   ";
3050  NEXTF
3055  PRINT@345,"SHIP EXPLODING";
3060  GOTO390
4000  FORG=1TO300:NEXTG:RETURN
5000  PORF=1TOJ
5010  IF(A(F)=E-1)+(A(F)=E)+(A(F)=E+1)+(A(F)=E+2)THEN51
    00
5020  IF(A(F)=E+3)+(A(F)=E+4)THEN5100
5050  PRINT@A(F),"*";
5100  NEXTF:RETURN
6000  PRINT@E+2,"*";:FORU=1TO100:NEXTU
6010  PRINT@E+1,"(*)";:FORU=1TO100:NEXTU
6020  PRINT@E+1,"( )";:FORU=1TO75:NEXTU
6030  FORU=1TO30:PRINT@E-1+RND(4)," *";:NEXTU
6040  FORU=1TO10:PRINT@E+63+RND(5),".";:GOSUB2500
6045  PRINT@E-65+RND(5),".";:GOSUB2500
6050  PRINT@E-1+RND(4)," :";:NEXTU:GOSUB4000:PRINT@E,"
      ";
6060  PRINT@E+64,"     ";:PRINT@E-64,"     ";:GOSUB5000
    :GOTO380
```


↙Reader Service index—see page 194

Time running out? Get into high gear with machine code.

Life in the Fast Lane

Terry Kepner & Claud M. Grace
P.O. Box 481
Peterborough, NH 03458

Most serious programmers at one time or another have seen the program Life. In an attempt to decrease the processing time many have tried to write their own versions of the game. As a result, two schools of Life have developed.

One school, usually the owners of machines like the TRS-80 and the PET, uses only BASIC, while the other school, usually those people who have access to assembler editors, programs Life with machine code.

Since most newcomers are purchasing machines with BASIC, they see Life run so slowly that they fail to see the reason for all the interest surrounding the game.

If they see it run in machine code however, they are fascinated. Unfortunately, beginners usually have difficulty understanding what machine code is and what it does.

For those of you who are curious about Life, but don't want to spend days decoding hex instructions, or don't want to shell out the money for an assembler editor, this article is for you.

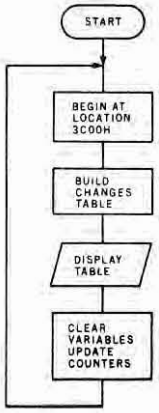

Fig. 1. General Logic

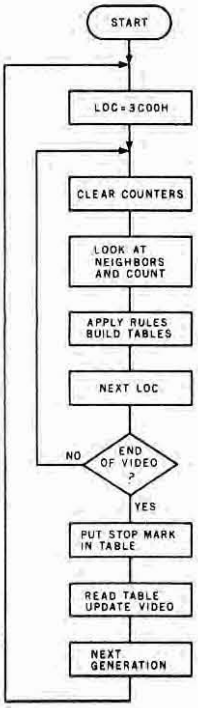

Fig. 2.

Three Versions of Life

There are three program listings with this article. The first listing, in BASIC, takes approximately 2½ minutes to evaluate one generation of Life and to update the video.

Since many of the more interesting features of Life (gliders, blinkers, blocks and guns) take from two to ten generations, or more, to find and observe, you would need a time-lapse camera and plenty of free time to get any useful results.

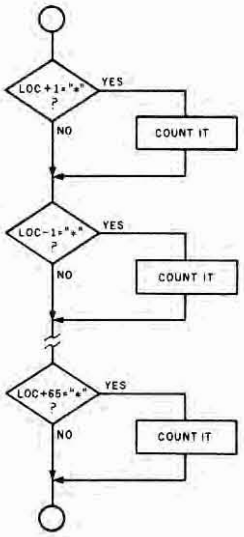

Fig. 3. Look at Neighbors

The second listing, however, is a hybrid BASIC-assembly code program. And it's fast! Almost a line for line conversion of the BASIC program into assembly code, it can be programmed into the TRS-80 Level II computer without additional software.

The third listing, completely in assembly code, is even faster than the hybrid version. The three programs were written to match one another as closely as possible. Studying the listings gives even the newest programmer insight into assembly code programming and its advantages over BASIC.

Let's start with the hybrid program. Its BASIC segment carries the assembly code instructions used by the assembly program. These instructions are held in the DATA statements. When the command RUN is given, the program READs these statements and POKEs the numerical instructions (in decimal) into memory at a specified address.

It then calls this assembly code routine via USR(0) in BASIC.

When the call is made, the computer leaves BASIC, executes the assembly code instructions, and returns to BASIC

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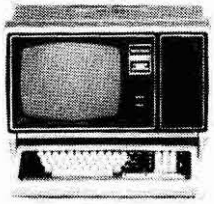

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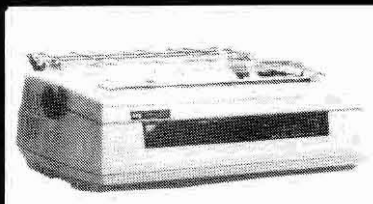

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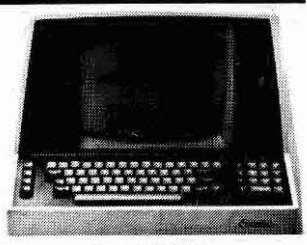

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```
1 REM  LIFE IN THE BASIC LANE
2 REM
3 REM
4 REM
5 REM  CLAUD M. GRACE
6 REM  1067 W. MIRACLE MILE   #97
7 REM  TUCSON,  AZ.     85705
8 REM
9 REM
10 REM
90 REM  THIS SETS UP A RANDOM PATTERN ON THE SCREEN
100 CLS
105 PRINT@0,"GENERATION 0";
110 FOR X=1 TO 40
120 J=RND(30)+17:K=RND(8)+4
130 PRINT@(K*64+J),"*";
140 NEXT X
141 REM  THIS LOOKS AT THE SCREEN, EVALUATES THE "*" IT FINDS,
142 REM       AND UPDATES THE COUNTERS
145 POP=40
146 REM   CALL THE VIDEO SCAN ROUTINE, THEN UPDATE
150 GOSUB 1000
155 GEN=GEN+1:PRINT@0,"GENERATION ";GEN;
170 GOTO 150
910 REM          THE PROGRAM SCANS THE VIDEO.  WHEN IT FINDS AN
920 REM          "*", IT CHECKS THE SURROUNDING 8 SPACES FOR
930 REM          LIVE NEIGHBORS AND COUNTS THEM.  IT THEN AP-
940 REM          PLIES THE RULES OF LIFE, RECORDS THE RESULT AND
950 REM          CONTINUES TO THE NEXT VIDEO LOCATION.  WHEN ALL
960 REM          OF THE VIDEO HAS BEEN SCANNED, THE TABLE IS READ
970 REM          AND ALL THE BIRTHS AND DEATHS ARE PUT ON THE
980 REM          SCREEN.  IT THEN RETURNS TO THE CALLING PRO-
990 REM          GRAM LINE FOR COUNTER UPDATES.
995 REM   THIS INITIALIZES THE COUNTERS FOR EACH NEW GENERATION
1000 VIDIO=15360
1010 TABLE=29696
1020 IX=TABLE
1030 HL=VIDIO
1035 REM  BEGIN SEARCH OF SURROUNDING 8 SPACES FOR NEIGHBORS
1037 REM        D= NUMBER OF NEIGHBORS ; A="*"
1040 IY=HL
1050 D=0
1060 A=42
1070 IF A=PEEK(IY+1) THEN GOSUB 2000
1080 IF A=PEEK(IY-1) THEN GOSUB 2000
1090 IF A=PEEK(IY-65)THEN GOSUB 2000
1100 IF A=PEEK(IY-64)THEN GOSUB 2000
1110 IF A=PEEK(IY-63)THEN GOSUB 2000
1120 IF A=PEEK(IY+63)THEN GOSUB 2000
1130 IF A=PEEK(IY+64)THEN GOSUB 2000
1140 IF A=PEEK(IY+65)THEN GOSUB 2000
1145 REM   APPLY THE RULES OF LIFE
1150 GOSUB 3000
1155 REM   MOVE TO NEXT VIDEO LOCATION
1160 HL=HL+1
1165 REM   IS THIS THE LAST VIDEO LOCATION?
1170 IF HL<>16384 THEN GOTO 1040
1175 REM   IF IT IS, THEN END THE LIST
1180 GOSUB 4000
1185 REM   AND PUT THE TABLE RESULTS ON THE VIDEO
1190 GOTO 5000
1995 REM   ADD ONE TO NEIGHBOR COUNT AND RETURN TO SEARCH
2000 D=D+1:RETURN
3000 REM   RULES OF LIFE
3005 REM   1ST, IS LOCATION A "*" ?
3010 IF A<>PEEK(HL) THEN 3300
3020 A=D
3025 REM   2ND, IF IT FAILS THE NEXT TWO TESTS, THE IT DIES
3030 IF A=2 GOTO 3400
3040 IF A=3 GOTO 3400
3045 REM   3RD, PLACE ITS ADDRESS IN THE TABLE, & CONTINUE
3050 H=INT(HL/256):L=HL-H*256
3060 POKE IX,L
3070 IX=IX+1
3080 POKE IX,H
3090 IX=IX+1
3100 GOTO 3400
3290 REM   2ND, ARE THERE ENOUGH NEIGHBORS FOR A BIRTH?
3300 A=D
3310 IF A<>3 THEN GOTO 3400
3315 REM   3RD, PLACE ITS ADDRESS IN THE TABLE
3320 H=INT(HL/256):L=HL-H*256
3330 POKE IX,L
3340 IX=IX+1
3345 REM   MAKING H GREATER THAN 128 MEANS A BIRTH
3350 H=H+128
3360 POKE IX,H
3370 IX=IX+1
3400 RETURN
4000 REM   STOP --  PLACE END OF LIST MARKER
4010 POKE IX,0
4020 IX=IX+1
4030 POKE IX,0
4040 IX=IX+1
4050 RETURN
4990 REM   UPDATE THE VIDEO FROM THE TABLE ROUTINE
5000 IX=TABLE
5005 REM   1ST, RECOVER THE H-L REGISTER ADDRESS FROM THE TABLE
5010 L=PEEK(IX)
5020 IX=IX+1
5030 H=PEEK(IX)
5040 IX=IX+1
5050 A=H
5055 REM   2ND, IS THIS THE END OF THE TABLE?
5060 IF A=0 THEN RETURN
5065 REM   3RD, IS IT A BIRTH?
5070 IF A>128 THEN GOTO 5200
5080 HL=256*H+L
5085 REM   4TH, PLACE A BLANK ON THE VIDEO
5090 POKE HL,32
5100 GOTO 5010
5200 H=H-128
5210 HL=H*256+L
5215 REM   4TH, PLACE AN "*" ON THE VIDEO
5220 POKE HL,42
5230 GOTO 5010
```

Listing 1. BASIC

```
1 REM    LIFE IN THE FAST LANE
2 REM
3 REM    CLAUD M. GRACE                  TERRY L. KEPNER
4 REM    1067 W. MIRACLE MILE, # 97      P.O. BOX 481
5 REM    TUCSON, ARIZONA    85705        PETERBOROUGH, N.H.   034
    58
6 REM
7 REM
8 REM
10 DEFINT Z
20 CLS
30 PRINT"          LIFE IN THE FAST LANE                    "
40 PRINTCHR$(13):PRINTCHR$(13)
50 PRINT"          TOUCH SPACE BAR TO START NEW RANDOM PATTERN"
60 PRINTCHR$(13):PRINTCHR$(13)
70 PRINT"          'C' TO CHANGE DELAY BETWEEN GENERATIONS"
80 PRINT:PRINT:PRINT
90 POKE 16526,0:POKE 16527,112:POKE 16553,255:GOSUB350 :CLEAR100
100 INPUT"DELAY BETWEEN GENERATIONS (APPROX 250/SECOND)"; SP
110 Z=1
115 REM  THIS SETS UP RANDOM PATTERN ON SCREEN
120 CLS
130 PRINT@0,STRING$(64," ");
140 FOR X=1 TO 60
150 J=RND(30)+17:K=RND(8)+4
160 PRINT@(K*64+J),"*";
170 NEXT X
175 REM  UPDATE SCREEN AND GENERATION COUNTER
180 Q=USR(0)
190 GEN=GEN+Z:PRINT@0,"GENERATION  ";GEN;
195 REM  TIME DELAY ROUTINE
200 FOR X=1 TO SP:NEXT X
210 K$=INKEY$:IF K$="" THEN 180
220 IF K$="C" THEN GEN=0:GOTO 100    :ELSE GEN=0:CLS:GOTO 140
225 REM  MACHINE LANGUAGE SCREEN UPDATE
227 REM  EQUIVALENT TO LINES 1000-1060
230 DATA 221,33,0,116,33,0,60,229,253,225,22,0,62,42
235 REM  EQUIVALENT TO LINES 1070-1090
240 DATA 253,190,1,204,78,112,253,190,255,204,78,112,253,190,191,
    204,78,112
245 REM  EQUIVALENT TO LINES 1100-1120
250 DATA 253,190,192,204,78,112,253,190,193,204,78,112,253,190,63
    ,204,78,112
255 REM  EQUIVALENT TO LINES 1130-1150
260 DATA 253,190,64,204,78,112,253,190,65,204,78,112,205,80,112
265 REM  EQUIVALENT TO LINES 1160-2000
270 DATA 35,62,64,188,194,7,112,205,129,112,195,142,112,20,201
275 REM  EQUIVALENT TO LINES 3000-3040
280 DATA 190,194,108,112,122,254,2,202,128,112,254,3,202,128,112
285 REM  EQUIVALENT TO LINES 3050-3310
290 DATA 221,117,0,221,35,221,116,0,221,35,195,128,112,122,254,3,
    194,128,112
295 REM  EQUIVALENT TO LINES 3320-3400
300 DATA 221,117,0,221,35,221,116,0,221,203,0,254,221,35,201
305 REM  EQUIVALENT TO LINES 4000-5010
310 DATA 221,54,0,0,221,35,221,54,0,0,221,35,201,221,33,0,116
315 REM  EQUIVALENT TO LINES 5020-5060
320 DATA 221,110,0,221,35,221,102,0,221,35,124,254,0,200
325 REM  EQUIVALENT TO LINES 5070-5230
330 DATA 254,128,242,170,112,54,32,195,146,112,203,188,54,42,195,
    146,112,300
340 REM  THIS POKES THE MACHINE LANGUAGE INSTRUCTIONS INTO MEMORY
350 ADDR=28672
360 READ CODE
370 IF CODE>255 THEN RETURN
380 POKE ADDR,CODE
390 ADDR=ADDR+1:GOTO 360
```

Listing 2. Hybrid BASIC-Assembly Code

to update the generation counter and check for additional user inputs. The process then repeats.

To understand the assembly code routine requires a little background information.

Life Strategy

Originally developed to simulate cell growth, Life's rules are rather simple: In order to survive, each cell must have two or three neighbors, otherwise it dies of "loneliness"; a cell with more than three neighbors dies from overcrowding; any empty space with exactly three neighbors will be the site of a "birth" and will be occupied by a new cell.

The interest and fun in Life comes from watching cells develop into interesting patterns, or, perhaps, even new Life forms.

There are several ways to program Life. One method uses two two-dimensional arrays—one for the current generation under evaluation, and the other for the survivors and births of that generation. Another method uses only one array, with the current cells positive but less than 128, births greater than 128 and deaths negative.

The strategy used in this article follows neither of the above two methods.

Since each generation is different from the previous one by some set of changes, all that is needed is a list of these changes —the births and deaths of each generation (see Fig. 1).

This list is built by looking at the eight surrounding spaces of

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each location on the video screen and counting the number of live cells (actually asterisks). This count is compared to the rules, and if the rules decree death, then the address of that cell is added to the list.

If the rules decree birth, the address of that cell has 8000 hex added to it and is placed on the list. For any other conditions, nothing is added to the list. After the last video position is considered, the address 0000 hex is added to the list as an end marker. This is demonstrated in Fig. 2.

The process involved in checking out the surrounding eight spaces of each video location is shown in Fig. 3.

Fig. 4 is the heart of the strategy. It applies two different rules, depending upon whether a video location is occupied or empty. For an empty space, if the neighbor count is not two or three, add that location's address to the list. This is its death warrant.

The address must be broken down into two hex numbers for the machine code routine to handle it, one for the last two digits (which are also in hex), and one for the first two digits (0080H = 80H + 00H).

For an empty cell, if it has exactly three neighbors, set the seventh bit of the most significant byte (the first two hex digits are known as the MSB and the last two as the LSB—least significant byte) of its address high. Add the address to the list. This is equivalent to adding 128 decimal to the address and is used to signify a birth. If none of these conditions are met, forget this location and go to the next one.

Fig. 5 reads the addresses off the table until it finds a zero. It also checks to see if each address is greater than 8000H and, if it is, resets the MSB bit low and sends a * to the resultant address. If it is lower than 8000H it sends a " " to that address.

As I mentioned earlier, the difference between the execution times of the BASIC and the hybrid versions is fantastic. One generation of Life in the hybrid version has approximately 3½ to four generations per second! This is a ratio of almost 550 to one.

At this high speed it was necessary to add a timing loop to the program to slow down the

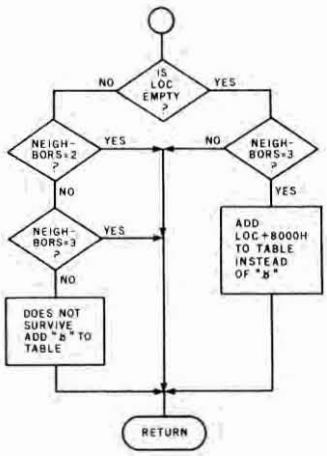

Fig. 4. Apply Rules & Build Table

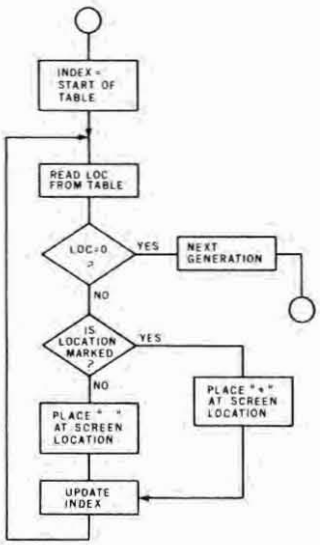

Fig. 5. Read Table & Update Display

```
00001 ;*****************************************************
00002 ;****** LIFE SOURCE CODE
00003 ;****** CREATED BY CLAUD M. GRACE
00004 ;
00005 ;*****************************************************
00006         ORG     7000H
00007 VIDIO   EQU     3C00H           ;STARTING ADDRESS
00008 TABLE   EQU     7400H           ;STARTING ADDRESS
00009 BUILD   LD      IX,TABLE        ;LOAD TABLE ADDRESS INTO IX
00010         LD      HL,VIDIO        ;LOAD VIDEO ADDRESS INTO H & L
00011 LOOP    PUSH    HL              ;PUSH HL ONTO STACK
00012         POP     IY              ;POP STACK (HL) INTO IY
00013         LD      D,0             ;LOAD 0 INTO REGISTER D
00014         LD      A,42            ;LOAD 42 INTO ACC. A
00015         CP      (IY+1)          ;COMPARE ACC. A WITH IY+1
00016         CALL    Z,COUNT         ;IF ZERO, CALL COUNT
00017         CP      (IY-1)          ;REPEAT ABOVE TWO STEPS
00018         CALL    Z,COUNT
00019         CP      (IY-65)
00020         CALL    Z,COUNT
00021         CP      (IY-64)
00022         CALL    Z,COUNT
00023         CP      (IY-63)
00024         CALL    Z,COUNT
00025         CP      (IY+63)
00026         CALL    Z,COUNT
00027         CP      (IY+64)
00028         CALL    Z,COUNT
00029         CP      (IY+65)
00030         CALL    Z,COUNT
00031         CALL    RULES           ;NOW LOOK AT RULES
00032         INC     HL              ;GO TO NEXT VIDEO LOC.
00033         LD      A,40H           ;LOAD 40HEX INTO A
00034         CP      H               ;COMPARE TO H REGISTER
00035         JP      NZ,LOOP         ;IF NOT ZERO, GO TO LOOP
00036         CALL    STOP            ;IF ZERO, END OF VIDEO
00037         JP      READ            ;JUMP TP READ
00038 COUNT   INC     D               ;ADD 1 TO REGISTER D
00039         RET
00040 RULES   CP      (HL)            ;COMPARE A TO CONTENTS OF ADDRESS IN HL
00041         JP      NZ,MTY          ;IF ITS EMPTY, JUMP TO MTY
00042         LD      A,D             ;LOAD CONTENTS OF REG. D INTO A
00043         CP      2               ;DOES IT = 2 ?
00044         JP      Z,GO            ;YES, JUMP TO GO
00045         CP      3               ;DOES IT = 3?
00046         JP      Z,GO
00047         LD      (IX+0),L        ;LOAD ADDRESS IN REG. H & L
00048         INC     IX              ;INTO ADDRESSES POINTED
00049         LD      (IX+0),H        ;TO BY REG. IX
00050         INC     IX
00051         JP      GO
00052 MTY     LD      A,D             ;LOAD REG. D INTO A
00053         CP      3               ;COMPARE WITH THE # 3
00054         JP      NZ,GO           ;IF NOT ZERO, JUMP TO GO
00055         LD      (IX+0),L        ;STORE ADDRESSES IN H & L
00056         INC     IX              ;IN ADDRESSES POINTED TO
00057         LD      (IX+0),H        ;BY THE IX REGISTER
00058         SET     7,(IX+0)        ;SET BIT 7 TO A 1 (BIRTH)
00059         INC     IX
00060 GO      RET                     ;RETURN TO LOOP CALLS
00061 STOP    LD      (IX+0),0        ;LOAD ZERO'S INTO ADDRESSES
00062         INC     IX              ;POINTED TO BY IX, END OF
00063         LD      (IX+0),0        ;TABLE
00064         INC     IX
00065         RET
00066 CELL    EQU     42              ;CELL = "*"
00067 BLANK   EQU     32              ;BLANK =" "
00068 READ    LD      IX,TABLE        ;LOAD TABLE ADDRESS INTO IX
00069 LOOP1   LD      L,(IX+0)        ;LOAD CONTENTS OF ADDRESS IN
00070         INC     IX              ;IX INTO H & L, RESPECTIVELY
00071         LD      H,(IX+0)
00072         INC     IX
00073         LD      A,H
00074         CP      0               ;IS THIS END OF TABLE?
00075         RET     Z
00076         CP      128             ;IS IT A BIRTH?
00077         JP      P,MT            ;IF PARITY FLAG IS SET, JUMP TO MT
00078         LD      (HL),BLANK      ;LOAD " " INTO ADDRESS IN HL
00079         JP      LOOP1
00080 MT      RES     7,H             ;RESTORE THE 7TH BIT OF H
00081         LD      (HL),CELL       ;LOAD "*" INTO ADDRESS IN HL
00082         JP      LOOP1
00083         END
```

Listing 3. Assembly Code

game. The loop is set at the beginning of the game by asking the operator what time delay is wanted.

Assembly Version

The assembly language version is only a little bit faster than the hybrid version, running about five to six generations per second.

Unfortunately there isn't a method for the user to input his or her own patterns onto the screen in these programs. It's discouraging to spend five to ten minutes putting a pattern on screen, only to see everything either die off or become static in five or ten seconds. Inserting a random pattern generator corrects this and the patterns usually last longer than ten seconds too!

Since most of the heavy-duty work is accomplished in the assembly code section of the program, it should be easy for you to write your own method of pattern entry. A pause key can also be added to allow you time to study the screen if an interesting Life form appears.

Be careful when adding statements to the BASIC portion of the hybrid program. The assembly code routine resides at the top of the memory, while the BASIC program occupies the lower part.

As long as the two do not overlap there aren't any problems, but when the BASIC section intrudes upon the assembly code routines, the program as a whole will malfunction and crash.

To avoid this catastrophe, find out the lowest address of RAM used by the assembly code routine, not counting the video memory cells. After power up, when MEMORY SIZE? prompts, input this address in decimal. (For this particular program the lowest address used by the assembly code routine is 28672.)

The sample programs have been liberally sprinkled with comments to help you understand assembly code and how it corresponds to BASIC. ■

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Learn about matrix handling, and destroy submarines at the same time.

U-Boat

Hubert C. Borrmann
2840 South Circle Dr.
Colorado Springs, CO 80906

Simplicity is the key to program writing for the beginner. Try starting with something easy, like a guessing game and then improve it.

In the following program, the computer thinks of a number, while you try to guess it. The computer then tells you how close you are.

By adding some graphic embellishments to this premise, we have a game that I call U-boat. The U-boat is hidden, and the player has to guess where it is.

This idea can be developed in several ways. We can divide the ocean into squares and hide the U-boat in one of them. If the player guesses the wrong square, the computer tells him whether he is high or low. By varying the number of squares, the player can change the difficulty.

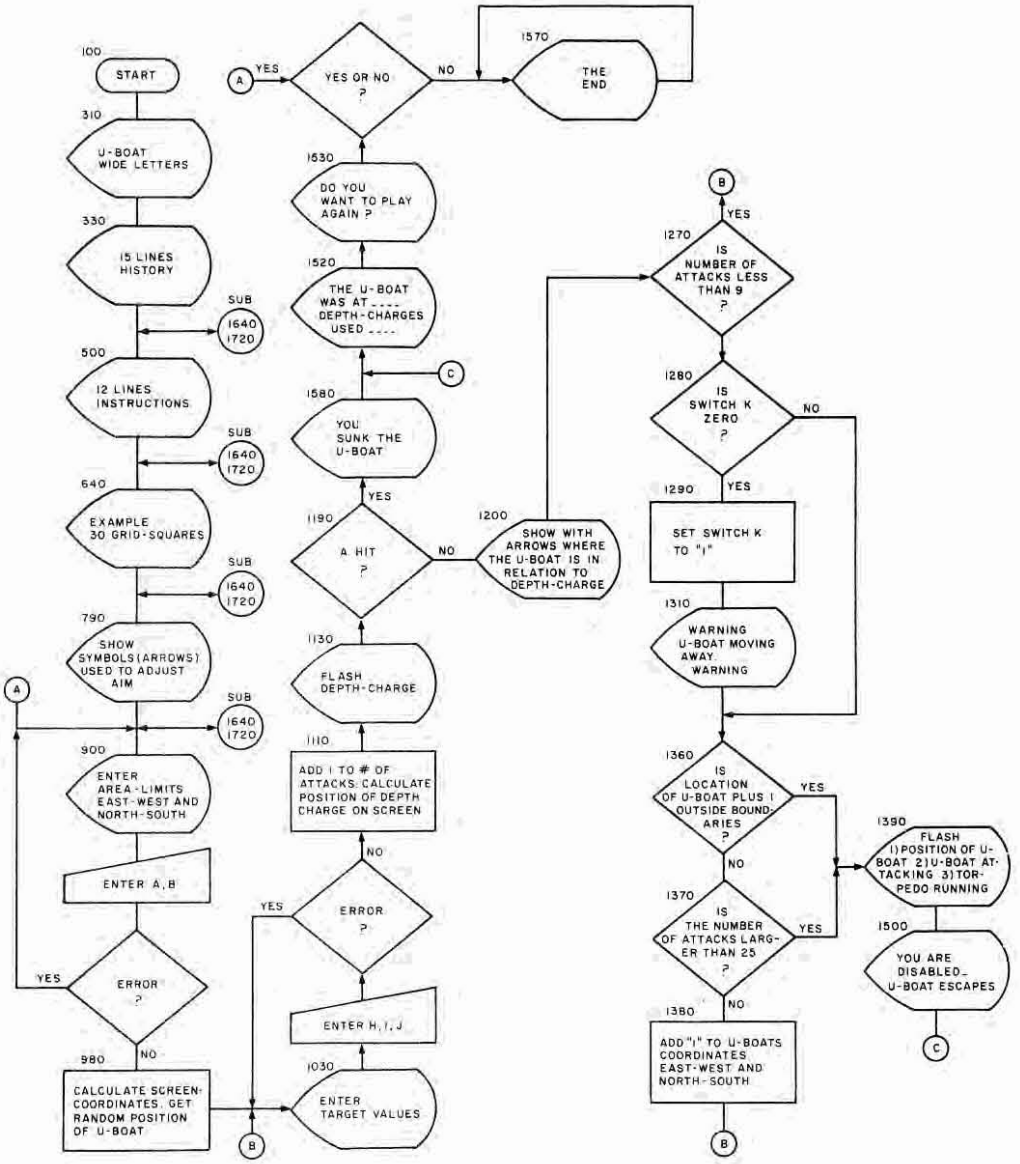

Fig. 1. Flowchart.

Using the Game Coordinates

But this approach is a little too simple. Instead, let's use coordinates, a set of numbers used to specify the location of a point on a grid. Coordinates are pairs of numbers, one representing the steps away from our starting point horizontally and the other representing a number of vertical steps down from the horizontal axis.

The set instruction uses this approach. The top-left corner of the screen is 0,0. If you instruct SET(10,1), you go ten steps to the right and one step down.

So far, the player must guess two numbers. But a U-boat isn't a surface craft, and you can't expect the sub to remain on the surface. So I'm going to add the third dimension of depth.

While I'm at it, I'm going to make a change in the language of the rules. Instead of merely guessing some numbers, the player is going to be dropping depth charges.

To give the player some help and guide him toward his prey, I'm going to let the on-board sonar indicate the relative direction of the U-boat from the location of the depth charge drop. The computer will show with arrows whether to increase (right)

or decrease (left) the east-west coordinate and, also, whether to increase (down) or decrease (up) the north-south coordinate.

The computer also verbally advises the player whether to increase the depth setting on his next drop (DOWN) or whether to decrease it (UP).

The computer therefore asks for three coordinates (east-west, north-south and depth) and accepts these values. It then compares these values with the values the player has picked for the location of the imaginary U-boat. If they match, the player has successfully attacked and destroyed a sub (i.e., guessed three numbers correctly).

Varying the Grid

Except for the screen usage, this is still a simple guessing game. You can vary the degree of difficulty by varying the size of the grid.

The set and reset instructions can use 128 horizontal positions and 48 vertical positions. Thus, the largest grid can be 5,969 squares, while the smallest is one by one, or one square. To keep it simple, let's say that the U-boat remains at a depth between 1 and 15, and that the player can't change this range.

After the player enters his guess, the computer responds by flashing the location of the depth charge on the screen and by indicating the necessary corrections required. We don't want an unending game, so after nine unsuccessful attacks let's change the strategy and move the U-boat one step horizontally and one step vertically. This will add some spice.

The player continues attacking (up to 25 times) or until the U-boat is reaching the border of our ocean. If the target has not been found by now, the computer wins. It indicates whether the player has won or lost, shows the position of the U-boat and the number of depth-charges used. The player can now choose to either play another game or to END.

The Flowchart

You still are not ready to write instructions. The flowchart comes first. A flowchart is like a road map, and if you follow this map faithfully, you won't get lost.

I don't know how much memory you have—I assume 16K. If you have 4K, you can still write the suggested program and leave out part 1 and the remarks.

Break your program down into two parts. Part 1 is just information, while part 2 is the actual game. Part 1 offers some history, some instructions of how to play the game, and an example.

Fig. 1 is the main chart. Fig. 2 is a set of instructions which have to be repeated several times. It's a delay subroutine that flashes the word SPACE, while the player is waiting. SPACE continues flashing until INKEY$ detects a keystroke. It is numbered higher than the body of the program, so that it is callable. (See Radio Shack's July, 1979, Newsletter.)

After a start symbol and a title frame, the next screen symbol indicates 15 lines of history. It is actually not 15 lines, since I reserve the top line for the heading U-boat on all frames, and I also reserve the last line to tell the player to press the space bar when he is ready. This instruction delay is provided by our subroutine.

There follows some instructions to the player, the subroutine, and two screens that illustrate the grid, symbols, and language the computer will use.

Again, I use the delay subroutine.

The Game

I now start part 2, the actual game. The circle with the letter A in it is a connector, and is used so that the logic lines do not have to cross each other. A starts with a query to enter the ocean limits.

The next symbol, a keyboard, indicates data entry. I accept the numbers for the limits, and write into the symbol the letters A and B. These are variables.

A good programmer will check entered data for validity, and I do this in the next symbol, the diamond. I check for a number between 1 and 127, and for the other number between 1 and 47. If there was an error, I go back to connector A.

If the entered limits are OK, I now have some work to do. The square box indicates my calculations. I first adjust the width and length of the screen to the desired ocean area. If the player chooses the east-west limit to be 64, for instance, this becomes the extreme right number of the screen. Position 32 is in the middle and so forth.

I let the TRS-80 pick the three coordinates of our imaginary U-boat: east-west, north-south and depth.

At connector B I ask for the three target coordinates, and the player makes his first guess. The keyboard symbol accepts the three values, variables H, I and J and these are edited in the next diamond. They have to fit into the pre-determined area. If the data are OK, I increment the attack counter.

The location of the depth-charge shows on the screen, flashing on and off (SET and RESET).

The next diamond determines whether we scored a hit or a miss. The U-boat is sunk if hit and that is indicated. The next symbol shows where the U-boat was on the screen, its coordinates, and the number of depth charges expended.

The game is over, and the computer asks whether another

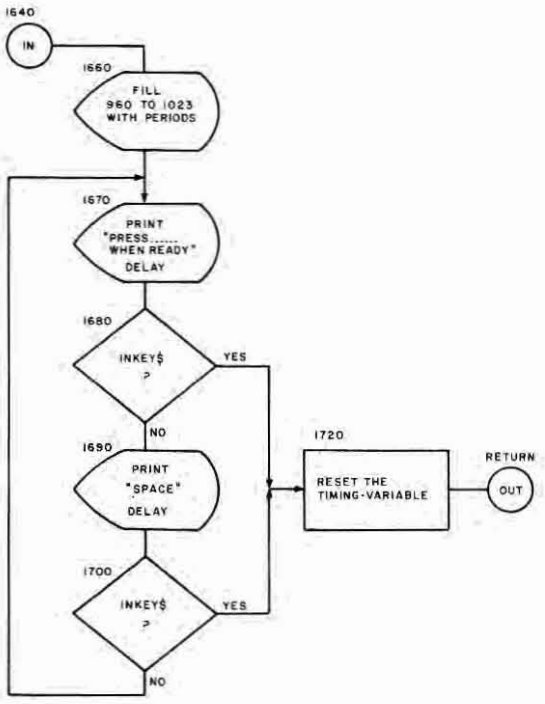

Fig. 2. Subroutine.

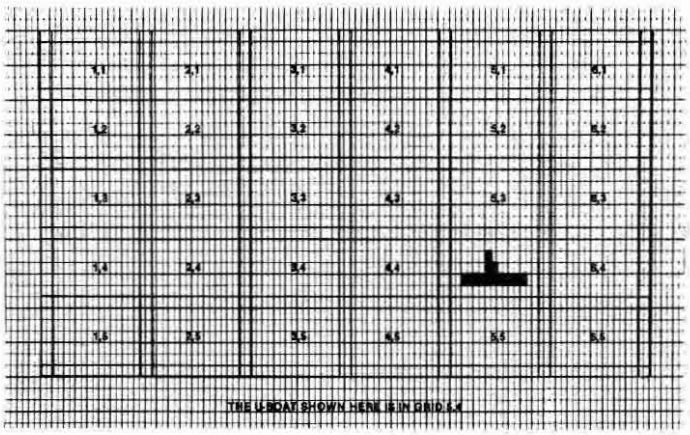

Fig. 3. Sample U-boat Grid.

Program Listing.

```
120 '   THE FOLLOWING IS A LIST OF THE VARIABLES USED :
130 '   A  =  EAST-WEST LIMIT OF AREA
140 '   B  =  NORTH-SOUTH LIMIT OF AREA
150 '   C  =  127/EAST-WEST LIMIT
160 '   D  =  47/NORTH-SOUTH LIMIT
170 '   E  =  EAST-WEST COORDINATE OF U-BOAT
180 '   F  =  NORTH-SOUTH COORDINATE OF U-BOAT
190 '   G  =  DEPTH OF U-BOAT (1-15)
200 '   H  =  EAST-WEST COORDINATE OF DEPTH-CHARGE
210 '   I  =  NORTH-SOUTH COORDINATE OF DEPTH-CHARGE
220 '   J  =  DEPTH-SETTING OF DEPTH-CHARGE
230 '   K  =  SWITCH, 1ST TIME IS ZERO
240 '   L, M, O, P  =  WORK VARIABLES
250 '   N  =  ATTACK COUNTER, CHGE STRATEGY AT 25.
260 '   T  =  FOR TIMING LOOPS
270 '   X  =  HORIZONTAL SCREEN COORDINATE
280 '   Y  =  VERTICAL SCREEN COORDINATE
290 '   SS AND SS$  ARE USED IN THE SUBROUTINE.
300 '
310 CLS:CLEAR250:PRINT CHR$(23):PRINT@398,"U  -  B  O
    A  T"
320 FOR T=1 TO 700:NEXT T:CLS
330 PRINT@20,"U  -  B  O  A  T";
340 PRINT@64,"THERE WERE TIMES DURING THE WORLD WARS, W
    HEN THIS WORD CAUSED"
350 PRINT"TERROR AMONG THE SEAMEN OF THE ALLIES. IT WAS
     DURING THE BATTLE"
360 PRINT"OF THE ATLANTIC IN W.W.2 THAT THE U-BOATS WER
    E FINALLY DEFEA-"
370 PRINT"TED BY HUNTER-KILLER GROUPS, AIRCRAFT AND IMP
    ROVED SONAR AND"
380 PRINT"RADAR DEVICES. THE HUNTER-KILLER TEAMS CONSIS
    TED OF SMALL AIR-"
390 PRINT"CRAFT CARRIERS, DESTROYERS AND/OR CORVETTES.
    ONCE A U-BOAT'S"
400 PRINT"POSITION WAS ESTIMATED, IT OFTEN DID NOT TAKE
     LONG FOR THE HUN-"
410 PRINT"TER OF THE TEAM TO PINPOINT THE POSITION OF T
    HE U-BOAT FOR THE"
420 PRINT"KILLER PARTNER. THE U-BOATS TRIED TO HIDE UND
    ER DIFFERENT DEN-"
430 PRINT"SITY LAYERS OF THE SEAWATER, WHICH DEFLECTED
    THE SONAR IMPUL-"
440 PRINT"SES AND BY REMAINING IMMOBILE AND SILENT. THE
     LACK OF OXYGEN"
450 PRINT"AND EXCESS OF CO-2 HOWEVER FORCED THE U-BOAT
    TO EVENTUALLY"
460 PRINT"SURFACE AND SOMETIMES TO COUNTERATTACK TO SAV
    E ITSELF."
470 GOSUB 1640
480 CLS
490 PRINT@20,"U  -  B  O  A  T ";
500 PRINT@70,"THIS IS HOW WE PLAY THIS GAME :"
510 PRINT"YOU ARE THE CAPTAIN OF A HUNTER-KILLER DESTRO
    YER UNDER ORDERS"
520 PRINT"TO PATROL A CERTAIN AREA OF THE OCEAN. THE AR
    EA IS DIVIDED"
530 PRINT"INTO GRID-SQUARES.  (YOU DECIDE THE NUMBER)"
540 PRINT"THE EAST-WEST LIMIT MAY BE BETWEEN 1 AND 127
    "
550 PRINT@395,"AND NORTH-SOUTH BETWEEN 1 AND 47 "
560 PRINT"IF THE E-W LIMIT IS 4 AND THE N-S LIMIT IS 3
    THEN THERE ARE 12"
570 PRINT"SQUARES TO SEARCH. THE U-BOAT COULD BE IN ANY
     OF THESE AT A"
580 PRINT"DEPTH BETWEEN 1 AND 15 (EACH UNIT = 20 METERS
    )."
590 PRINT"IF YOU DROP A DEPTH-CHARGE PATTERN INTO THE R
    IGHT SQUARE SET"
600 PRINT"FOR THE RIGHT DEPTH, YOU HAVE DESTROYED THE U
    -BOAT."
610 PRINT@832," THE FOLLOWING SCREEN WILL SHOW A GRID P
    ATTERN 6 X 5 "
620 GOSUB 1640
630 CLS
640 PRINT@195,"1,1       2,1       3,1       4,1
    5,1       6,1";
650 PRINT@323,"1,2       2,2       3,2       4,2
    5,2       6,2";
660 PRINT@451,"1,3       2,3       3,3       4,3
    5,3       6,3";
670 PRINT@579,"1,4       2,4       3,4       4,4
    5,4       6,4";
680 PRINT@707,"1,5       2,5       3,5       4,5
    5,5       6,5";
690 FOR L=0 TO 121
700 SET(L,7):SET(L,13):SET(L,19):SET(L,25):SET(L,31):SE
    T(L,37):NEXT L
710 FOR L=7 TO 37
720 SET(0,L):SET(20,L):SET(40,L):SET(60,L):SET(80,L):SE
    T(100,L):SET(120,L)
730 SET(1,L):SET(21,L):SET(41,L):SET(61,L):SET(81,L):SE
    T(101,L):SET(121,L):NEXT L
740 FOR L=83 TO 98:SET(L,29):NEXT L:SET(90,27):SET(90,2
    8):SET(91,28)
750 PRINT@844,"THE U-BOAT SHOWN HERE IS IN GRID  5,4.";
760 GOSUB 1640
770 CLS
780 PRINT@20,"U  -  B  O  A  T";
790 PRINT@64,"THE SCREEN WILL SHOW THE DEPTH-CHARGE PAT
```

game is desired. If the answer is yes, then the computer goes to the start of part 1, via connector A. If the answer is no it shows THE END and stays in an unending loop.

You Miss

That was if the player scored. If he missed, we calculate the direction of the U-boat in relation to the depth-charge and indicate with arrows and/or the words UP or DOWN how the player should adjust his aim.

The next diamond asks if this is attack nine or higher. If it was not, the player makes another run, via B. Otherwise the U-boat moves a little at a time. To be fair, the computer informs the player.

Since I want to give this warning only once, I employ a switch K, which is zero the first time and one from then on. If the switch is zero, I make it one and show the warning message.

Before the computer can move the U-boat, however, it has to check that the new location is not outside the ocean area. If the location is valid, the computer next checks if this is the 26th unsuccessful attack. If not, the computer now moves the U-boat by adding one to its coordinates. This moves it one step to the right and one step down.

Then the computer, via connector B, lets the player make another run.

If the earlier check has indicated that the U-boat would move outside the limits, or that the player has performed more than 25 unsuccessful attacks, the computer gives the U-boat captain a break. As you see on the flowchart, the position of the U-boat is flashed on the screen, and "U-boat attacking" and "Torpedo running." It then informs the player that he is disabled and that the U-boat has escaped. Via connector C the screen shows the statistics.

Coding the Game

When starting the actual program coding, I use the program pad and the screen layout forms, and also some scratch paper. On a separate sheet marked variables, I write those used and their meaning. I enter the list of variables in the program as REMARK statements after I'm done.

If X-programs later, you want to make some improvements in this program, the list of variables will be invaluable. So leave plenty of space for this, and start with line number 100 or so for the Program Listing.

Line 310 sets the screen up for wide letters, CHR$(23), and prints U-boat. CLS sets the screen to normal width and builds the history screen, lines 330–460.

Line 470 links to the subroutine, 1640. (Before renumbering, this was 10,000.) After CLS and the instructions, lines 490–610 are printed and linked to the subroutine in line 620.

For an example, let's use a grid with six squares across the five squares down. This is a total ocean area of 30 squares (Fig. 4). Name these squares (1,1), (1,2), (1,3) and so on. (See lines 640–680.) Build the framework for these squares with FOR-NEXT loops in lines 690–730, using SET instructions. Add a U-boat in one of the squares, say 5,4, and so state in line 750. Draw the U-boat in line 740.

Line 760 links to the subroutine again. Now, you are ready to print your last informational frame, lines 790–880. Use arrows; see CHR$ 91, 92, 93, 94.

Part Two

First, set up the area and ask for the limits. Edit the entered values in lines 920 and 950. Note that line 930 contains a RANDOM statement, so that the built-in random number generator will not come up with the same number consecutively.

Now enter A for east-west, B for north-south. In line 970, tell the player how many squares he has to search. This number is L.

Calculating the screen coordinates is simple, if the player has chosen the full screen grid. Any entered east-west number corresponds directly to the screen positions.

However, if the player chooses an east-west limit of 64, then any entered east-west number occupies two logical screen positions. The same is true for the north-south coor-

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```
    TERNS AND HOW YOU"
800 PRINT"SHOULD ADJUST YOUR AIM AND DEPTH SETTING :"
810 PRINT@212,CHR$(94);"  = INCREASE E-W COORDINATE"
820 PRINT@276,CHR$(93);"  = DECREASE E-W"
830 PRINT@340,CHR$(91);"  = DECREASE N-S"
840 PRINT@404,CHR$(92);"  = INCREASE N-S"
850 PRINT@468,"UP = DECREASE DEPTH"
860 PRINT@530,"DOWN = INCREASE DEPTH"
870 PRINT@706,"Y O U R   O R D E R S   A R E :"
880 PRINT@770,"F I N D   A N D   D E S T R O Y   T H E
    U - B O A T !"
890 GOSUB 1640
900  CLS:N=0:K=0
910  PRINT@10,"ENTER EAST-WEST LIMIT ( 1 TO 127 )  ";:I
    NPUT A
920  IF A<1 OR A>127 THEN PRINT@ 50,"ERROR";:GOTO910
930  CLS : RANDOM
940  PRINT@ 10,"ENTER NORTH-SOUTH LIMIT ( 1 TO 47 )  ";
    :INPUT B
950  IF B<1 OR B>47 THENPRINT@ 50,"ERROR";:GOTO910
960  CLS
970  L=A*B:PRINT@0,"YOU HAVE";L;"SQUARES TO SEARCH.";
980  C=INT(127/A):D=INT(47/B)
990  E=RND(A)
1000  F=RND(B)
1010  G = RND(15)
1020 FOR L=1 TO 800: NEXT
1030  PRINT@ 0,"ENTER TARGET VALUES (E-W, N-S, DEPTH)";
1040 PRINT@37,"          ";
1050 PRINT@37,"";
1060  INPUT H,I,J
1070 PRINT@49,"                    ";
1080 IF H<1 OR H>A THEN PRINT@50,"ERROR";:GOTO 1030
1090 IF I<1 OR I>B THEN PRINT@50,"ERROR";:GOTO 1030
1100 IF J<1 OR J>15 THEN PRINT@50,"ERROR";:GOTO 1030
1110  N=N+1:X=H*C:Y=I*D:PRINT@50,"      ";
1120 X=X-INT(C/2):Y=Y-INT(D/2)
1130  FOR L=1 TO 6
1140  RESET(X,Y)
1150  FOR M=1 TO 40:NEXT M
1160   SET(X,Y)
1170  FOR M=1 TO 40:NEXT M
1180  NEXT L
1190 IF H=E AND I=F AND J=G THEN 1580
1200  PRINT@ 49,"";
1210 IF H<E THENPRINT CHR$(94);CHR$(94);CHR$(94);" ";:G
    OTO 1230
1220 IF H>E THENPRINT CHR$(93);CHR$(93);CHR$(93);" ";
1230 IF I<F THENPRINT CHR$(92);CHR$(92);CHR$(92);" ";:G
    OTO 1250
1240 IF I>F THENPRINT CHR$(91);CHR$(91);CHR$(91);" ";
1250  IF J < G THENPRINT"DOWN";:GOTO1270
1260  IF J > G THENPRINT"UP  ";
1270  IF N < 9 THEN1030
1280  IF K <> 0 THEN1360
1290  K=1
1300  FOR L=1 TO 8
```


dinates. Calculate these modifiers in line 980 and keep them in C and D.

Lines 990–1010 generate the U-boat's position. Keep secret the east-west coordinate in E, the north-south coordinate in F and the depth in G.

The player now gets a shot at the U-boat. The computer tells him to enter the target values. Before he does this, a waiting loop is executed in line 1020, to let him know that he has L squares to search.

The three entered coordinates go into H, I and J (1030–1060) and are checked for errors.

What is this check? The player cannot accept any coordinate less than 1 or larger than the chosen limits.

Add one to the number of attacks (counter N). To show the location of this depth-charge on the screen, lines 1110 and 1120 must calculate it, while lines 1130–1180 do the flashing.

An Example

Here's an example. Assume the player answered the area limit question with two east-west and two north-south squares. Thus, A = 2 and B = 2.

Looking at line 980, C will be 63 (127 divided by 2), and D will be 23 (47 divided by 2). If the player entered the coordinates 1,1 (H = 1, I = 1), X will be 1 times 63 (H times C). Y will be 1 times 23 (I times D) lines 1110.

In the next line 1120 these values are adjusted for the middle of their areas. X equals 63 minus 31 (63 divided by 2), which is 32. Y equals 23 minus 11 (23 divided by 2), which is 12, so the instruction is SET(32,12), and if you look at the screen layout you will see that this point is in the middle of square 1,1, the top-left square.

Back to our flowchart and pro-

```
1310  PRINT@960,"W A R N I N G !  U-BOAT IS MOVING AWAY
    .  W A R N I N G ";
1320  FOR M=1TO150 : NEXT M
1330  PRINT@960,"
                  ";
1340  FOR M=1TO30 : NEXT M
1350  NEXT L
1360  IF (E+1>A) + (F+1>B) THEN1390
1370  IF N > 25 THEN1390
1380  E=E+1:F=F+1:GOTO 1030
1390  P=E*C:O=F*D:P=P-INT(C/2):O=O-INT(D/2)
1400  FOR L=1 TO 10
1410  PRINT@960,"W A R N I N G ! U - B O A T   I S   A
    T T A C K I N G";
1420  PRINT@0,"SONAR REPORTS :  T O R P E D O    R U N
    N I N G  !       ";
1430  SET(P,O)
1440  FOR M=1 TO 100:NEXT M
1450  PRINT@960,"              $
                  ";
1460  PRINT@0,"
                ";
1470  RESET(P,O)
1480  FOR M=1 TO 30:NEXT M
1490  NEXT L
1500  PRINT@ 0,"YOU ARE DISABLED BY ENEMY TORPEDO, U-BO
    AT ESCAPES.";
1510  FOR L=1 TO 2000:NEXT L
1520  PRINT@960,"THE U-BOAT WAS AT";E;"-";F;"-";G;"  ";
    N;"DEPTH-CHARGES USED";
1530  PRINT@ 0,"DO YOU WANT TO PLAY AGAIN (YES / NO)
                ";
1540 INPUT A$
1550 IF  LEFT$(A$,1)="Y" THEN 900
1560 CLS:PRINT CHR$(23)
1570 PRINT@ 524,"T H E     E N D";:GOTO 1570
1580  PRINT@ 0,"Y O U     S U N K     T H E     U - B O A
    T   ! ";
1590  FOR L=1 TO 1000:NEXT L
1600  PRINT@0,"
                  ";
1610  PRINT@960,"
                  ";
1620  GOTO 1520
1630  END
1640  ' SUBROUTINE TO DISPLAY MESSAGE AND TO WAIT UNTIL
1650 '      THE SPACE BAR IS DEPRESSED
1660 PRINT@960,STRING$(63,".");
1670 PRINT@980,"PRESS          WHEN READY.";
1680 FOR SS=1 TO 30:SS$=INKEY$:IF SS$<>"" THEN 1720ELSE
     NEXT SS
1690 PRINT@986,"'SPACE'";
1700 FOR SS=1 TO 30:SS$=INKEY$:IF SS$<>"" THEN 1720ELSE
     NEXT SS
1710 GOTO 1670
1720 SS=99:NEXT SS:RETURN
```

gram. Check for a hit in line 1190 by comparing the coordinates of the U-boat with the entered ones. If it is a hit, line 1580, informs the player that he has destroyed a U-boat.

The coordinates and number of depth-charges used are shown in line 1520. Now ask the player if he wants to play again, and if the response starts with a Y (lines 1530–1550), the computer goes where the connector A orders it, to line 900. If the response is N, we set the screen for wide letters, print THE END and enter an endless loop (lines 1560–1570). This can be replaced with a timing loop and an End statement.

If the player misses, the computer must show where the U-boat is in relation to the depth-charge. Start at line 1200, if the entered east-west coordinate is smaller than the U-boat's, then the U-boat is to the right on the screen. The computer prints arrows pointing to the right (line 1210).

If the entered north-south coordinate is larger than the U-boat's, the U-boat is higher up on the screen and the computer points that way with up-arrows (line 1240).

Next, check the attack counter at line 1270; if the number is less than nine, go to 1030 via B, and let the player make another attack. If it is nine or larger, move the U-boat.

Line 1280 controls switch K. This is set to zero in line 900. After nine attacks set it to 1, print the warning message "U-boat is moving away" and flash it (lines 1300–1350). If switch K were 1, you bypass all this and check whether you can move the U-boat (line 1360).

If you can move it, you first check the attack counter N again, in line 1370, and if this

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counter is larger than 25, the U-boat wins.

If the counter N is not larger than 25, add 1 to the U-boat's coordinates (east-west and north-south) and let the player have another run at 1030, via B.

The U-boat Wins

Looking at the flowchart, you come to line 1390 where the U-boat wins. The computer flashes the U-boat's position, calculated in line 1390. (Compare this line with lines 1110 and 1120 for the depth charge.)

Also, print U-boat attacking in line 1410 and Torpedo running in line 1420. Variables P and O will have the U-boat's coordinates and these are flashed for awhile (1400-1490). Line 1500 announces that the player is disabled, and the U-boat escapes. This stays on the screen while the timing loop at 1510 runs its course; then, you go to connector C on the flowchart.

You have reached the end of the coding, but some addresses may have to be filled in yet. Certain instructions can only be completed after the program is written. You have to leave these addresses blank until you can fill them in at the end of your coding.

As you program, make a pencil X next to the line where you have to do some filling in. This is part of desk checking. Slowly read through your code, and look for syntax errors, for missing quotes, commas and periods.

If, while writing the instructions, you deleted some lines, check for statements that go to these nonexistent lines.

Now is the time to enter the code for the list of variables we have been keeping. In this program they are lines 100-300.

You can renumber the lines if you have the program, but this is not mandatory.

Whether you renumber or not, now is the time to write the line numbers on the flowchart, next to the symbol to which they correspond. Later, if you want to make some changes, or explain a certain routine, this will help you locate the area. ■

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The presidential simulation they play in the White House.

A Heartbeat Away

Clinton Morey
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Peerless, MT 59253

The President of the United States receives a telegram from the U.S. Ambassador to Panama. Panamanians are rioting in the streets and throwing bombs at American citizens in the canal zone. The President's advisors are divided on what to do. Some suggest taking a hard line, condemning Panama and ordering U.S. troops into the streets. Others urge caution, putting the troops on alert, but taking no overt action to further worsen the situation. What will the President do?

Computer Re-Creations

Each student in my high school goverment class had to make that decision, as if he were the President. The U.S.-Panama crises of 1964 occurred when Lyndon Johnson was President of the United States. To give my students an understanding of the types of decisions a President must make, I designed a computer program to recreate this minor crises in our nation's past.

The program is not a simulation but a re-creation of an historical event, with some allowance for student interaction. It's run on a Level II, 16K. In this historical re-creation, the computer compares the student's responses with those made by President Johnson, but follows closely the true course of events regardless of the student's decisions. This allows the student to learn about an historical incident in a high interest situation, to compare his decisions with those of a real President and to evaluate the quality of the decisions made.

The computer program gives information to the President in bits and pieces. Messages from the American ambassador or the senior military officer come to the desk of the President (Fig. 1), requiring him to make some kind of decision. Later developments often require the President to alter his decisions as new facts are revealed. And, just as in real life, the President's advisors suggest alternate courses of action.

This bit-by-bit acquisition of information is important in helping the student understand the decision making process. We could all be great presidents, if we had the gift of hindsight.

Classroom Discussion

There are no right or wrong answers in the course of this historical re-creation. Although some students make decisions that could possibly lead to war, the value of this computer program comes from an empathy for the tough decisions that a President must make. Thus, a very important part of the activity takes place after each student has gone through the program, in the form of classroom discussion.

The program is not a game—but it has proven to be fun for my students who have used it. From a teacher's standpoint, the value of the program is not in the level of enjoyment, but in the changes that occur in the student. In my classes, I have seen significant changes in student's perceptions of the Presidency after working through this program.

I believe there is a place in computer instruction for historical re-creation, not just recreation. ■

```
DATE: JANUARY 9, 1964
TO: PRESIDENT MOREY
FROM: U.S. EMBASSY TO PANAMA
-----------------------------------------------------------------------------
LARGE CROWDS OF PANAMANIAN CITIZENS HAVE GATHERED ALONG THE CANAL ZONE BOUNDRY. SHOUTING. JEERING AND THROWING ROCKS
AND ANYTHING THAT CAME TO HAND.
RIOTING HAS BROKEN OUT IN COLON AND PANAMA CITY
PANAMANIAN STUDENTS AND CIVILIANS HAVE THROWN MOLOTOV COCKTAILS AT BUILDINGS AND AUTOMOBILES.
CARS WITH CANAL ZONE LICENSE PLATES HAVE BEEN ATTACKED AND THEIR OCCUPANTS PULLED OUT AND SAVAGELY BEATEN.
PANAMANIAN AUTHORITIES HAVE BEEN OF LITTLE HELP.  PANAMANIAN POLICE FORCE HAVE STOOD ASIDE.  PANAMANIAN NATIONAL GUARD UNITS
HAVE REMAINED IN THEIR BARRACKS.
CANAL ZONE POLICE FORCE TOO SMALL (ONLY 88 MEN) TO CONTROL RIOTERS
REQUEST U.S. ARMY TROOPS BE CALLED OUT TO PROTECT CANAL ZONE.
-----------------------------------------------------------------------------
```

Fig. 1.

Program Listing

```
10 REM  THE PRESIDENT DECIDES...PART 1
15 DIM D$(14)
20 CLS:PRINT@460,"THE PRESIDENT DECIDES...PART1":FORX=1TO800
```

```
    :NEXTX:CLS:PRINT"YOU ARE ABOUT TO BEGIN A SIMULATION CO
    NCERNING THE TYPES OF":PRINT"DECISIONS THAT MUST BE MAD
    E BY AMERICAN PRESIDENTS."
25 GOSUB10000
30 PRINT"THE SITUATIONS YOU ARE GOING TO FACE ARE REAL.  PRE
    SIDENTS IN  THE PAST HAVE HAD TO DEAL WITH THESE ISSUE
    S."
35 GOSUB10000
40 PRINT"AS YOU STUDY THE EVENTS AND MAKE DECISIONS TRY TO E
    VALUATE":PRINT"NOT ONLY YOUR CHOICES BUT ALSO THOSE OF
    THE PRESIDENT WHO":PRINT"MADE THE REAL LIFE DECISIONS."
50 GOSUB10010
60 INPUT"ENTER YOUR LAST NAME";N$
70 CLS:PRINT"WELCOME TO THE HALLS OF POWER PRESIDENT ";N$;".
    "
80 PRINT:PRINT"YOU ARE GOING TO GO THROUGH A TIME OF TESTING
     SIMILIAR TO THAT":PRINT"FACED BY PRESIDENT LYNDON JOHN
    SON IN 1964.":GOSUB10000
90 PRINT"THE DECISIONS YOU MAKE WILL BE COMPARED TO THE DECI
    SIONS MADE BY PRESIDENT JOHNSON DURING THAT PERIOD.":FO
    RX=1TO1200:NEXTX
100 PRINT"FOR THE SAKE OF THE ENTIRE COUNTRY, I WISH YOU THE
     BEST OF":PRINT"LUCK IN YOUR IMPORTANT TASK PRESIDENT "
    ;N$
110 GOSUB10010
130 CLS:PRINT"DATE:  JANUARY 7, 1964":PRINT:PRINT
140 PRINT"PRESIDENT ";N$;" YOU HAVE BEGUN SERVING YOUR NEW T
    ERM AS":PRINT"PRESIDENT ONLY SIX WEEKS AGO.  A MESSAGE
    ARRIVES AT YOUR DESK.":FORX=1TO1200:NEXTX
150 LPRINT"DATE: JANUARY 7, 1964"
160 LPRINT"TO: PRESIDENT ";N$
170 LPRINT"FROM: U.S. EMBASSY IN PANAMA"
180 LPRINT"-------------------------------------------------
    ---------------------------------------------------
    ------"
190 LPRINT"A GROUP OF AMERICAN HIGH SCHOOL STUDENTS AT BALBO
    A HIGH SCHOOL IN THE PANAMA CANAL ZONE HAVE RAISED THE
    AMERICAN FLAG IN"
200 LPRINT"FRONT OF THE HIGH SCHOOL BUILDING.  THE PEOPLE OF
     PANAMA ARE AWARE OF WHAT THE STUDENTS HAVE DONE."
210 LPRINT"-------------------------------------------------
    ---------------------------------------------------
    -----------"
220 PRINT@896,"READ THE MESSAGE AND PRESS ENTER TO CONTINUE.
    "
230 A$=INKEY$:IFA$="" THEN 230
240 CLS:PRINT"ALTHOUGH ON THE SURFACE THIS SEEMS LIKE AN INO
    FFENSIVE ACT,":PRINT"YOU ARE AWARE THAT TROUBLE COULD R
    ESULT.":FORX=1TO1200:NEXTX
241 PRINT"THE FLAG RAISING VIOLATED AN AGREEMENT PRESIDENT K
    ENNEDY HAD":PRINT"MADE WITH PANAMANIAN PRESIDENT ROBERT
    O CHIARI IN 1962.":GOSUB10000
242 PRINT"THE U.S. AND PANAMA HAVE BEEN TRYING TO REACH AN A
    GREEMENT":PRINT"REGARDING CHANGES IN THE 60 YEAR OLD TR
    EATY GOVERNING U.S."
243 PRINT"CONTROL OVER THE CANAL AND THE SURROUNDING ZONE.
    NO BREAK-":PRINT"THROUGHS HAD BEEN ACHIEVED IN THOSE TA
    LKS BUT THE TWO":PRINT"PRESIDENTS HAD AGREED THAT THE F
    LAGS OF THEIR TWO COUNTRIES"
244 PRINT"WOULD FLY SIDE BY SIDE.":GOSUB10000
245 GOSUB10010
250 PRINT"SINCE THE SUMMER OF 1963 THE CIA HAS BEEN WARNING
    YOU THAT":PRINT"YOU SHOULD EXPECT DIFFICULTIES IN PANAM
    A IN LATE 1963 OR EARLY":PRINT"1964.":GOSUB10000
260 PRINT"THE CIA HAS SAID THAT FIDEL CASTRO, WORKING CLOSEL
    Y WITH THE":PRINT"PANAMANIAN COMMUNIST PARTY, HAS BEEN
    SENDING GUNS, MONEY AND":PRINT"AGENTS INTO PANAMA.
270 PRINT"THE CIA HAS SAID THAT DEMONSTRATIONS WERE LIKELY A
    ND AN":PRINT"ATTEMPTED COUP AGAINST THE LEGAL GOVERNMEN
    T WAS POSSIBLE."
280 GOSUB10000
290 PRINT"THE CIA ALSO WARNS THAT IF THAT DOES HAPPEN, THE C
    ANAL AND THE":PRINT"CANAL ZONE WOULD BE SPECIAL TARGETS
    .":GOSUB10000
300 GOSUB10010
310 PRINT"JANUARY 9, 1964":PRINT:PRINT"PRESIDENT ";N$;".  TW
    O DAYS HAVE PASSED SINCE THE INCIDENT":PRINT"AND THINGS
     IN PANAMA HAVE APPEARED STABLE.":PRINT"TODAY, YOU HAVE
     RECEIVED THIS MESSAGE:"
315 GOSUB10000
320 LPRINT"DATE: JANUARY 9, 1964"
330 LPRINT"TO: PRESIDENT ";N$
340 LPRINT"-------------------------------------------------
    ---------------------------------------------------
    ---"
350 LPRINT"PANAMANIAN STUDENTS HAVE ORGANIZED PROTEST MARCH.
     THEY ENTERED THE CANAL ZONE AND WENT TO BALBOA HIGH S
    CHOOL."
360 LPRINT"THEY FOUGHT WITH CANAL ZONE POLICE AND AS THEY LE
    FT THE CANAL ZONE, THEY BROKE WINDOWS, BURNED AUTOMOBIL
    ES, AND CAUSED"
370 LPRINT"EXTENSIVE PROPERTY DAMAGE.  SEVERAL STUDENTS AND
    POLICEMEN WERE INJURED."
380 GOSUB 10020
390 GOSUB 10010
400 PRINT"YOU MEET WITH YOUR ADVISORS AND THEY SUGGEST THE U
    .S.":PRINT"TAKE THE FOLLOWING ACTIONS:":PRINTTAB(5)"(1)
     SEND A PROTEST TO THE PANAMANIAN GOVERNMENT.":PRINTTAB
    (5)"(2) ASK THE GOVERNMENT OF PANAMA TO HELP."
410 PRINTTAB(5)"(3) ALERT U.S. ARMY TROOPS STATIONED IN THE
    CANAL ZONE.":PRINTTAB(5)"(4) ORDER U.S. ARMY TROOPS TO
    PROTECT THE CANAL ZONE."
420 PRINT"-------------------------------------------------
    ---------":PRINT"CONSIDER THE SUGGESTIONS OF YOUR ADVISO
    RS.  YOU WILL BE ASKED":PRINT"MAKE A DECISION ON EACH O
    NE.":GOSUB10010
430 PRINT"PRESIDENT ";N$;":":PRINTTAB(5)"WOULD YOU PROTEST W
    HAT HAD HAPPENED TO THE GOVERNMENT OF":PRINTTAB(5)"PANA
    MA (YES/NO)":INPUTD$(1)
440 PRINTTAB(5)"WOULD YOU ASK THE GOVERNMENT OF PANAMA FOR H
    ELP":INPUTD$(2)
450 PRINTTAB(5)"WOULD YOU ALERT U.S. ARMY TROOPS STATIONED I
    N PANAMA":INPUTD$(3)
```


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```
460 PRINTTAB(5)"WOULD YOU ORDER U.S. ARMY TROOPS TO DEFEND T
    HE CANAL":INPUTD$(4)
470 GOSUB10000
480 CLS:FORZ=1TO10:FORX=1TO20:PRINT@465,"URGENT MESSAGE":NEX
    TX:FORY=1TO20:CLS:NEXTY:NEXTZ
490 LPRINT"DATE: JANUARY 9, 1964"
500 LPRINT"TO: PRESIDENT ";N$
510 LPRINT"FROM: U.S. EMBASSY TO PANAMA"
520 GOSUB10020
530 LPRINT"LARGE CROWDS OF PANAMANIAN CITIZENS HAVE GATHERED
     ALONG THE CANAL ZONE BOUNDRY, SHOUTING, JEERING AND TH
    ROWING ROCKS"
540 LPRINT"AND ANYTHING THAT CAME TO HAND.":LPRINT"RIOTING H
    AS BROKEN OUT IN COLON AND PANAMA CITY.":LPRINT"PANAMAN
    IAN STUDENTS AND CIVILIANS HAVE THROWN MOLOTOV COCKTAIL
    S AT BUILDINGS AND AUTOMOBILES."
550 LPRINT"CARS WITH CANAL ZONE LICENSE PLATES HAVE BEEN ATT
    ACKED AND THEIR OCCUPANTS PULLED OUT AND SAVAGELY BEATE
    N."
560 LPRINT"PANAMANIAN AUTHORITIES HAVE BEEN OF LITTLE HELP.
     PANAMANIAN POLICE FORCE HAVE STOOD ASIDE.  PANAMANIAN
    NATIONAL GUARD UNITS":LPRINT"HAVE REMAINED IN THEIR BAR
    RACKS."
570 LPRINT"CANAL ZONE POLICE FORCE TOO SMALL (ONLY 80 MEN) T
    O CONTROL RIOTERS."
580 LPRINT"REQUEST U.S. ARMY TROOPS BE CALLED OUT TO PROTECT
     CANAL ZONE."
590 GOSUB 10020
600 PRINT"YOUR ADVISORS HAVE SEEN THE MESSAGE.  THEY SUGGEST
    :":PRINTTAB(5)"(1) YOU LODGE PROTEST WITH PANAMA GOVERN
    MENT.":PRINTTAB(5)"(2) YOU REQUEST AID FROM THE GOVERNM
    ENT OF PANAMA."
610 PRINTTAB(5)"(3) YOU ORDER U.S. ARMY TROOPS TO STATION TH
    EMSELVES IN":PRINTTAB(5)"THE CANAL ZONE BUT HOLD THEIR
    FIRE.":PRINTTAB(5)"(4) YOU ORDER U.S. ARMY TROOPS TO PR
    OTECT CANAL ZONE AND"
620 PRINTTAB(5)"FIRE ON PANAMANIAN IF NECESSARY.":PRINT"----
    ----------------------------------------------"
630 PRINT"DECIDE WHAT YOU WILL DO ON EACH OF THESE REQUESTS.
    "
640 GOSUB10010
650 PRINT"PRESIDENT ";N$;", PLEASE INDICATE YOUR DECISION ON
     THE FOLLOW-":PRINT"ING SUGGESTIONS.":GOSUB10000
660 INPUT"LODGE A PROTEST WITH THE PANAMANIAN GOVERNMENT";D$
    (5):INPUT"REQUEST AID FROM THE GOVERNMENT OF PANAMA";D$
    (6):INPUT"ORDER US TROOPS INTO CANAL ZONE BUT NOT TO FI
    RE";D$(7)
670 INPUT"ORDER US TROOPS TO FIRE ON PANAMANIANS IF NECESSAR
    Y";D$(8)
700 GOSUB10000
705 IF LEFT$(D$(7),1)="N" AND LEFT$(D$(8),1)="N" GOTO 720
710 CLS:IF LEFT$( D$(7),1 )=LEFT$( D$(8),1 ) PRINT"YOUR ANSW
    ERS ARE INCONSISTENT PRESIDENT ";N$:PRINT"YOU HAVE ORDE
    RED U.S. ARMY TROOPS INTO THE CANAL ZONE BUT CAN":PRINT
    "THEY FIRE ON PANAMANIANS?":GOSUB10000:GOTO650
720 CLS:PRINT"EVALUATION OF DECISIONS...":PRINT"PRESIDENT JO
    HNSON DID NOT PROTEST TO THE GOVERNMENT OF":PRINT"PANAM
    A.  HE DID ASK FOR THEIR AID AND HE DID ORDER U.S. ARMY
    ":PRINT"TROOPS TO BE CALLED OUT BUT THEY HAD ORDERS NOT
    TO FIRE."
730 PRINT"----------------------------------------------------
    ------------"
740 IFLEFT$(D$(5),1)="Y"PRINT"PRESIDENT ";N$;", YOUR DECISIO
    N TO PROTEST TO THE GOVERNMENT":PRINT"OF PANAMA WAS DIF
    FERENT THAN THAT MADE BY PRESIDENT JOHNSON."
750 IF LEFT$(D$(6),1)="N"PRINT"YOUR DECISION NOT TO ASK THE
    GOVERNMENT OF PANAMA FOR AID IN":PRINT"THIS CRISES DIFF
    ERED WITH THE DECISION MADE BY PRESIDENT":PRINT"JOHNSON
    ."
760 IFLEFT$(D$(8),1)="Y"PRINT"UNLIKE YOU PRESIDENT ";N$;",PR
    ESIDENT JOHNSON DID NOT":PRINT"WANT AMERICAN SOLDIERS T
    O FIRE ON PANAMANIAN CIVILIANS."
770 PRINT"----------------------------------------------------
    ---------":GOSUB10010
780 PRINT"CONTINUING WITH OUR SIMULATION WE WILL FOLLOW EVEN
    TS AS THEY":PRINT"CONFRONTED PRESIDENT JOHNSON BASED ON
     HIS DECISIONS.":GOSUB10000
790 CLS:FOR2=1TO10:FORX=1TO20:PRINT@465,"URGENT MESSAGE":NEX
    TX:FORY=1TO20:CLS:NEXTY:NEXTZ
795 LPRINT"DATE: JANUARY 9, 1964"
800 LPRINT"TO: PRESIDENT ";N$
810 LPRINT"FROM: COMMANDER OF AMERICAN TROOPS STATIONED IN T
    HE CANAL ZONE"
820 GOSUB10020
830 LPRINT"AMERICAN SOLDIERS ARE BEING SHOT AT BY SNIPERS.
    SEVERAL CASUALITES REPORTED.  REQUEST PERMISSION TO FIR
    E ON SNIPERS."
840 GOSUB10020
850 CLS:PRINT"YOUR ADVISORS--THE SECRETARY OF STATE, THE SEC
    RETARY OF DEFENSE":PRINT"THE DIRECTOR OF THE CIA, AND O
    THER AREA SPECIALISTS ALL AGREE":PRINT"YOU SHOULD ALLOW
     U.S. TROOPS TO PROTECT THEMSELVES."
860 GOSUB10000
870 PRINT"----------------------------------------------":P
    RINT"PRESIDENT ";N$;", IT'S YOUR DECISION.  WILL YOU AL
    LOW U.S. TROOPS TO  RETURN FIRE IN THEIR EFFORTS TO PRO
    TECT AMERICANS?":INPUTD$(9)
875 IFLEFT$(D$(9),1)="N"PRINT"-------------------------------
    ------------------------------":FORX=1TO2000:NEXTX:GOTO
    920
880 GOTO 1000
900 GOSUB10000
910 PRINT"ALTHOUGH PRESIDENT JOHNSON DID NOT CHOOSE TO AUTHO
    RIZE U.S.":PRINT"TROOPS TO FIRE AT PANAMANIANS AS YOU D
    ID, EVENTS SOON FORCED":PRINT"HIM TO TAKE THAT STEP.":G
    OSUB10000
920 PRINT"SNIPER FIRE FROM PANAMANIANS KILLED FOUR AMERICAN
     SOLDIERS AND":PRINT"WOUNDED SEVERAL.  PRESIDENT JOHNSON
     FELT THIS REQUIRED AMERICAN":PRINT"TROOPS TO RETURN FI
    RE."
930 GOSUB10010
1000 CLS:PRINT"WHILE YOU CONTINUE YOUR DUTIES ON JANUARY 9,
     YOUR ADVISORS":PRINT"RECEIVE A MESSAGE FROM YOUR EMBASS
```

```
Y IN PANAMA AND ASK YOU TO":PRINT"RETURN TO HANDLE SOME
 MORE DECISIONS.":GOSUB10000
1010 LPRINT"TO: PRESIDENT "N$
1020 LPRINT"FROM: U.S. EMBASSY IN PANAMA"
1030 GOSUB10020
1040 LPRINT"PRESIDENT CHIARI HAS INDICATED TO US THAT HE WIL
     L BREAK DIPLOMATIC RELATIONS WITH THE UNITED STATES BEC
     AUSE OF THE AGRESSION"
1050 LPRINT"OF THE U.S. ARMY TROOPS AGAINST PANAMANIAN CITIZ
     ENS. I TRIED TO MAKE CLEAR TO PRESIDENT CHIARI THAT WE
     WERE ONLY DEFENDING"
1060 LPRINT"OUR NATIONALS AND PROTECTING TERRITORY LEGALLY U
     NDER OUR CONTROL.":LPRINT"PRESIDENT CHIARI SAID THE U.S
     . WOULD RECEIVE FORMAL NOTICE OF THE BREAKING OF DIPLOM
     ATIC RELATIONS TOMORROW."
1070 GOSUB10020
1080 GOSUB10000
1090 PRINT"WITH THIS NEWS, YOU GO TO BED.  YOUR ADVISORS WIL
     L WAKE YOU IF":PRINT"IMPORTANT NEWS ARRIVES DURING THE
     NIGHT.":PRINT:PRINT:PRINT"SLEEP TIGHT PRESIDENT ";N$;".
     ":GOSUB10000
1100 GOSUB10000
1110 GOSUB10010
1120 CLS:PRINT"JANUARY 10, 1964":PRINT:PRINT"THIS MORNING YO
     U MEET IN THE CABINET ROOM WITH YOUR ADVISORS":PRINT"TO
      DETERMINE WHAT YOU SHOULD DO NEXT.":PRINT
1130 PRINT"CIA DIRECTOR MC CONE POINTS OUT THAT TROUBLE HAS
     BEEN BREWING":PRINT"IN PANAMA FOR AT LEAST 6 MONTHS.  H
     E SAYS PANAMA'S IRRITATION":PRINT"OVER THE FLAG INCIDEN
     T IS UNDERSTANDABLE, BUT THAT THE"
1140 PRINT"ACTIVITIES WHICH HAVE OCCURED SINCE THAT INCIDENT
      ARE PART":PRINT"OF A WELL-PLANNED ANTI-AMERICAN DEMONS
     TRATION.":PRINT"REVIEW THE REPORTS OF THE PREVIOUS DAY
     AND PRESS <ENTER> WHEN YOU WISH TO CONTINUE.":INPUTA
1150 CLS:PRINT"YOUR ADVISORS RECOMMEND YOU TALK DIRECTLY WIT
     H PRESIDENT":PRINT"CHIARI OF PANAMA.":INPUT"WILL YOU AS
     K YOUR STAFF TO PLACE A CALL TO CHIARI (YES/NO)";D$(10)
1160 IFLEFT$(D$(10),1)="Y"GOTO1200
1165 GOSUB10000
1170 PRINT"UNLIKE YOU PRESIDENT ";N$;", PRESIDENT JOHNSON PL
     ACED THE":PRINT"CALL TO CHIARI.  I'M NOT SURE I AGREE W
     ITH YOUR DECISION NOT":PRINT"TO TALK DIRECTLY WITH THE
     PANAMANIAN PRESIDENT."
1175 GOSUB10000
1180 PRINT"BUT LET'S GO ON WITH THE PHONE CALL AS PLACED BY
     PRESIDENT":PRINT"JOHNSON."
1185 GOSUB10010
1200 CLS:GOSUB10000
1210 PRINT"FOR A TRANSCRIPT OF THE PHONE CALL SEE THE TELETY
     PE."
1220 GOSUB10000
1230 LPRINT"TRANSCRIPT OF TELEPHONE CONVERSATION BETWEEN PRE
     SIDENT LYNDON JOHNSON AND PRESIDENT CHIARI.":LPRINT"JAN
     UARY 10, 1964"
1240 GOSUB10020
1250 LPRINTTAB(10)"JOHNSON:  HELLO, MR. PRESIDENT.  MR. PRES
     IDENT i WANTED TO SAY TO YOU THAT WE DEEPLY REGRET THE
     SITUATION OF VIOLENCE"
1260 LPRINT"THAT HAS DEVELOPED IN PANAMA.  WE APPRECIATE VER
     Y MUCH YOUR CALL TO THE PANAMANIAN PEOPLE TO REMAIN CAL
     M.  WE RECOGNIZE THAT"
1270 LPRINT"YOU AND I SHOULD DO EVERYTHING WE CAN TO RESTORE
      QUIET, AND I HOPE THAT YOU'LL DO EVERYTHING POSSIBLE T
     O QUIETEN THE SITUATION"
1280 LPRINT"AND I WILL DO THE SAME.  YOU AND I SHOULD BE AWA
     RE OF THE POSSIBILITY, AND THE LIKLIHOOD, THAT THERE AR
     E ELEMENTS UNFRIENDLY"
1290 LPRINT"TO BOTH OF US WHO WILL EXPLOIT THIS SITUATION."
1300 LPRINTTAB(10)"CHIARI:  I FEEL, MR PRESIDENT, THAT WHAT
     WE NEED IS A COMPLETE REVISION OF ALL TREATIES WHICH AF
     FECT PANAMA-U.S. RELATIONS"
1310 LPRINT"BECAUSE THAT WHICH WE HAVE AT THE PRESENT TIME I
     S NOTHING BUT A SOURCE OF DISSATISFACTION WHICH HAS REC
     ENTLY, OR JUST NOW"
1320 LPRINT"EXPLODED INTO VIOLENCE WHICH WE ARE NOW WITNESSI
     NG."
1330 LPRINTTAB(10)"JOHNSON:  MR. PSESIDENT, I AM SENDING TOM
      MANN, OUR ASSISTANT SECRETARY OF STATE, TO YOUR COUNTR
     Y AS MY PERSONAL"
1340 LPRINT"REPRESENTATIVE.  HE AND HIS GROUP WILL DO EVERYT
     HING IN THEIR POWER TO FIND A SOLUTION TO THE CURRENT P
     ROBLEMS."
1350 LPRINTTAB(10)"CHIARI:  I CAME TO WASHINGTON IN 1961 AND
      TALKED WITH PRESIDENT KENNEDY ABOUT TREATY REVISIONS.
      IN THREE YEARS, MR."
1360 LPRINT"PRESIDENT, NOT A THING HAS BEEN DONE TO ALLEVIAT
     E THE SITUATION."
1370 LPRINTTAB(10)"JOHNSON:  PRESIDENT CHIARI, WE MUST LOOK
     FORWARD AND NOT BACKWARD.  VIOLENCE IS NO WAY TO SETTLE
      GRIEVANCES. FIRST, LET"
1380 LPRINT"US END THE VIOLENCE; THEN WE CAN BEGIN TO TALK O
     VER OUR DIFFERENCES AND FIND SOLUTIONS."
1390 LPRINTTAB(10)"CHIARI:  YOUR COUNTRY HAS OFTEN SHOWN IND
     IFFERENCE TO PANAMA'S PROBLEMS."
1400 LPRINTTAB(10)"JOHNSON:  OUR DELEGATION WILL BE ON A PLA
     NE IN 30 MINUTES AND WILL ARRIVE IN PANAMA IN 5 HOURS.
      I CANNOT ACT MUCH "
1410 LPRINT"FASTER THAN THAT, MR. PRESIDENT."
1420 LPRINTTAB(10)"CHIARI:  I AM GRATEFUL FOR YOUR COOPERATI
     ON, MR. PRESIDENT.  I AM GLAD YOU ARE A MAN OF ACTION A
     ND OF FEW WORDS."
1430 LPRINT"I AM SURE OUR DIFFICULTIES WILL BE IRONED OUT."
1440 GOSUB10020
1450 GOSUB10010
1460 PRINT"AS YOUR DELEGATION GETS READY TO LEAVE, YOUR ADVI
     SORS SUGGEST":PRINT"YOU HAVE THEM...":PRINT"----------
     ----------":PRINT"(1) AGREE
     TO EXPLORE NEW TREATY ARRANGEMENTS IF GOVERNMENT OF"
1470 PRINT"PANAMA STOPS THE VIOLENCE.":PRINT"(2) TELL PRESID
     ENT CHIARI HIS GOVERNMENT MUST RESTORE ORDER,":PRINT"RE
     SUME DIPLOMATIC RECOGNITION AND AGREE TO A PLAN OF COOP
     ERA-":PRINT"ION IN STUDYING THE PROBLEM WITH NO PRIOR
     COMMITMENTS."
1480 PRINT"(3) TELL PRESIDENT CHIARI THE US DOES NOT RESPOND
      TO BLACKMAIL":PRINT"AND WE WILL SEND IN ADDITIONAL TRO
     OPS IF NEEDED.":PRINT"(4) AGREE TO ANY REASONABLE REQUE
     STS PANAMA WANTS IF THEY CAN":PRINT"RESTORE PEACE."
1485 PRINT"----------":INPUT"ENTER THE NUMBER OF YOUR ORD
     ER TO THE U.S. DELEGATION";N
1490 IFN<1GOTO1450
1495 IFN>5GOTO1450
1500 ONNGOTO1600,1700,1800,1900
1600 CLS:PRINT"PRESIDENT ";N$;", YOUR DECISION DIFFERED FROM
      THAT OF PRES.":PRINT"JOHNSON.  PRESIDENT JOHNSON DECID
     ED IT WOULD NOT BE WISE TO":PRINT"GIVE IN TO DEMANDS MA
     DE BY RIOTERS.":GOTO2000
1700 CLS:PRINT"PRESIDENT ";N$;", YOUR DECISION WAS THE SAME
     AS PRESIDENT":PRINT"JOHNSON'S.":GOTO2000
1800 CLS:PRINT"THIS IS A RATHER SERIOUS THREAT YOU ARE MAKIN
     G PRESIDENT":PRINT N$;".  PRESIDENT JOHNSON DID NOT CHO
     OSE TO MAKE THIS THREAT.":PRINT"EVEN HAD IT BEEN SUCCES
     SFUL, THE U.S. WOULD HAVE LOST MANY"
1810 PRINT"FRIENDS IN LATIN AMERICA."
1820 GOSUB10010
1830 GOTO2000
1900 CLS:PRINT"PRESIDENT ";N$;", HOW COULD YOU!  WILL YOU GI
     VE IN TO ANY":PRINT"TERRORIST OR ANY GROUP OF PEOPLE WH
     O WANT TO PUSH THE U.S.":PRINT"AROUND FOR THEIR OWN ADV
     ANTAGE?"
2000 GOSUB10010
2010 PRINT"PRESIDENT JOHNSON LET THE GOVERNMENT OF PANAMA KN
     OW THE U.S.":PRINT"WOULD NOT CONSIDER REQUESTS FOR TREA
     TY NEGOTIATIONS":PRINT"UNTIL THE VIOLENCE HAD STOPPED A
     ND PANAMA RESUMED DIPLOMATIC":PRINT"RECOGNITION OF THE
     U.S."
2020 GOSUB10000
2030 PRINT"IT TOOK SEVERAL DAYS BEFORE PANAMA REALIZED THE U
     .S. WOULD":PRINT"NOT BACK DOWN FROM ITS STAND.":GOSUB10
     000
2040 PRINT"PRESIDENT CHIARI, REALIZING NOTHING WAS TO BE GAI
     NED FROM":PRINT"FURTHER RIOTING ORDERED THE PANAMA NATI
     ONAL GUARD OUT OF ITS":PRINT"BARRACKS.  ORDER WAS QUICK
     LY RESTORED.":GOSUB10000
2050 INPUT"PRESS ENTER TO CONTINUE";O:CLS:PRINT"THE CRISES W
     AS OVER.  WITHING A FEW MONTHS PANAMA AND THE":PRINT"U.
     S. WERE AGAIN  ON FRIENDLY TERMS.":GOSUB10000
3000 PRINT"END OF SIMULATION."
9999 END
10000 FORX=1TO1200:NEXTX:RETURN
10010 PRINT@896,"PRESS <ENTER> TO CONTINUE."
10015 A$=INKEY$:IFA$="" THEN 10015
10016 CLS
10017 RETURN
10020 LPRINT"----------
```


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Not just another game—this one has real personality.

Slot Machine

Stewart E. Fason
115 Via La Silva
Palm Beach, FL 33480

People seem to have the erroneous idea that we computers are dumb machines. I deny the allegation (I also resent the alligators). It is the programmers who are dumb. Oh sure, these pawky proponents of perspicacity do just fine with GOTO's, FORNEXT loops, integers and cosines; but they seldom realize that we would like to establish some rapport with our operators.

For almost two years, I slaved away doing fancy arithmetic, keeping records, sorting, adding and deleting *ad nauseum*. From time to time, I'd get to play Startreck (oh wow). My boss wouldn't even buy me a dust cover. The bum smoked and you know what ashes do to my kkeybboardd. Suffice it to say that life had been a real drag.

Hit of the Party

Everything changed when my boss decided to throw a party for about 100 people. I suggested that he allow me to do a little showing off; something to make it easier for the guests and myself to get acquainted. After much arguing, he acquiesced, and, during a rare moment of creativity rewrote an old slot machine program.

I was the hit of the party; people stood in line to get at me. Why? Because the program now had personality. Let's take a look at the program and I'll point out features that you can add to your programs to give your computer some personality.

In line 10 multiple statements save memory. The DEFSTR function in line 20 defines s,x,y,z, and v as variables, which saves time and memory. Instead of having to type S$, you need only type S. I already know that S is a string variable.

Lines 40-60 set the symbols on each wheel. As written, I pay a jackpot on the average of once every 200 plays. This is easily changed. See lines 90 and 100 for keys to data numbers.

The magic begins at line 200. The player gives me his name (v$). At 700 you'll find the power of IF-THEN-ELSE. If the player has less than $10 left, I keep quiet. However, if he has more than $10 and has lost $5-10 in a row, I get out the needle. At 710 I recognize when the player goes broke, and comment.

If he is down to his last dollar, I let him know that I know, at 720. When the player is down to two bucks, I am at line 730. I branch to the subroutine at 920 where a random number generator decides which remark I will make.

Don't overlook the power of randomly generated remarks. They do away with predictibility.

At line 790 the ubiquitous random number generator strikes again. Notice that if the player has increased his original $7 to over $25 I get mad and branch to 980 where I really have some fun.

When a player hits the jackpot at line 890 I get to show off in a dramatic way. Notice the OUT255,4. That turns on my cassette recorder. My boss had previously recorded a John Phillips Sousa march which, when a jackpot was hit, played loudly for about 10 seconds.

The OUT255,0 turns off my cassette. The GOTO 740 allows the player to continue. At the party, the GOTO 740 was changed to:

```
PRINT"I've had enough of you . . . you lucky
  rat.":PRINT"Next player please.":FOR
  I=1to 1500:NEXT:GOTO10
```

This reinitiates the program.

Tacky Remarks

The same night one of my colleagues was set up with an astrology/advice program. In addition to the frequent use of randomly generated tacky remarks, it had one item that really blew people's minds. Someone would walk up and see displayed the following: "Hello there. I am Dr. Himmelstein, the world renowned Psychiatrist/Astrologer. I can cast your horoscope and help you with problems. Type in your name and we can begin the session." Who could resist such an invitation.

A guy would type in JOHN JONES and my colleague would say, "Are you the John Jones from Virginia?" Jones is now thinking, "How the hell did this computer know that?". The computer knew because our boss had placed data in the program about John Jones. The subroutine that programs something unique about each guest looks like this:

```
100 INPUT"tell me your name.";A$
110 IF A$="JOHN JONES" THEN PRINT
"AH YES, ONE OF THE JONES BOYS
FROM PHILADELPHIA.":GOTO200
120 IF A$="JOE SMITH" THEN PRINT
"HOW'S YOUR HAIR TRANSPLANT DO-
ING?:GOTO 200
```

The above can accommodate many guests (depending on your memory). In case someone shows up who is not on file, you could make your last statement of the routine look like this:

```
150 PRINT"YOUR RECORDS HAVE BEEN
  TURNED OVER TO THE CIA ";A$;" AND I
  CAN'T COMMENT.": GOTO200
```

This way you have all bases covered.

Well friends, that is the story of how I got personality. Give some to your computer and it will thank you. I've gotta scram now because I see the boss coming with the . . . . oh no . . . the Electric Pencil. Rats! I was hoping for some more fun and games. ■

Program Listing

```
10 CLEAR:CLS:D=7
20 DEFSTR S,X,Y,Z,V
30 REM SET THE SYMBOLS ON EACH OF THE THREE WHEELS
40 DATA 6,5,4,2,5,6,3,2,4,1,2,6,4,5,6,1,2,4,5,1
50 DATA 4,5,3,2,4,6,4,5,6,1,5,4,5,6,1,5,6,3,4,5
60 DATA5,1,6,5,6,6,5,5,4,6,5,1,1,4,5,6,1,5,6,5,1
70 DIM S(6),R(3,20),X(8),Y(8),Z(8)
80 ' DEFINE THE SYMBOLS
90 S(1)="**BELL**":S(2)="*CHERRY*":S(3)="*LEMON**"
100 S(4)="**BAR***":S(5)="*ORANGE*":S(6)="**PLUM**"
110 FOR I=1TO3:FOR J=1TO20:READ R(I,J):NEXTJ:NEXT I
120 PRINT:PRINT"          WELCOME TO FASON'S CASINO.
130 PRINT:PRINT"STEP RIGHT UP STRANGER AND TRY YOUR LUC
    K."
140 PRINT:PRINT"CHERRY **** **** PAYS 3, CHERRY CHERRY
    **** PAYS 5"
150 PRINT"ORANGE ORANGE ORANGE  OR ORANGE ORANGE BAR PA
    YS  10":PRINT"PLUM PLUM PLUM OR PLUM PLUM BAR WINS
     14
160 PRINT"BELL BELL BELL OR BELL BELL BAR WINS 18
180 PRINT:PRINT"BAR BAR BAR PAYS SUPER JACKPOT OF $500,
    000.00
190 PRINT:PRINT"YOU HAVE $7.00 CREDIT.  PLEASE TYPE YOU
    R FIRST NAME.
200 INPUT"TO PULL MY ONE ARM, PRESS 'ENTER'.";V:GOTO230
220 INPUT
230 ' WHEEL TIMING INSURES SEQUENTIAL STOPS
240 R1=RND(20)+5 :R2=RND(20)+R1:R3=RND(30)+R2:I=1
250 CLS
260 IF I>R1THEN 290
270 GOSUB 750
280 A=A+1:B=B+1:C=C+1:GOTO 350
290 IF I>R2 THEN 320
300 GOSUB 750
310 B=B+1:C=C+1:GOTO 350
320 IF I>R3 THEN 430
330 GOSUB 750
340 C=C+1
350 I=I+1
360 IF A<21 THEN 380
370 A=1
380 IF B<21 THEN 400
390 B=1
400 IF C<21 THEN 420
410 C=1
420 GOTO 260
430 X=S(R(1,A)):Y=S(R(2,B)):IF C<>1THEN 450
440 C=21
450 C=C-1:Z=S(R(3,C))
460 ' CHECK FOR WINNER AND DETERMINE PAYOFF
470 IF X<>"**BAR***"THEN 510
480 IF Y<>"**BAR***"THEN 510
490 IF Z<>"**BAR***"THEN 510
500 D=D+500000:GOTO 890
510 IFX<>"**BELL**"THEN 560
520 IF Y<>"**BELL**"THEN 560
530 IF Z<>"**BELL**"THEN 550
540 D=D+18:GOTO 790
550 IF Z="**BAR***"THEN 540
560 IF X<>"**PLUM**"THEN 610
570 IFY<>"**PLUM**"THEN 610
580 IFZ<>"**PLUM**"THEN 600
590 D=D+13:GOTO 790
600 IFZ="**BAR***"THEN 590
610 IF X<>"*ORANGE*"THEN 660
620 IF Y<>"*ORANGE*"THEN 660
630 IF Z<>"*ORANGE*"THEN 650
640 D=D+9:GOTO 790
650 IF Z="**BAR***"THEN 640
660 IF X<>"*CHERRY*"THEN 700
670 IF Y<>"*CHERRY*"THEN 690
680 D=D+4:GOTO 790
690 D=D+2:GOTO 790
700 O=O+1:D=D-1:IFD<10THEN710ELSEIFO=5THENPRINT:PRINT"N
    OW THINGS ARE GOING MY WAY."ELSEIFO=10THENPRINT:PR
    INT"WHOOPEE, I'VE GOTCHA NOW!":O=0
710 IFD<1THENPRINT:PRINT"OH OH ";V;" YOU DID IT!":GOTO
    910
720 IFD=1THENPRINT:PRINT"LAST CHANCE ";V;" GET LUCKY!
730 IFD=2THENGOSUB 920
740 PRINT:PRINT:PRINT:PRINT"$";D;"LEFT ";:GOTO 220
750 ' THE NEXT LINE MAKES THE WHEELS SPIN
760 FORU=1TO2:NEXT:PRINTCHR$(23):PRINT@390,S(R(1,A));S(
    R(2,B));S(R(3,C)):RETURN
780 ' RANDOMLY GENERATED TACKY REMARKS
790 IFD>25THEN 980 ELSEIFD<5THEN 1070 ELSEPRINT:PRINT"W
    INNER","WINNER":PRINT:Q=RND(10):IFQ=1THENPRINT"HOW
     COME YOU'RE SO LUCKY?"ELSEIFQ=2THENPRINT"A TURKEY
     LIKE YOU SHOULDN'T BE  SO LUCKY."ELSEIFQ=3THENPRI
    NT"GOOD GRIEF!  YOU DID IT AGAIN!
800 IFQ=4THENPRINT"HOW CAN ANYBODY WHO LOOKS SO    STUP
    ID BE SO LUCKY????
810 IFQ=5THENPRINT"YOU BETTER QUIT NOW! ";V
820 IFQ=6THENPRINT"YOU HAVE THE MAGIC TOUCH."ELSEIFQ=7T
    HENPRINT"THIS IS YOUR LUCKY DAY.
830 IFQ=8THENPRINT"YOU LUCKY CREEP! ";V
840 IFQ=9THENPRINT"OH NO ";V;"  ANOTHER WINNER!
850 IFQ=10THENPRINT"WITH YOUR LUCK, YOU SHOULD GO    TO
    LAS VEGAS.
860 GOTO 740
870 PRINTCHR$(23)
880 ' TURN ON CASSETTE RECORDER WHEN JACKPOT IS MADE
890 FORI=1TO2000:NEXTI:OUT255,4:FORT=1TO300:PRINT"  SUP
    ER JACKPOT  SUPER JACKPOT":NEXTT:OUT255,0:CLS:GOTO
    740
900 ' EVEN THE COMPUTER HAS SOME COMPASSION.
910 FORI=1TO1200:NEXT:CLS:PRINTCHR$(23):PRINT:PRINT:PRI
    NT"  TOO BAD ";V;" YOU LOSE":PRINT:PRINT:PRINT:PRI
    NT"NEXT VICTIM PLEASE":FORI=1TO1500:NEXT:GOTO 10
920 PRINT:A=RND(5):IFA=1THENPRINT"WITH YOUR LUCK, IF YO
    UR BROTHER  DIED THEY WOULD BURY YOU.
930 IFA=2THENPRINT"YOU MUST BE LUCKY AT LOVE BUT":FORI=
    1TO1500:NEXT:PRINT"CONSIDERING YOUR LOOKS........"
    :FORI=1TO1500:NEXT:PRINT".........I DOUBT IT!
940 IFA=3THENPRINT"ARE YOU ALWAYS SO LUCKY? ";V
950 IFA=4THENPRINT"I DENY BEING RIGGED.
960 IFA=5THENPRINT"YOU DON'T DESERVE SUCH LUCK!
970 RETURN
980 H=H+1:IFH>1THEN 1040 ELSEPRINT"NOW YOU'VE MADE ME M
    AD.":FORI=1TO1500:NEXTI:CLS:PRINT:PRINT:PRINT"I DO
    N'T LIKE GETTING BEATEN ";V:PRINT:PRINT"KEEP IT UP
     AND I JUST MAY TURN MYSELF OFF !!!!
990 PRINT:PRINT"IF YOU DON'T BELIEVE IT, JUST WATCH THI
    S.....
1000 FORI=1TO3700:NEXT:FORI=1TO190:E=RND(1000):PRINT@E,
    "HA":NEXTI:CLS:FORI=1TO3700:NEXT
1010 CLS:PRINT:PRINT"DON'T WORRY ";V;" I'M NOT QUITTING
    .
1020 PRINT:PRINT"WE COMPUTERS GOTTA HAVE SOME FUN TOO Y
    OU KNOW!
1030 PRINT:PRINT"NOW LET'S GET ON WITH THE GAME ";V:GOT
    O 740
1040 PRINT:U=RND(8):IFU=1THENPRINT"I'M GETTING SICK OF
    THIS ";V ELSEIFU=2THENPRINTV:PRINT"I WISHED YOU HA
    D STAYED HOME.
1050 IFO>4THENO=0
1060 GOTO740
1070 PRINT:IFD=3THENPRINT"WHEW !  THAT WAS CLOSE."ELSEI
    FD=4THENPRINT"JUST IN THE NICK OF TIME.
1080 GOTO740

DONE
```

And now. . . a brief word from our computer.

On the Radio

Don Hastings
Box 366
Hemingway SC 29554

A broadcast log is a listing of everything that will be broadcast in a day. It must meet strict FCC requirements and must be prepared with great care. It controls every event that must be aired, much as a computer program controls every action of a computer. Without the broadcast log, the broadcast engineer or announcer does not know what occurs next.

A Broadcast Log Program

The program we at WKYB have developed for our 32K Level II TRS-80 schedules all our programs, news, public-service and commercial announcements. It will do so within the time limits we specify and at the specific spaces within our log we have set aside for each. Our next step is to couple the computer to a printer to actually print the log, but our program as it stands has cut log preparation time in half and produced a log far more consistent with what we want than any individual could do.

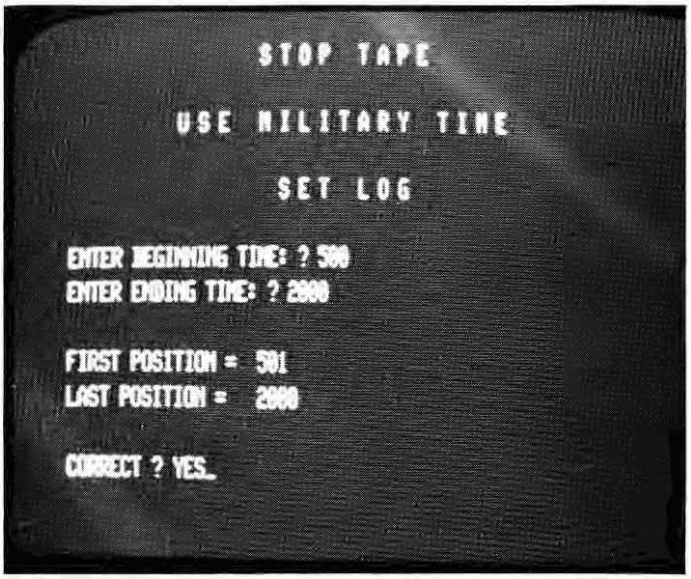


Photo 1. Setting sign-on and sign-off times. Note use of military time and conversion of time to log positions.

It takes our logger about 30 minutes to prepare the worksheet for entering, about 15 minutes for the computer to digest it all and less than ten to spit it all back out. It then takes another 15 minutes for the logger to copy the necessary information off the screen onto our log sheets. Presently the most time-consuming work is pretyping the log sheets with our programs and headings and then filling in the commercial information as it has been positioned by the computer. We'll eliminate this when we add the printer and disks.

Log preparation is tedious, yet extremely critical, in broadcasting; it can drive you batty, and often does. Now we can place all the seemingly impossible requirements for each account into the computer's memory, and each is given its due consideration.

I have modified our log program, which I wrote, into a general program that most radio stations can use with a minimum of modifications. I admit this is a cut-down version, but all you need is a TRS-80 Level II with 16K. The program has no hidden loops to mess you up, so it is just begging to be customized for your particular requirements after you've run it a couple of times. Since no two radio stations will prepare their logs in exactly the same way, I recommend you first see what I have done and then tear into it at your pleasure.

Please note that I have given you a detailed description of the main variables used in the program. The unused P in this program sets the priority of accounts. You may wish to add such a feature to your modification. We use two arrays: A for all accounts and carousel positions, and L for the actual log positions.

On the Radio

All of our commercials are played from four carousels, so our program is written for use with up to four carousels (for all you non-broadcasters, a carousel is simply a drum holding up to 24 separate commercial

tapes; any one can be selected and played automatically). When entering an account, you will assign it a carousel and slot within that carousel. This becomes the account number for that log—the computer remembers an account placed in carousel #1 and in slot 12 as account 112.

If you have less than four carousels, simply load your commercials into the carousels you have. As far as the computer is concerned, you've just decided not to use the remaining carousels. If you use more than four carousels, have fun modifying the program—it isn't hard, just time consuming. If you use Gocarts, Instacarts or any device with more than 24 slot positions per source, you are in real trouble. You will have to confine yourself to 24 slots until you rewrite the program with a dimensioned array for your sources. It will probably not run in 16K. We use dimensioned arrays for all our sources, but we also have 32K memory. I modified the program so it would fit in 16K.

The log array is dimensioned with the first number designating the hour and the second number the log position within that hour. L(10,15) is the 10AM hour and the 15th position within that hour. Note, it is not 10:15! L(14,20) is the 20th position in the 2PM hour. Your logger must learn using military time if you want to use this program.

Our log hour is divided into three commercial clusters every 15 minutes, 12 per hour. A commercial cluster consists of one play of each of the four carousels. We can schedule 48 separate events in any one hour. It is improbable we'll have to do this, but the computer now has the flexibility to place an event precisely where it is needed from any one of the four carousels. If you use less than four carousels, your cluster will run as you have loaded the machines. The computer cannot shift your loads.

Before the computer starts logging your commercials, you may have some preference as to which clusters you want to use first in each hour. Line 300 is the place for this. Enter as a DATA statement the first log position of each cluster in the order you wish the clusters used. If you want the first cluster in each hour used first, enter your first data position as 1.

Please note that regardless of how many carousels you use, this program is written for four—thus the first log position of the second cluster will be position 5, the first log position of the third cluster will be 9, etc. Once you learn this, the rest is a piece of cake. The chart should help you visualize cluster positions. I have shown the clusters spread evenly around the hour. The computer doesn't care how your clusters are actually spread. Always remember that the computer considers a cluster as four events, regardless of how many you utilize, and it should present no problem.

Set Q in line 310 to how many commercial minutes you allow per hour. Set I of line 310 to the maximum commercial time you allow in any one cluster. Set B to how many commercial clusters you allow in any one hour. I hope you got the implication of that last figure. When you enter your data statement in line 300, simply skip any clusters you don't want to use. Then set B to equal the total number of entries in your data statement.

The program still has 12 clusters, but you have placed the ones you do not want to use "off limits," so it can't place anything in those areas. If you run only six commercial breaks per hour, you will enter the first position of the six you wish to use in line 300. Set B = 6 in line 310 and your program schedules commercials only in those clusters you specified from the carousels you loaded. It does not exceed the commercial minutes you selected. You are in control.

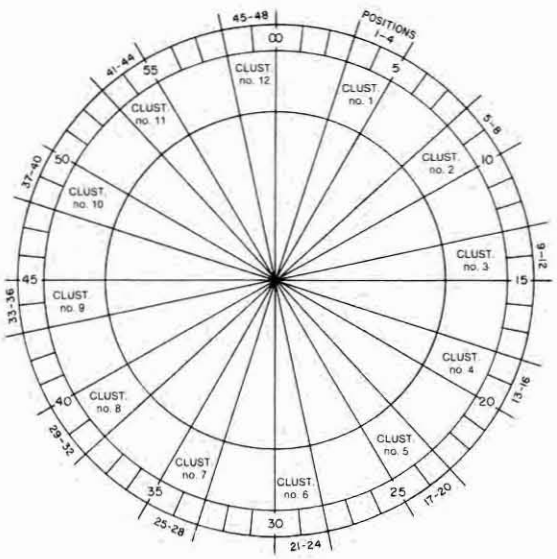


Chart of cluster positions.

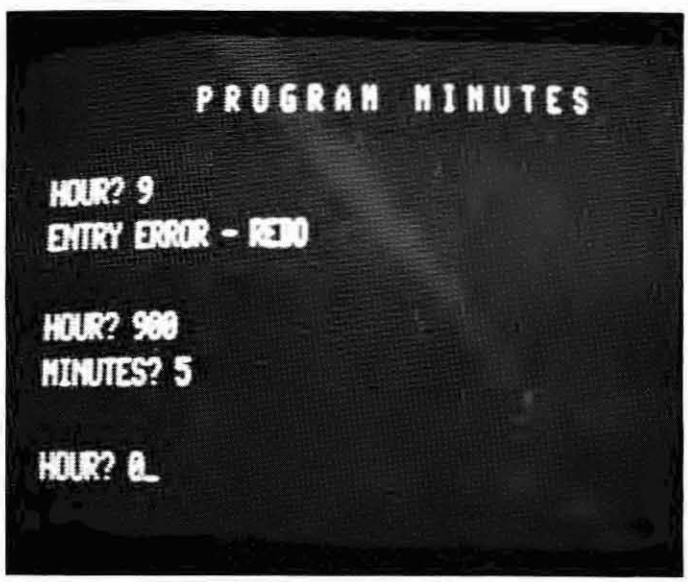
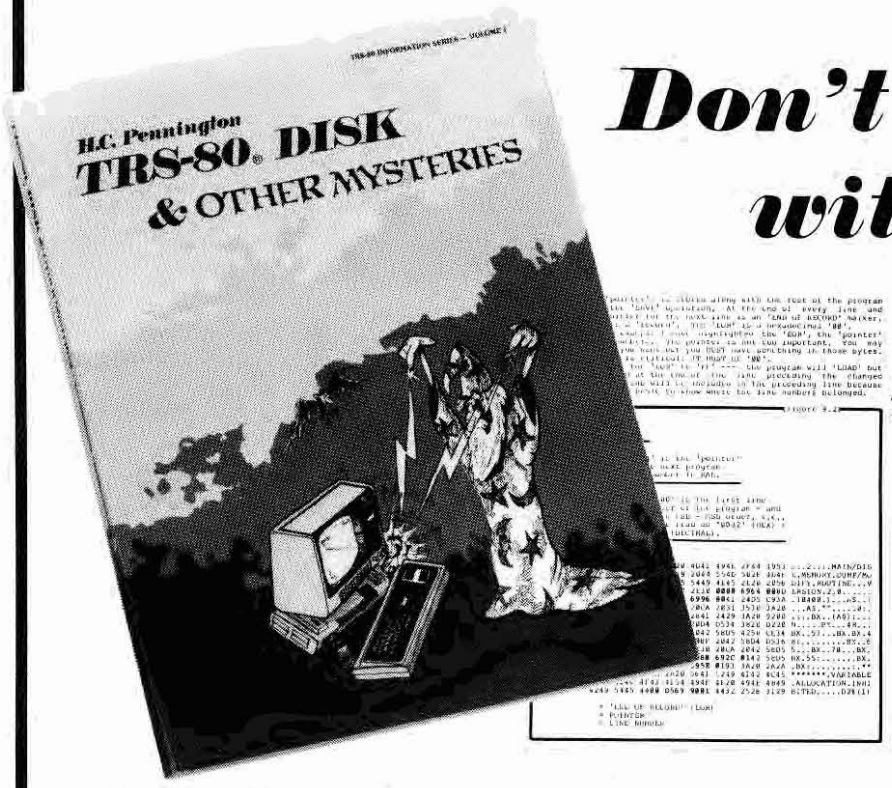


Photo 2. Entering program minutes not logged through computer. Note incorrect entry for 9 AM with prompt by computer. Example is declaring five commercial minutes during 9 AM.

Photo 3. Example of protected position where a special feature prevents these log positions from being used. Protected positions here are the second and third log positions of the noon hour.



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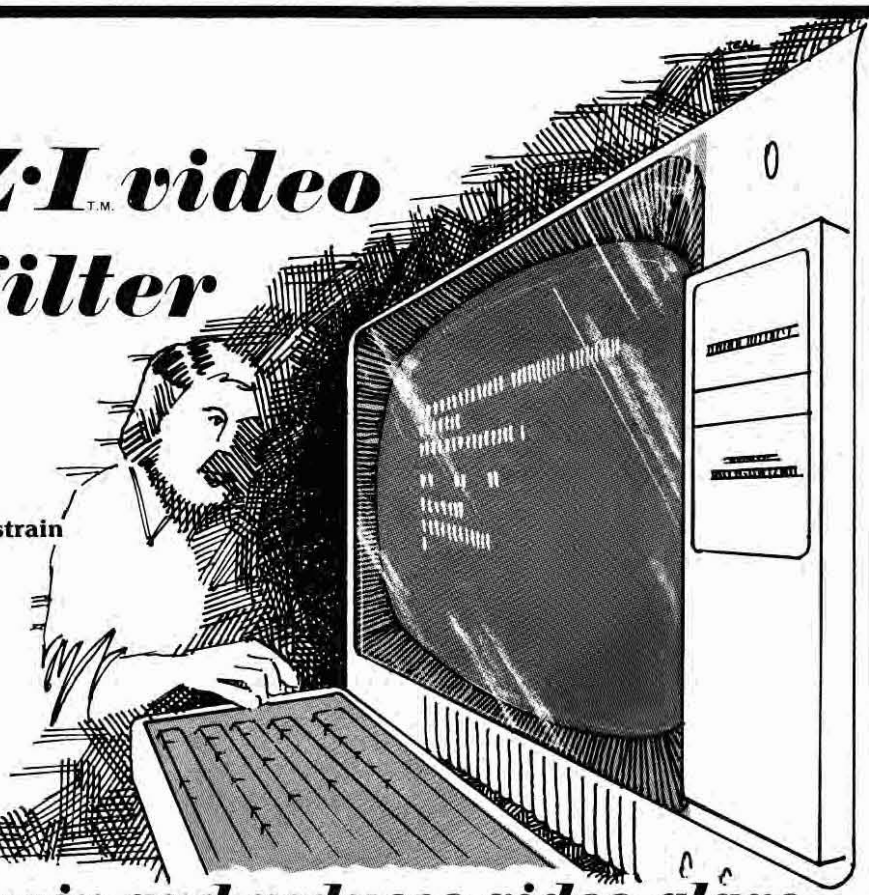

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✓Reader Service Index—see page 194

Running the Program

After you enter the program, make a copy of it immediately before you modify it. This can save you many pains later. Also, run it a couple of times before modifying it since strange things can happen to a modified program that hasn't been completely debugged from keyboard errors.

The first thing up on the screen is a request for your sign-on and sign-off times (military

Log program.

```
10 REM ** LOG 2.0 ** WRITTEN BY DON HASTINGS, HEMINGWAY, S.C.
12 REM ** MEMORY REQUIRED TO RUN WITH REMARKS APP 15K
15 '
20 REM ** A = ACCOUNT                      N = 1ST LOG ENTRY
21 REM ** B = BREAKS                       O = MAX LOG ATTEMPTS
22 REM ** C = LOGGING ADJUST               P =
23 REM ** D = TIME CONVERSION              Q = MAX SEC/HR
24 REM ** E = TIME CONVERSION              R = LENGTH SPOT LOGGED
25 REM ** F = SIGN ON TIME                 S = SPOTS BEING LOGGED
26 REM ** G = SIGN OFF TIME                T = BREAK LENGTH SEC
27 REM ** H = LOG HOUR                     U = EVENT START
28 REM ** I = MAX SEC PER BREAK            V = EVENT END
29 REM ** J = ENTRY CONTROL RETURN         W = VARIABLE
30 REM ** K = LOGGING ATTEMPTS             X = VARIABLE
31 REM ** L = LOG POSITION                 Y = VARIABLE
32 REM ** M = CAROUSEL                     Z = VARIABLE
33 '
40 REM ** A ARRAY = ACCOUNTS & CAROUSELS
42 REM ** L ARRAY = LOG
99 '
100 CLS:PRINT:PRINT:PRINT TAB(18)"B R O A D C A S T   L O G"
110 PRINT:PRINT TAB(25)"L O G   2.0":PRINT:PRINT:PRINT TAB(20)"L E
    V E L  II - 1 6 K":PRINT:PRINT
120 PRINT"     WRITTEN BY DON HASTINGS - HEMINGWAY, SOUTH CAROLINA
    "
130 PRINT:PRINT:PRINT TAB(8)" ";:FOR X=1TO45:PRINT"*";:NEXT:PRINT@
    1," "
140 FOR X=1TO125:SET(X,1):SET(X,16):SET(X,45):NEXT
150 FOR Y=1TO45:SET(1,Y):SET(125,Y):NEXT
160 DIM A(500):DIM L(24,48)
170 F=100:G=2500
199 '
200 CLS:PRINT TAB(18)"S T O P   T A P E"
210 PRINT:PRINT TAB(10)"U S E   M I L I T A R Y   T I M E"
220 PRINT:PRINT TAB(20)"S E T   L O G":GOSUB9000:F=U:G=V
230 O=(G-F)/100:O=INT(O*12)+10 : REM ** PREVENT HANG-UP LATER DURI
    NG LOGGING
295 '
296 REM *** LINE 300 SETS ORDER CLUSTERS WILL BE FILLED
297 REM *** Q = MAX COMMERCIAL MINUTES PER HOUR
298 REM *** I = MAX COMMERCIAL SECONDS ANY CLUSTER
299 REM *** B = COMMERCIAL CLUSTERS PER HOUR
300 DATA 1,25,17,41,9,33,5,29,21,45,13,37
310 Q=18:I=120:B=12
320 Q=Q*60: : REM ** COMVERTS Q TO SECONDS
499 '
500 CLS:PRINT TAB(10)"P R O G R A M   M I N U T E S"
510 PRINT:INPUT"HOUR";X:IF X=0 GOTO700
520 IF X<F-1 OR X>G PRINT"ENTRY ERROR - REDO":GOTO510 : REM ** TIM
    E ENTERED BEYOND LOG LIMITS
530 X=INT(X/100)
540 INPUT"MINUTES";Z:Z=Z*60:IF Z>Q GOTO540
550 L(X,0)=L(X,0)+Z:GOTO510
699 '
700 CLS:PRINT TAB(10)"P R O T E C T E D   P O S I T I O N S":PRINT
710 INPUT"ENTER PROTECTED POSITION: ";Z:IF Z=0 GOTO1000
720 IF Z<F OR Z>G GOTO 760 : REM ** TIME ENTERED BEYOND LOG LIMITS
730 X=INT(Z/100):Y=Z-(X*100):IF Y>48 GOTO760
740 L(X,Y)=100:GOTO 710 : REM ** LOG SPACE (HOUR,POSITION) SET ASI
    DE
760 PRINT:PRINT"ERROR - REDO":GOTO710
999 '
1000 CLS:PRINTTAB(10)"S P E C I A L   L O G G I N G":J=2
1010 GOSUB9400:PRINT:IF A=0 GOTO1100
1020 INPUT"POSITION: ";Z:IF Z=0 GOTO1100
1021 IF Z<F OR Z>G GOTO1090 : REM ** TIME ENTERED BEYOND LOG LIMIT
    S
1022 X=INT(Z/100):Y=Z-(X*100) : REM ** ENTRY BROKEN DOWN INTO X,Y
    ARRAY
1023 PRINT:INPUT"CORRECT (Y/N): ";X$:IF ASC(X$)=78 GOTO1060
1030 IF L(X,Y)=0 GOTO1050
1040 PRINT"OCCUPIED BY";A(L);:INPUT"SHALL I REMOVE (Y/N): ";X$:IF
    ASC(X$)=78GOTO1000
1050 L(X,Y)=A:CLS:PRINT"NEXT POSITION - ACCOUNT #";A:GOTO1020
1060 A(A+24)=0:A(A)=0:GOTO1000
1090 PRINT"INCORRECT DATA - REDO":GOTO1020
1099 '
1100 CLS:PRINTTAB(10)"S P E C I F I E D   T I M E S"
1110 J=3:GOSUB9400:J=1:IF A=0 GOTO2000
1115 PRINT:INPUT"CORRECT (Y/N): ";X$:IF ASC(X$)=78 THEN A(A)=0:GOT
    O1100
1117 A(A+72)=1 : REM ** CODES THIS ACCOUNT AS A SPECIFIED TIME ENT
    RY
1120 CLS:PRINT"ACCOUNT";A;"","TIME PERIOD";J;"","  SPOTS LEFT";A(A
    +48)
1130 GOSUB9000:N=1:IF V-U>800 THEN N=0
1140 PRINT:INPUT"SPOTS = ";S:IF S>A(A+48)PRINT"ENTRY ERROR":GOTO11
    40
1150 A(A+48)=A(A+48)-S:CLS:PRINT"LOGGING":GOSUB9500
1160 CLS:J=J+1:IF S<>0 PRINT:PRINT"UNABLE TO LOG";S:GOTO1190
1170 IF A(A+48)<>0 GOTO1120
1180 GOTO1100
1190 A(A+48)=A(A+48)+S:INPUT"OTHER TIMES AVAILABLE";Z$:IF ASC(Z$)<
    >78 GOTO1120
1195 IF S>A(A+48) GOTO1120 ELSE 1100
1199 '
2000 CLS:PRINTTAB(15)"G E N E R A L   A C C O U N T S":J=3
2010 GOSUB9400:IF A=0 GOTO2100 ELSE 2000
2098 '
2099 REM *** ACCOUNT VERIFICATION ***
2100 CLS:A=101:X=1
2110 PRINT TAB(18)"CAROUSEL NUMBER";INT(A/100)
2120 PRINT"ACCOUNT","CODE","LENGTH","SPOTS"
2130 PRINTA,A(A),A(A+24),A(A+48)
2140 A=A+1:IF X<12 THEN X=X+1:GOTO2130
2150 PRINT:INPUT"ALL CORRECT (Y/N): ";X$:IF ASC(X$)=78 GOTO2200
2160 X=1:IF A=125 OR A=225 OR A=325 THEN A=A+76
2170 IF A=425 GOTO4000
2180 CLS:GOTO2110
2200 Y=A-12:CLS:INPUT"INCORRECT ACCOUNT #";A:GOSUB9410
2210 X=1:A=Y:GOTO2180
3999 '
4000 CLS:PRINT"LOGGING GENERAL ACCOUNTS":N=0:U=F:V=G
4020 A=101
4030 IF A(A+72)=1 GOTO4050
4040 S=A(A+48):IF S>=1 GOSUB9500:A(A+48)=S
4050 A=A+1:IF A=125 OR A=225 OR A=325 THEN A=A+76:GOTO4030
4060 IF A=425 GOTO4070 ELSE 4030
4070 IF N=0 PRINT:N=1:PRINT"VERIFYING":GOTO4020
4999 '
5000 CLS:PRINT"WHAT IS YOUR PLEASURE":PRINT:PRINTTAB(10)"1. ACCOUN
    T LIST"
5010 PRINTTAB(10)"2. ACCOUNT LOGGING":PRINTTAB(10)"3. LOG ANALYSIS
    "
5020 PRINTTAB(10)"4. RE-LOG":PRINTTAB(10)"5. COMPLETED LOG"
5070 PRINT:INPUT"CHOICE";X
5080 ON X GOTO5500,6000,6500,7000,8000
5498 '
5499 REM *** ACCOUNT LISTING ***
5500 X=101
5505 CLS:PRINT"ACCOUNT","NOT LOGGED","ACCOUNT","NOT LOGGED"
5510 FOR A=X TO X+11:PRINT A,A(A+48),A+12,A(A+60):NEXT
5520 PRINT:INPUT"CONTINUE ";X$:IF ASC(X$)=78 GOTO5000
5530 X=X+100:IF X<500 GOTO5505 ELSE 5000
5998 '
5999 'REM *** ACCOUNT DISPLAY ***
6000 W=0:PRINT:INPUT"WHICH ACCOUNT ";A:IF A=0 GOTO5000
6010 CLS:PRINT"ACCOUNT #";A:D=INT(F/100)
6020 FORX=1TO48:IF L(D,X)=A GOTO6050
6030 NEXT:D=D+1:IF(D*100)<G GOTO6020
6040 PRINTW;"LOGGED":GOTO6000
6050 PRINT"LOGGED AT POSITION";(D*100)+X:W=W+1:GOTO6030
6498 '
6499 REM *** COMMERCIAL MINUTES ***
6500 CLS:PRINT"HOUR","MINUTES","HOUR","MINUTES"
6510 PRINT:FORX=1TO12
6520 PRINT X*100,L(X,0)/60;
6530 PRINT,(X+12)*100,L(X+12,0)/60:NEXT
6540 PRINT:INPUT"CONTINUE ";X$:GOTO5000
6998 '
6999 REM *** RE-LOG ***
7000 PRINT:INPUT"ACCOUNT #";A:IF A=0 GOTO5000
7005 IF A(A+72)=1 INPUT"SPECIFIED TIME ACCOUNT - SHALL WE CONTINUE
    ";Z$:IF ASC(Z$)=78 GOTO5000
7010 CLS:IF A(A)=0 INPUT"UNUSED POSITION - WILL YOU ADD";X$:IF ASC
    (X$)=78 GOTO7000 ELSE GOSUB9410:GOTO7050
```

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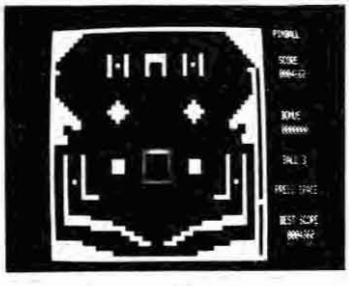

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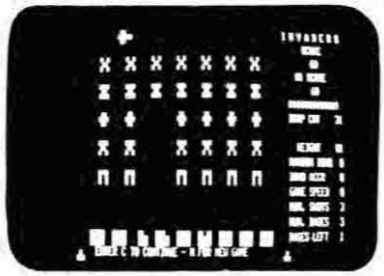

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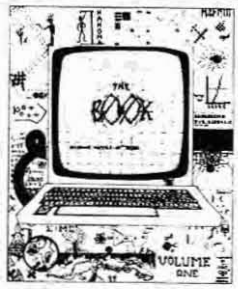

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by John Blattner, PhD from Mumford

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```
7020 PRINT:PRINT"LOG ADJUSTMENT":D=INT(F/100)
7030 FOR X=1TO48:IF L(D,X)=A THEN L(D,X)=1:GOTO7070
7040 NEXT X:D=D+1:IF(D*100)<G GOTO7030
7050 PRINT"RELOGGING":S=A(A+48):U=F:V=G:GOSUB9500
7060 PRINT"LOGGED";A(A+48)-S:A(A+48)=S:GOTO7100
7070 A(A+48)=A(A+48)+1
7080 L(D,0)=L(D,0)-A(A+24):GOTO7040
7100 D=INT(F/100):PRINT:PRINT"WORKING"
7110 FOR X=1TO48:IF L(D,X)=1 THEN L(D,X)=0
7120 NEXT:D=D+1:IF(D*100)<G GOTO7110 ELSE 5000
7998 '
7999 REM *** COMPLETED LOG ***
8000 PRINT:INPUT"WHICH HOUR";H:Y=INT(H/100):IF H+48<F OR H>2400 GO
     TO8000
8005 CLS:U=1:V=13:W=25:Z=37
8020 PRINTH+U;"=";L(Y,U),
8030 PRINTH+V;"=";L(Y,V),
8040 PRINTH+W;"=";L(Y,W),
8045 PRINTH+Z;"=";L(Y,Z)
8050 U=U+1:V=V+1:W=W+1:Z=Z+1
8055 IF U=5 OR U=9 PRINT
8060 IF U<13 GOTO8020
8070 PRINT:INPUT"CONTINUE (Y/N): ";X$:IF ASC(X$)=78 GOTO5000
8080 H=H+100:Y=Y+1:IF H>=G GOTO5000 ELSE 8005
8998 '
8999 REM ** TIME TO EVENT CONVERSION ***
9000 PRINT:INPUT"ENTER BEGINNING TIME: ";U:IF U=0 RETURN
9020 INPUT"ENTER ENDING TIME: ";V
9030 D=INT(U/100)*100:U=(D+1)+(U-D)*.8
9040 E=INT(V/100)*100:V=E+(V-E)*.8
9050 U=INT(U+.01):V=INT(V+.01):IF U<F OR V<U OR V>G GOTO9090
9060 PRINT:PRINT"FIRST POSITION = ";U:PRINT"LAST POSITION = ";V
9070 PRINT:INPUT"CORRECT ";X$:IF ASC(X$)=78 GOTO9000
9080 RETURN
9090 PRINT:PRINT"ERROR - REDO":GOTO9000
9398 '
9399 REM *** ACCOUNT ENTRY ***
9400 PRINT:INPUT"ACCOUNT #";A:IF A=0 RETURN
9401 IF A>124 AND A<201 GOTO9450 : REM ** TESTS ACCOUNT NUMBER
9402 IF A>224 AND A<301 GOTO9450 : REM ** IS ACTUALLY A CAROUSEL
9403 IF A>324 AND A<401 GOTO9450 : REM ** AND SLOT POSITION
9404 IF A<101 OR A>424 GOTO9450
9405 IF A(A)<>0 GOTO9460
9410 PRINT:INPUT"PRODUCT CODE ..... ";A(A):IF J=1 RETURN
9420 INPUT"SPOT LENGTH ..... ";A(A+24):IF J=2 RETURN
9430 INPUT"NUMBER SPOTS ..... ";A(A+48):RETURN
9450 PRINT"INCORRECT ENTRY - REDO":GOTO9400
9460 PRINT"NUMBER ALREADY IN USE":GOTO9400
9498 '
9499 REM *** LOGGING ***
9500 R=A(A+24):K=0:RESTORE:Z=0
9505 M=INT(A/100):C=N:IF C=1 GOTO9510
9507 C=INT(10/S):IF C<1 THEN C=1 : REM ** ESTABLISHES SPREAD
9510 H=INT(U/100)
9520 READ L:L=L+M-1:Z=Z+1:IF Z=B RESTORE:Z=0 : REM ** FILL CLUSTER
     S IN ORDER SPECIFIED
9530 D=H*100:IF D+L<U THEN H=H+1:GOTO9530
9540 IF D+L>V GOTO9510
9550 IF L>H+48 THEN H=H+1:GOTO9520
9560 IF L(H,L)<>0 GOTO9800 : REM ** DESIRED SPACE NOT EMPTY
9570 IF L(H,0)+R>Q THEN H=H+1:GOTO9530
9600 T=0:X=1 : REM ** NEXT LINES CHECK FOR PRODUCT CONFLICT
9610 IF M<3 THEN W=L(H,L+X):T=A(W+24)+T:IF A(A)=A(W) GOTO9800
9620 IF M+X<3 THEN X=X+1:GOTO9610
9630 X=1:IF M=1 GOTO9660
9640 W=L(H,L-X):T=A(W+24)+T:IF A(A)=A(W) GOTO9800
9650 IF X<M-1 THEN X=X+1:GOTO9640
9660 IF T+R>I GOTO9800 : REM ** CHECK CLUSTER LENGTH
9700 PRINTA;"LOGGED AT";D+L:K=0
9710 L(H,L)=A:L(H,0)=L(H,0)+R:S=S-1:IF S=0 RETURN
9720 H=H+C:GOTO9530 : REM ** NEXT ATTEMPTED HOUR
9800 K=K+1:IF K>O RETURN : REM ** NUMBER OF ATTEMPTS TO LOG
9810 H=H+1:GOTO9530
```

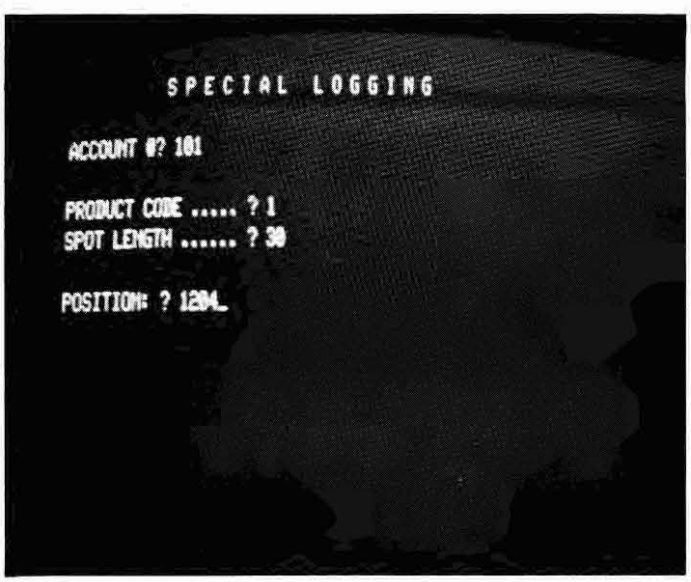

Photo 4. Special logging of an account that must be logged manually at a specific log position. In this case account 101 will be logged at position 1204.

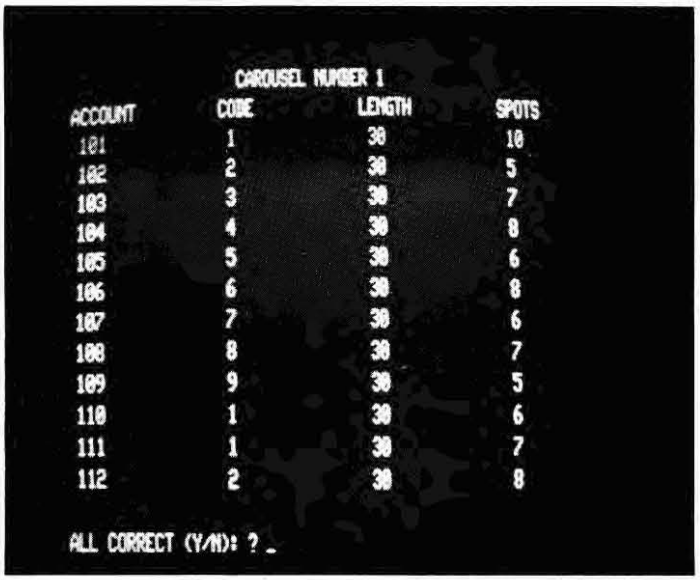

Photo 5. All account entries displayed before final logging for any corrections to the general account entries. It's too late to correct the specified time accounts as they are already logged.

time, remember). The computer immediately converts these to log positions. The computer will still have 48 positions per hour whether you are using all of them or not. As with most entries in this program, the computer will feed it back to you and give you the opportunity to reconsider.

Next comes a request for program minutes. If you have any commercial time within an hour that you won't log through the computer, you enter it so the computer will keep an accurate record of your total commercial time each hour. Simply enter the hour, then the minutes within that hour. When you're finished, enter a zero for the hour and the program will move on to the next segment. If you seldom approach the maximum commercial time you accept, you may wish to eliminate this section.

To help you in program modification, I have spaced the printout between sections of the program and placed a heading on each.

The next section allows you to protect one or more specific log positions from being used by the computer. To protect the noon hour, fifth position, from any entry by the computer, enter 1205. You may protect as many positions as you wish; enter a zero when you're done. If you have little need for this section, eliminate it. Conversely, you may wish to expand this section so that instead of protecting an individual log position it sets aside the entire cluster. To do this you might enter the first position of the cluster to be protected and change line 740 to that in Example 1.

```
740 L(X,Y) = 100:L(X,Y + 1) = 100:L(X,-
Y + 2) = 100:L(X,Y + 3 = 100:GOTO710
```

Example 1.

Beginning with the next section, enter your first account numbers. These always constitute a three-digit number with the first digit indicating the carousel (1-4) and the next two digits the slot within that carousel (01-24). A commercial loaded in carousel #2, slot 4, is entered as account 204.

You also have to supply pertinent data, such as the product code, commercial length and number of commercials, about each account. You must know which commercials have specific logging requirements such as time and product protection. This program gives product protection only within the cluster in which the account is logged.

If you wish to increase product protection beyond one cluster, you must modify lines 9620, 9630 and 9650 of the log-

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THE ALTERNATE SOURCE ✓138

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DVR is available separately, with a relocating module to allow users to dump the program in a specified memory location, for **$9.95** on cassette or **$12.95** on diskette. LEVEL II and DOS versions on the same cassette.

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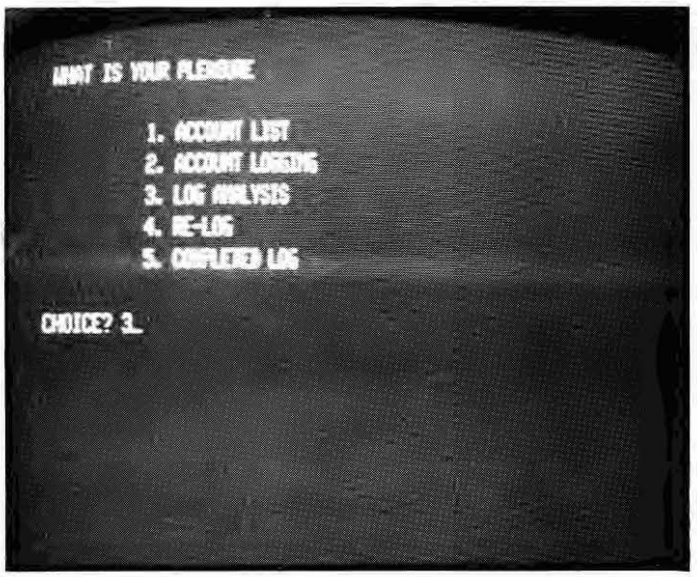


Photo 6. Logging completed, you can now choose the displays as you need them.

ging subroutine. This program thinks in terms of log position only, never time.

The product code identifies the product type being promoted to avoid conflicts within the same cluster. The product code is always numeric, never alphanumeric. Any number of product codes may be used; however, the more is not the merrier . . . it becomes confusing. Thirty numbers or less should provide sufficient categories for most stations; we use 14. Your experience in your own station should dictate how many are best for you.

All commercial length must be entered in seconds. If the same account is running more than one length commercial, you must load each as a separate account. Remember, the account number really only identifies a specific cartridge playing in a carousel. It is not good scheduling to have commercials of differing length on the same cartridge, even for the same client, since one miscue can throw the whole rotation off.

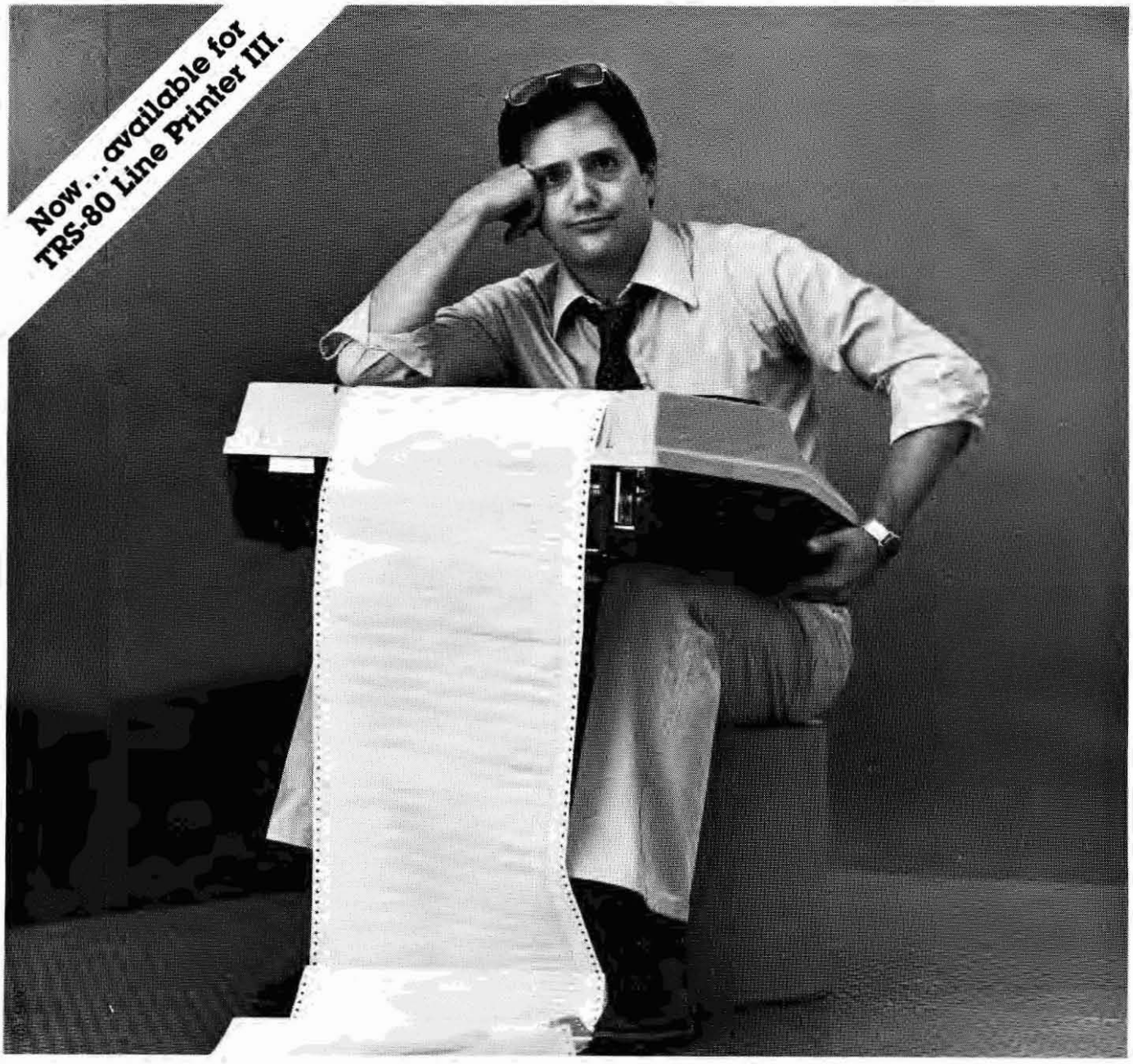
Generally, entering a zero exits you from most routines. If you attempt in this section to place on account in a space already filled, the computer asks permission before removing it. The program generally is built around double checks such as this to avoid simple entry errors that can wreck a log.

Computer Logging of Accounts

The "specified times" section is only for accounts that must be logged within specified time periods, as opposed to the previous section where the account had to be aired at a specific time. Any number of time periods can be required for any one account, but one time period for one account must be finished before you proceed to the next.

The computer will guide you step by step through this section by asking you the beginning and ending of one time period and the number of commercials for that client to be logged within that period. The time period will be converted to log positions, and the computer will still have 48 positions per hour, even if you "locked out" some or most of these positions.

When you have entered all accounts that must be logged within specific time periods, enter a zero for the next account number. If a particular time period becomes crowded, you can run out of log positions for individual carousels within that



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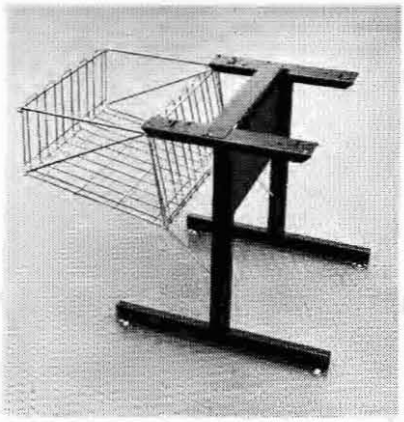

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period. The computer informs you of the lack of available positions within that period with a query if other periods are available. If you can expand the time period for that account to include even one more cluster, answer "yes," and you will be given the opportunity to do so.

All remaining accounts will be entered under "general accounts." Everything entered in this section spreads throughout the broadcast day on a more-or-less even basis. The major difference in this routine and previous ones is that you were asked immediately if the entry was correct; now you conclude all entries before you get a chance for corrections. The reason for this is that in all routines prior to this the accounts were actually logged as you fed them into the computer. All remaining accounts are logged as a group.

When you have entered the last account, enter a zero. All the accounts are now displayed for you for individual correction. All accounts entered under the "specified" routines show a zero for number of spots. This means they are logged and don't need corrections.

To correct an entry, state "no"—the entries as they stand are not correct. Enter the account number of the incorrect entry, and you get an opportunity to reenter all the data. The display then begins again at that account. Once you verify that all entries are correct, the final logging process begins. It should conclude in a matter of minutes.

During the logging process you get "comfort" displays of what the computer is doing to assure that it *is* doing something.

This is important in initial runs or after modifications to see if some program error has caused you to "hang up." If entered correctly, the program cannot hang up during the logging process. During logging the display informs you which carousel is being logged and where each account is being placed. The computer does not require your attention during this process.

At the conclusion of the logging process you get a choice of five displays:

Account List
Account Logging
Log Analysis
Re-log
Completed Log

Account List merely displays each account number and any commercials that can't be logged. If any were not logged, you might be oversold for the commercial minutes you allowed, or had more of one product code than you had clusters.

Account Logging shows you where any account you select is

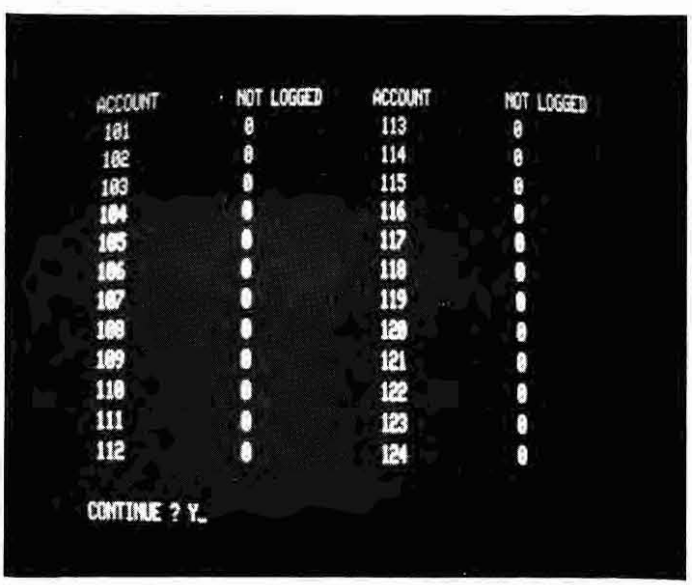

Photo 7. Account List display indicates that all accounts in this carousel are logged.

logged. This is good for spot-checking the spread of the general accounts or that a specified time account is logged within the time periods specified.

Log Analysis merely displays the total commercial minutes logged within each hour of the broadcast day. If you declared any minutes at the beginning of the program not logged through the computer, these would be included in this display.

The Re-log program is your opportunity to tell the computer you do not like the log positions selected for any given account and to do that account over again with new positions. You cannot specify the time periods of a re-logged account. If you tell the computer to re-log an account you logged within specified time periods, the computer will warn you and give you an opportunity to reconsider. If you continue, that account may be placed anywhere on the log where vacancies occur. You may re-log an account any number of times.

The final display, Completed Log, shows you one hour of the log at a time beginning with the hour you specify. If you specify an hour before sign-on or after sign-off, your request is ignored. The display moves in sequence through each hour as long as you tell it to continue until it reaches sign-off. If you wish to look only at a specific hour and return to the menu, you may.

Each log position (1-48) for the hour is shown with the account number logged at that position. Where no account is logged a zero is displayed. We tried the display with simply a blank space when no account was logged; but for some reason, our logger found it easier to copy with the zeros present.

Program Embellishments

Naturally there are error traps throughout the program to catch the most obvious entry errors. I don't claim perfection, just reasonable performance.

Remarks spaced throughout the program aid you in understanding points that are most likely candidates for modification of confusion. I added these remarks specifically for this article, they are not a part of our running program. You will have memory available for many more routines if you eliminate these remarks from your running program.

The account arrays for product codes, length and number of commercials are identified for you in lines 9410-9430.

For 24-hour stations, the computer must have a sign-on and and sign-off time. Enter 100 for sign-on, 2500 for sign-off.

If you have sign-on and sign-off times that never vary, you

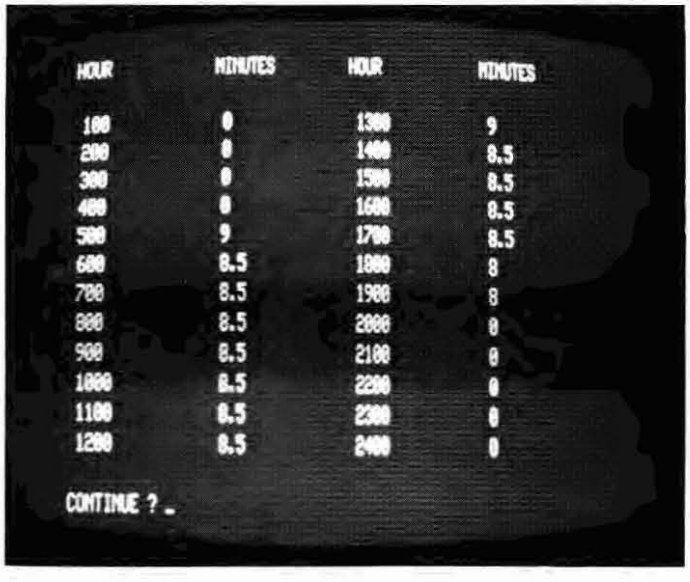

Photo 8. The commercial time logged in each hour of the broadcast day including any minutes declared at the beginning of the program.

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may prefer to eliminate the first section altogether and just enter a line in the program that sets F (sign-on) to your first log position and G (sign-off) to your last log position. A good line is 170. I used this to establish a basic parameter to give the subroutine a place to start. You can then simply eliminate lines 200-220.

On the same order, if you have the same commercial minutes to declare during the same hours over a long period of time you can include some lines between 500 and 510 that automatically declare these commercial minutes without your having to enter them.

You can handle protected positions the same way in lines 700-760 if you have certain positions within an hour on every log. I suggest you place your line between 700 and 710. In each case, simply remember to use the L array and the first figure for the hour, the second figure for the log position within the hour. In keeping track of the commercial minutes for each hour, we use log position zero since it is a valid array but not a valid actual log position.

Similarly, in the "special logging" section you can add a fixed line for fixed events on every log. We use such a feature to automatically log all of our weather, headlines and newscasts. During periods of automation we also use it for scheduling our announce carts, jingles and station promos.

A further word about the sign-on/sign-off conversion to log position and within the specified time routine. These assume the clusters are spread evenly around the hour. If your clusters do not, you will be forced to rewrite the time-to-event subroutine in lines 9000-9070. Don't bother. Simply change the entire routine so that instead of entering the times you actually enter the log positions. The computer operator can simply have a time wheel in front of the operating position with the clusters clearly outlined as to their occurrence within each hour. This also provides more flexibility in changing your format, or if you use a variety of formats on differing hours.

As for the rest of the program, I am sure you will have little difficulty figuring out what I did, using your list of variables supplied at the beginning. ■

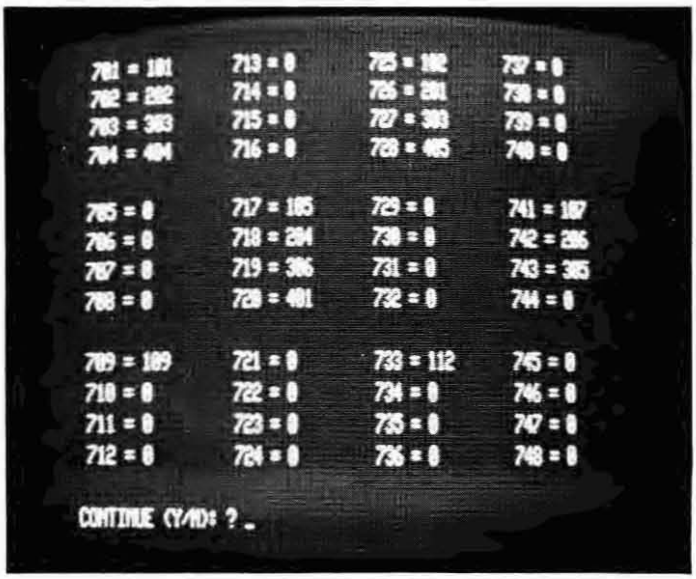

Photo 9. Sample log page. This is the 7 AM log. Note 12 clusters with four events in each, 48 events total. The events do not describe the broadcast time but represent only the commercial position within an hour. Commercial positions are determined by your programming.

PROGRAMMING TOOLS FOR YOUR TRS-80™

INSIDE LEVEL II

The Programmers Guide to The Level II ROMS

INSIDE LEVEL II is a comprehensive reference guide to the Level II ROMs which allows the machine language or Basic programmer to easily utilize the sophisticated routines they contain. Concisely explains set-ups, calling sequences, and variable passage for number conversion, arithmetic operations, and mathematical functions, as well as keyboard, tape, and video routines. Part II presents an entirely new composite program structure which loads under the SYSTEM command and executes in both Basic and machine code with the speed and efficiency of a compiler. In addition, the 18 chapters include a large body of other information useful to the programmer including tape formats, RAM useage, relocation of Basic programs, USR call expansion, creating SYSTEM tapes of your own programs, interfacing of Basic variables directly with machine code, a method of greatly increasing the speed at which data elements are stored on tape, and special precautions for disk systems. INSIDE LEVEL II is a clearly organized reference manual. It is fully typeset and packed with nothing but useful information. It does not contain questions and answers, ROM dumps, or cartoons. INSIDE LEVEL II.....$15.95

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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 alphabetized with a fast Shell/Metzner sort by disk or 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). One drive and 32K required. INDEX.....$19.95

SINGLE STEP THROUGH RAM OR ROM WITH STEP80

STEP80 allows you to step through any Basic or machine language program one instruction at a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so that the "target program" may perform its display functions unobstructed. STEP80 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, and relocate to any page in RAM. The display may also be routed to your line printer through the device control block so custom print drivers are automatically supported. STEP80.....$16.95

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This complete package includes 3 versions of the machine language FFTASM routine assembled for 16, 32, 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 use variables 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 require less than 1550 bytes of memory. FFTASM.....$49.95

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The SK-2 is the most versatile clock modification available for the TRS-80. Speeds may 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 MHz, 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.....$24.95

RAM SPOOLER FOR PARALLEL OR SERIAL PRINTERS

This program is a full feature print formatting package featuring user defineable line and page length (with line feeds inserted between words or after punctuation), screen dump, and printer pause control. The serial version allows baud rate selection from the keyboard. In addition, printing is done from a 4K expandable buffer area so that the LPRINT or LLIST command returns control to the user while printing is being done. Ideal for Selectric or other slow printers. Allows printing and processing to run concurrently. Please specify PARALLEL or SERIAL (RS-232 interface) version. SPOOLER.....$16.95

DUPLICATE SYSTEM TAPES WITH "CLONE"

Make duplicate copies of ANY tape written for Level II. They may be SYSTEM tapes (continuous or not) or data lists. The file name, load address, entry point, and every byte (in ASCII format) are displayed on the video screen. CLONE.....$16.95

RAM TEST FOR LEVEL II

This machine language program is a very thorough test for several types of RAM errors. A complete test of each individual bit in a 48K machine takes just 14 seconds. Includes a separate test for power line glitches. RAMTEST.....$9.95

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LYNC

from Midnight Software

High level data communications for Model IIs with CP/M. LYNC will send and receive any file with automatic error checking and retries. Either end may initiate transfers, and multiple files may be sent with wildcard filenames and direct or indirect listing. Remote or local directories may be called from within the program. Features full protocol, non-protocol file transfer, and real-time conversation modes. May be used over phone lines at 300 baud or direct to another computer at up to 9600 baud. Also available for other CP/M computers. LYNC....$95.00

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Reader Service index—see page 194

Use this program to keep track of your tapes.

Tape Librarian

Raymond J. Herold
8363 Shady Grove Drive
Manassas, VA 22110

Computer tape libraries are born in a black hole of chaos.

You start your collection simply, with perhaps a Radio Shack Blackjack/Backgammon tape. Then, you buy a few programs from ISI. Once you learn the ropes, you write some of your own. Other tapes come to you from friends and neighbors.

Before you know it, you've begged, borrowed, bought or stolen several dozen tapes—and they're laying around in disarray.

Some tapes probably don't have labels. Others probably have several programs back-to-back. Where's the data file you were working on last month? Sound familiar? You need help. You need a tape library management system.

Little Maintenance

Tape management systems range in complexity from the hand-entered log records of control clerks to sophisticated online cataloging modules. The one I describe here is specifically for the microcomputer owner. Fifteen minutes of file maintenance every several weeks will index all of your programs and data files.

The system stores up to 48 tape entries on a TRS-80 Level II with 16K and allows up to five file entries for each tape. You can index up to 240 programs and files.

The information stored for each tape consists of its number, its name and a description. Data stored for each file comprises its name, date created, type of file and tape counter position.

```
            TAPE MANAGEMENT SYSTEM

     -- MENU --

1 - LIST FILE ENTRIES
2 - ADD TAPE # ENTRY(S) TO FILE
3 - UPDATE SELECTED TAPE #
4 - DELETE TAPE # ENTRY(S)
5 - LIST FILE ENTRIES ON LINE PRINTER
6 - SAVE FILE ON CASSETTE

ENTER FUNCTION? +
```

Fig. 1. Options available once a TLMS file is established.

```
                    FILE  ENTRIES

1 GAME #1        7 LEVEL1         13 ADVENTURES    19 DMSBKUP
2 EDTASM         8 MORTGAGE       14 DATAMAN       20 GAMES #4
3 PROGCONV       9 HOMEAPPL       15 GAMES #3      21 SARGON
4 STARTREK       10 ISI GAMES     16 TAPMGT        22 CROSSREF
5 MICROCHESS     11 TUTOR1        17 TAPMGTFILE    23 LOADMOD
6 GAMES #2       12 TUTOR2        18 PRINTMOD      24 RENUM
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

   -- OPTIONS --
1 - LIST MORE ENTRIES
2 - LIST DATA FOR SPECIFIC ENTRY.
3 - RETURN TO MENU
? +
```

Fig. 2. Tape Numbers and Names.

Program Listing. Tape Library Management System.

```
10 CLEAR0:CLEAR MEM-4670
20 DIM NU(48),NM$(48),DE$(48),F$(48,5),D$(48,5),T$(48,5
   ),C$(48,5)
25 FORZ=1TO7:READPL$(Z):NEXTZ
40 CLS:PRINT:PRINT"DO YOU WISH TO CREATE A NEW TAPE MAN
   AGEMENT DATA FILE"
50 PRINT"OR LIST/UPDATE AN EXISTING ONE?":PRINT:INPUT"R
   EPLY:  NEW OR OLD";A$
60 IFLEFT$(A$,1)="N"THENSW=1:GOSUB1000:GOTO100
70 IFLEFT$(A$,1)="O"THENGOSUB8000:GOTO100
80 GOTO40
100 CLS:PRINT:PRINTTAB(15)"TAPE MANAGEMENT SYSTEM":F=0
110 PRINT:PRINTTAB(5)"-- MENU --":PRINT
120 PRINT"1 - LIST FILE ENTRIES"
130 PRINT"2 - ADD TAPE # ENTRY(S) TO FILE"
140 PRINT"3 - UPDATE SELECTED TAPE #"
150 PRINT"4 - DELETE TAPE # ENTRY(S)"
160 PRINT"5 - LIST FILE ENTRIES ON LINE PRINTER"
180 PRINT"6 - SAVE FILE ON CASSETTE"
190 PRINT:INPUT"ENTER FUNCTION";F
195 ONFGOSUB2000,1000,3000,4000,6000,7000:GOTO100
1000 ' ADD TAPE
1005 IFSW<>1THEN8000
1010 CLS
1020 PRINTTAB(3)"-- TAPE INFORMATION --":PRINT
1030 PRINTPL$(1):PRINTPL$(2):PRINTPL$(3):PRINT:PRINT
1040 PRINTSTRING$(63,"-"):PRINTTAB(3)"-- FILE INFORMATI
   ON --"
1050 PRINT:PRINTPL$(4):PRINTPL$(5):PRINTPL$(6):PRINTPL$
   (7)
1160 FORA=1TO4:PRINT@147,"*";:FORB=1TO100:NEXTB:PRINT@1
   47," ";:FORB=1TO100:NEXTB:NEXTA
1200 Y=0:PRINT@145,"";:INPUTX
1203 IFX<1ORX>48THENPRINT@192,PL$(2);:PRINT@145,"   ";:
   GOTO1200
1205 IFNU(X)>0ORLEN(NM$(X))>0THENPRINT@192,PL$(2);:PRIN
   T@150,"** TAPE # ";NU(X);"ALREADY ON FILE **";:FOR
   Z=1TO800:NEXTZ:PRINT@145,STRING$(42," ");:GOTO1200
1207 NU(X)=X
1210 PRINT@192,PL$(2);:INPUTNM$(X)
1215 IF(LEN(NM$(X))>10)THENPRINT@218,STRING$(15," ");:P
   RINT@256,PL$(3);:GOTO1210
1230 PRINT@256,PL$(3);:INPUTDE$(X)
1235 IF(LEN(DE$(X))>24)THENPRINT@290,STRING$(31," ");:G
```

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16K MEMORY UPGRADE KITS — $54
for TRS-80*, Apple II, Sorcerer (specify)

PRINTERS

NEC Spinwriter
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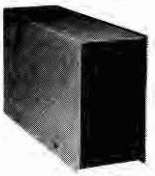

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INTELLIGENT TERMINAL SYSTEM ST-80-III BY LANCE MIKLUS: Enables a TRS-80* to act as a dial-up terminal on any standard time sharing network. Provides a TRS-80* with control key, ESC Key, Repeat Key, Rub Out Key, Break Key, full upper and lower case support, selectable printer output and program selectable transmission rates **$139/$10**

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INSORT-80: Callable form BASIC via USR. Sorts "Random" Disk Files. "Disk" to "Disk" sort times — 350 records in 35 secs, 1000 records in 6 minutes, 3500 records in 12 minutes. Machine language processing. Up to 35 sort keys ascending/descending. Utility to build BASIC program. Runs under NEWDOS. **$49.95/$10**

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BASIC-80: Disk Extended BASIC ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records. **$325/$25**
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BDS 'C' COMPILER: Supports most features of language, including structures, arrays, pointers, recursive function evaluation, and overlays. Package contains: compiler, linker, library manager; sample source files include games, a terminal emulator with disk I/O plus the source for many standard library functions; BDS C User's Guide; Book - The C Programming Language by Dennis Ritchie and Brian Kernigham. Requires at least 24K of RAM **$125/$20**

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✓Reader Service index—see page 194

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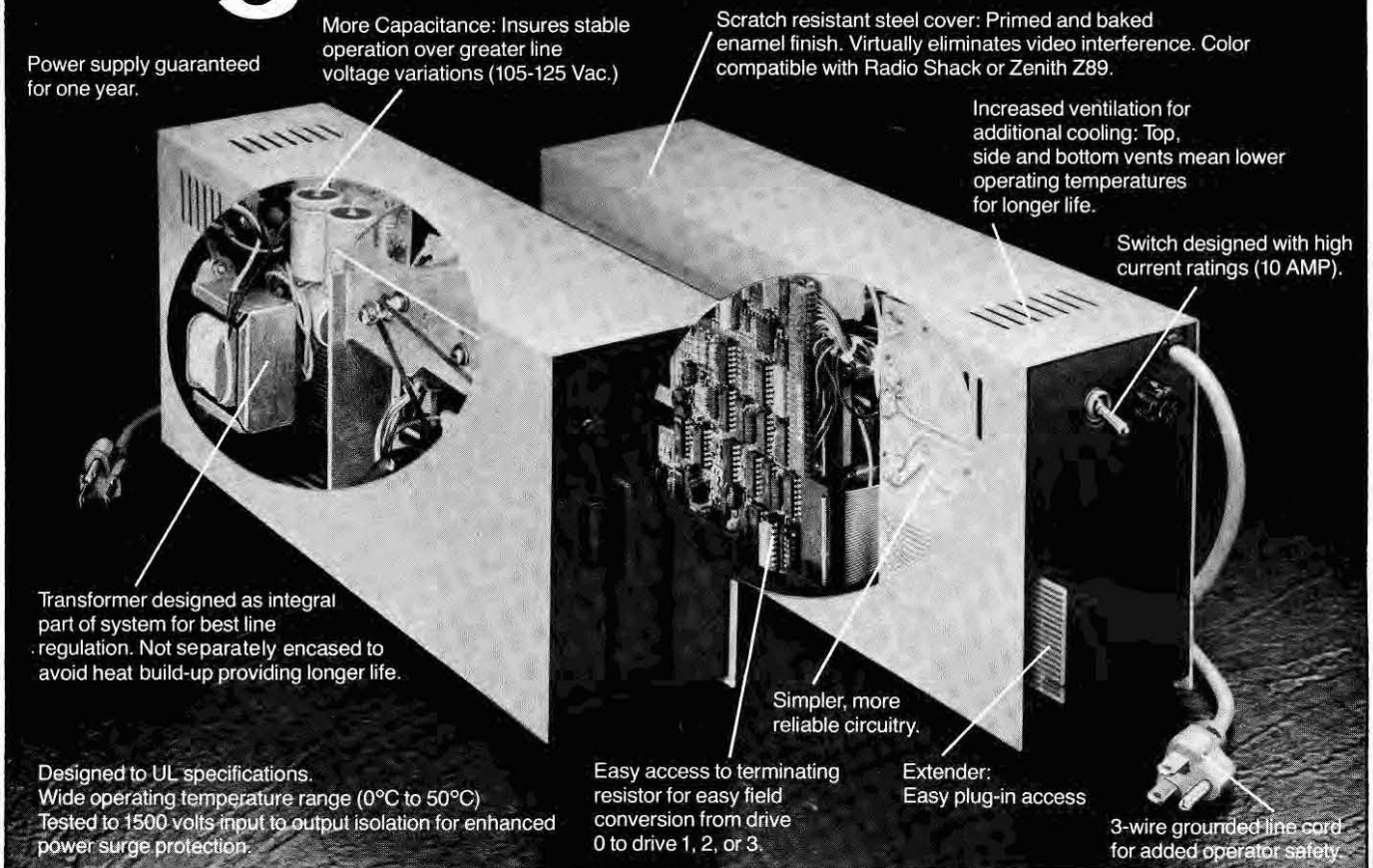

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✓Reader Service—see page 178

```
    OTO1230
1240 PRINT
1250 A$="":PRINT@384,"";:INPUT"IS ABOVE DATA CORRECT -
    YES OR NO";A$
1255 IFLEFT$(A$,1)="N"THENNU(X)=0:NM$(X)="":GOTO1000
1260 IFLEFT$(A$,1)<>"Y"THENPRINT@420,STRING$(15," ");:P
    RINT@448,STRING$(64,"-");:GOTO1250
1270 PRINT@448,STRING$(64,"-");
1300 Y=Y+1
1305 IFY>5THENCLS:PRINT:PRINT"5 FILE  LIMIT HAS BEEN EX
    CEEDED FOR TAPE #";NU(X);" - PRESS ENTER":PRINT:IN
    PUTA$:GOTO1399
1310 PRINT@640,PL$(4);:INPUTF$(X,Y)
1315 IF(LEN(F$(X,Y))>14)THENPRINT@704,PL$(5);:PRINT@665
    ,STRING$(24," ");:GOTO1310
1320 PRINT@704,PL$(5);:INPUTD$(X,Y)
1325 IF(LEN(D$(X,Y))>8)THENPRINT@768,PL$(6);:PRINT@734,
    STRING$(15," ");:GOTO1320
1330 PRINT@768,PL$(6);:INPUTT$(X,Y)
1335 IF(LEN(T$(X,Y))>5)THENPRINT@832,PL$(7);:PRINT@808,
    STRING$(20," ");:GOTO1330
1340 PRINT@832,PL$(7);:INPUTC$(X,Y)
1345 IF(LEN(C$(X,Y))>12)THENPRINT@874,STRING$(20," ");:
    GOTO1340
1350 A$=" ":PRINT@896,"";:INPUT"IS ABOVE DATA CORRECT -
     YES OR NO";A$
1360 IFLEFT$(A$,1)="N"THENY=Y-1:GOSUB1400:GOTO1300
1370 IFLEFT$(A$,1)<>"Y"THEN1350
1375 IFS2=1THEN1399
1380 A$=" ":PRINT@896,"DO YOU WISH TO ADD ANOTHER FILE
    TO TAPE #";NU(X);"- YES OR NO";:INPUTA$
1385 IFLEFT$(A$,1)="Y"THENGOSUB1400:GOTO1300
1387 IFLEFT$(A$,1)<>"N"THEN1380
1388 IFS1=1THEN1399
1390 A$=" ":PRINT@896,"DO YOU WISH TO ADD ANOTHER TAPE
    TO THE FILE";:INPUTA$
1392 IFLEFT$(A$,1)="Y"THEN1000
1394 IFLEFT$(A$,1)<>"N"THEN1390
1399 RETURN
1400 PRINT@665,STRING$(24," ");:PRINT@734,STRING$(15,"
    ");:PRINT@815,STRING$(15," ");:PRINT@880,STRING$(2
    0," ");:PRINT@896,STRING$(63," "):RETURN
2000 ' LIST ENTRIES
2005 L1=1:L2=6
2010 CLS
2015 PRINTTAB(25)"FILE  ENTRIES":PRINT
2020 FORI=L1TOL2
2025   PRINTI;NM$(I),TAB(15)I+6;NM$(I+6),TAB(30)I+12;NM
    $(I+12),TAB(45)I+18;NM$(I+18)
2030 NEXTI
2035 PRINTSTRING$(63,"+")
2100 PRINT@643,"-- OPTIONS --"
2110 F=0:PRINT"1 - LIST MORE ENTRIES"
2120 PRINT"2 - LIST DATA FOR SPECIFIC ENTRY":PRINT"3 -
    RETURN TO MENU":INPUTF
2125 IFF=2THENGOSUB2200:GOTO2000
2130 IFF=3THEN100
2135 IFF<>1THEN2100
2140 IFL1>1THENGOTO2000
2145 L1=L1+24:L2=L2+24:GOTO2010
2200 PRINT@896,"ENTER TAPE #";:INPUTN
2205 IFN>48THEN2200
2210 IFN<1ORNU(N)=0THENPRINT@896,"** NOT A VALID TAPE #
    ":FORZ=1TO600:NEXTZ:GOTO2200
2220 CLS:PRINT:PRINT"TAPE NUMBER";STRING$(10,".");NU(N)
2225 PRINT"TAPE NAME";STRING$(12,".");NM$(N)
2235 PRINT"TAPE DESCRIPTION";STRING$(5,".");DE$(N)
2237 PRINT
2240 PRINTSTRING$(63,"+")
2242 IFS1=1THEN2999
2245 PRINTTAB(20)"-- FILES ON TAPE --"
2250 PRINT"FILE NAME       DATE WRITTEN     TYPE
     COUNTER LOCATION":PRINT
2260 FORJ=1TO5
2265   PRINTJ;F$(N,J);:PRINTTAB(18)D$(N,J),T$(N,J),C$(N
    ,J)
2270 NEXTJ
2273 IFS2=1THEN2299
2275 PRINT@960,"PRESS ENTER";:INPUTA$
2299 RETURN
2999 RETURN
3000 ' FILE UPDATE
3010 CLS:PRINT:PRINTTAB(5)"-- FILE UPDATE MENU --":PRIN
    T:PRINT"1 - ADD FILE(S) TO A TAPE # ENTRY":PRINT"2
     - UPDATE EXISTING FILE(S) IN A TAPE # ENTRY":PRIN
    T"3 - DELETE FILE(S) FROM TAPE # ENTRY"
3012 PRINT"4 - RETURN TO FUNCTION MENU":INPUTI
3020 ONIGOSUB3100,3200,3300
3050 IFI=4THEN3999
3060 GOTO3010
3100 ' ADD A FILE
3110 S1=1:GOSUB2200:S1=0:X=N
3120 Y=0:FORZ=1TO5
3125   IFLEN(F$(N,Z))>0THENY=Y+1
3130 NEXTZ
3135 PRINT@640,PL$(4):PRINTPL$(5):PRINTPL$(6):PRINTPL$(
    7)
3140 S1=1:GOSUB1300:S1=0
3199 RETURN
3200 ' UPDATE FILE
3210 S2=1:GOSUB2200:S2=0:X=N
3220 Y=0:PRINT@896,"ENTER FILE #";:INPUTY
3225 IFY<1ORY>5THEN3220
3227 PRINT@384," ":PRINT:PRINT:PRINT:PRINT
3228 PRINT@640,PL$(4):PRINTPL$(5):PRINTPL$(6):PRINTPL$(
    7)
3230 S2=1:GOSUB1310:S2=0
3235 A$="":PRINT@896,"DO YOU WISH TO CHANGE ANOTHER FIL
    E  - YES OR NO";:INPUTA$
3240 IFLEFT$(A$,1)="N"THEN3299
3245 IFLEFT$(A$,1)="Y"THENPRINT@896,STRING$(63," "):GOT
    O3220
3250 GOTO3235
3299 RETURN
3300 ' DELETE FILE
3310 S2=1:GOSUB2200:S2=0:X=N
3320 PRINT@896,"WHICH FILE DO YOU WISH TO DELETE";:INPU
    TY
3325 IFY<1ORY>5THEN3320
3330 O=0:IFLEN(F$(N,Y))=0THENPRINT@896,"NO ENTRY FOR FI
    LE";Y;"    1-TRY ANOTHER ENTRY   2-UPDATE MENU";:I
    NPUTO
3335 IFO=1THENS2=1:GOSUB2220:S2=0:GOTO3320
3340 IFO=2THEN3399
3345 F$(N,Y)="":D$(N,Y)="":T$(N,Y)="":C$(N,Y)="":GOSUB3
    400
3350 S2=1:GOSUB2220:S2=0:X=N
3355 A$="":PRINT@896,"DO YOU WISH TO DELETE ANOTHER FIL
    E:   YES OR NO";:INPUTA$
3360 IFLEFT$(A$,1)="Y"THENS2=1:GOSUB2220:S2=0:GOTO3320
3399 RETURN
3400 FORZ=1TO4
3410   IFLEN(F$(N,Z))>0THEN3480
3430     F$(N,Z)=F$(N,Z+1):D$(N,Z)=D$(N,Z+1):T$(N,Z)=T
    $(N,Z+1):C$(N,Z)=C$(N,Z+1)
3435   F$(N,Z+1)="":D$(N,Z+1)="":T$(N,Z+1)="":C$(N,Z+
    1)=""
3480 NEXTZ
3499 RETURN
3999 RETURN
4000 CLS:PRINT:INPUT"WHICH TAPE # ENTRY DO YOU WISH TO
    DELETE";D
4005 IFD>48THEN4000
4010 IFNU(D)=0ORLEN(NM$(D))=0THENPRINT:INPUT"TAPE ENTRY
     DOES NOT EXIST.  PRESS ENTER";A$:GOTO4099
4020 NU(D)=0:NM$(D)="":DE$(D)="":FORZ=1TO5:F$(D,Z)="":D
    $(D,Z)="":T$(D,Z)="":C$(D,Z)="":NEXTZ
4050 CLS:PRINT:PRINT"TAPE ENTRY";D;"DELETED.  PRESS ENT
    ER.":INPUTA$
4099 RETURN
6000 ' PRINT
6005 IFPEEK(14312)>127THEN6099
6010 PC=66:GOSUB6500
6015 FORI=1TO48
6020   IFNU(I)<>0THENLPRINT:LPRINT"TAPE#";NU(I);:LPRINT
    TAB(12)"NAME: ";NM$(I);:LPRINTTAB(36)"DESCRIPTION:
     ";DE$(I):PC=PC+2
6030   FORJ=1TO5
6040     IFLEN(F$(I,J))>0THENLPRINTTAB(10)"FILE";J;" "
    ;F$(I,J);:LPRINTTAB(36)"TYPE: ";T$(I,J);:LPRINTTAB
    (50)"COUNTER POSITION:  ";C$(I,J):PC=PC+1
6050   NEXTJ
6060   IFPC>50THENGOSUB6500
6070 NEXTI
6099 RETURN
6500 FORZ=PCTO64:LPRINT:NEXTZ:PC=3:LPRINTTAB(30)"TAPE M
    ANAGEMENT SYSTEM PRINT":LPRINT:RETURN
7000 ' WRITE O/P TAPE
7010 CLS:PRINT:PRINT"READY CASSETTE FOR OUTPUT":PRINT:I
    NPUT"PRESS ENTER";A$
7030 FORX=1TO48
7040   IFNU(X)=0THEN7070
7050   FORY=1TO5
7055     IFLEN(F$(X,Y))=0THENF$(X,Y)="*"
```

For example, you may have a cassette on which you put Santa Paravia, Space Trek, Airmail Pilot and Golf. The tape name, therefore, is ISI Games. The description is Instant Software Games. You have one file entry each for Santa Paravia, Space Trek, Airmail Pilot and Golf, containing creation date, file type (BASIC) and tape counter positions.

When you begin program execution, you can create a new TLMS file, or read and update an existing one. Tapes must be numbered from one. The options (Fig. 1) available once a TLMS file is established are:

List File Entries: This lists the first 24 tape numbers and names on the monitor (Fig. 2). From this screen you can list the remaining 24 tapes; list all data for a specific tape (Fig. 3); control or return to the main menu.

Add Tape# Entry to File: This lets you add more tape entries to an existing file. Error detection stops you from inadvertently writing over an existing entry.

```
TAPE NUMBER..... 10
TAPE NAME.....ISI GAMES
TAPE DESCRIPTION.....INSTANT SOFTWARE GAMES

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    -- FILES ON TAPE --
FILE NAME       DATE WRITTEN    TYPE          COUNTER LOCATION

 1 SANTA PARAVIA  07/15/79      BASIC           10
 2 SPACE TREK IV  07/15/79      BASIC           150
 3 AIRMAIL PILOT  07/15/79      BASIC           280
 4 GOLF           07/15/79      BASIC           350
 5

PRESS ENTER? +
```

Fig. 3. Data for a Specific Tape.

FILE 1	SANTA PARAVIA	BASIC	10
FILE 2	SPACE TREK IV	BASIC	150
FILE 3	AIRMAIL PILOT	BASIC	300
FILE 4	GOLF	BASIC	400
FILE 5			

Table 1a. Before you delete Space Trek IV.

FILE 1	SANTA PARAVIA	BASIC	10
FILE 2	AIRMAIL PILOT	BASIC	300
FILE 3	GOLF	BASIC	400
FILE 4			
FILE 5			

Table 1b. After you delete Space Trek IV.

```
7057        IFLEN(D$(X,Y))=0THEND$(X,Y)="*"
7060        IFLEN(T$(X,Y))=0THENT$(X,Y)="*"
7064        IFLEN(C$(X,Y))=0THENC$(X,Y)="*"
7065     NEXTY
7070  NEXTX
7100  PRINT#-1,"TAPMGT"
7110  FORX=1TO48
7115     IFNU(X)=0THEN7150
7120     PRINT#-1,NU(X),NM$(X),DE$(X),F$(X,1),F$(X,2),F$(
      X,3),F$(X,4),F$(X,5),D$(X,1),D$(X,2),D$(X,3),D$(X,
      4),D$(X,5),T$(X,1),T$(X,2),T$(X,3),T$(X,4),T$(X,5)
      ,C$(X,1),C$(X,2),C$(X,3),C$(X,4),C$(X,5)
7150  NEXTX
7160  W$="*":E=999:PRINT#-1,E,W$,W$,W$,W$,W$,W$,W$,W$,W$
      ,W$,W$,W$,W$,W$,W$,W$,W$,W$,W$,W$,W$,W$,W$
7170  FORX=1TO48
7172     IFNU(X)=0THEN7190
7175     FORY=1TO5
7180        IFF$(X,Y)="*"THENF$(X,Y)=""
7182        IFD$(X,Y)="*"THEND$(X,Y)=""
7184        IFT$(X,Y)="*"THENT$(X,Y)=""
7186        IFC$(X,Y)="*"THENC$(X,Y)=""
7188     NEXTY
7189  IFS4=1THENRETURN
7190  NEXTX
7199  RETURN
8000  PRINT:INPUT"READY CASSETTE.  PRESS ENTER";A"
8010  INPUT#-1,L$
8020  IFL$<>"TAPMGT"THENPRINT:PRINT"** TAPE LABEL DOES N
      OT MATCH. MAKE SURE CORRECT TAPE WAS":INPUT"PLACED
       IN RECORDER.  PRESS ENTER.";A$:GOTO8000
8030  INPUT#-1,N,I1$,I3$,A$(1),A$(2),A$(3),A$(4),A$(5),B
      $(1),B$(2),B$(3),B$(4),B$(5),E$(1),E$(2),E$(3),E$(
      4),E$(5),G$(1),G$(2),G$(3),G$(4),G$(5)
8040  IFN=999THEN8099
8060  NU(N)=N:NM$(N)=I1$:DE$(N)=I3$
8080  FORZ=1TO5:F$(N,Z)=A$(Z):D$(N,Z)=B$(Z):T$(N,Z)=E$(Z
      ):C$(N,Z)=G$(Z):NEXTZ
8082  X=N:S4=1:GOSUB7175:S4=0
8085  GOTO8030
8099  SW=1:RETURN
15000 DATA "ENTER TAPE NUMBER","ENTER TAPE NAME - 10 PO
      S.","ENTER TAPE DESCRIPTION - 24 POS."
15100 DATA "ENTER FILE NAME - 14 POS.","ENTER DATE CREA
      TED - MM/DD/YY","ENTER FILE TYPE - 5 POS. (EX: BAS
      IC-LOAD-DATA)","ENTER TAPE COUNTER POSITION(S) - E
      X: 10 50 100"
```

Update Selected Tape: This lets you add to files, or delete them from a tape entry. You can also update a file.

For example, if you have a version of Startrek III that you replaced on a tape with an updated version, you can change the file entry accordingly. You need only to enter the information to be changed. For all other data fields, such as title and file type just press the enter key.

The add function places the file entry in the next available slot, up to a limit of five. For example, if two entries exist, and you add one, it will be tagged File 3.

The delete function compresses your files. Suppose your entries for tape 10 are those listed in Table 1a. By deleting Space Trek IV the result is shown in Table 1b.

Delete Tape Entry: This will delete a tape entry and all of its files. This slot will then be blank in subsequent tape lists. You can now add a tape with this number.

List File Entries on Printer: If you have a line printer available, this produces a hard-copy of your TLMS file.

Save File on Cassette: This saves a new or updated TLMS file for later use.

Error-Trapping Features

The tape library management system program also contains complete edit and error-trapping features. The data prompts are straightforward, and the screens are easy to read. With a few minutes of practice, you can master the program.■

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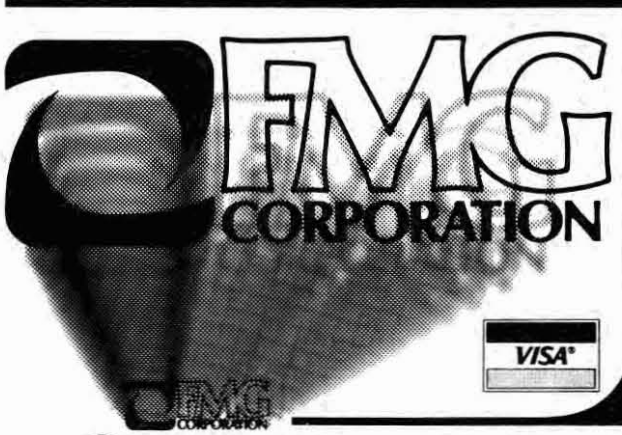

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↙Reader Service index—see page 194

Hide your passwords from prying eyes.

The Invisible Password

Michael A. Conley
Los Angeles, CA 90046

Have you ever needed to load a password-protected program and wished you could keep those nearby from seeing the password? Here's a simple, short program that will do the trick nicely!

It's written for the TRS-80, Disk BASIC, using the Apparat NEWDOS operating system—but it can easily be modified for whatever your particular system requires. The real advantage of NEWDOS is that it allows single-step boot and load of this program. The program then calls and displays the disk directory without exiting from BASIC.

How It Works

By using the INKEY$ function to input the password, you won't display the characters on the screen. A loop allows you to input up to eight characters as a password. The ENTER key, however, can be used at any time to terminate the input.

The display next asks for the program name. A similar loop allows us to INKEY$ up to 12 characters (remember those file extensions) but this time, the input is echoed to the display (Example 1).

Once the input is completed, line 270 attempts to load the program. If an error is encountered, such as an invalid password or an incorrect file name, an error-trapping routine restarts the invisible password allowing the user another attempt.

```
FILE DIRECTORY --- DRIVE 0      HOPMAC    -- 09/16/79

PAYFORM   P          DISKDUMP/BAS   P     TVLABEL    P
RADINST   P          DIRCHECK/CMD   P     INVNTORY/PCL   P
RCV/DAT   P          RADLABEL   P         CREWPAY    P



        ENTER PASSWORD:

        WHAT PROGRAM NAME:  PAYFORM
```

Example 1.

```
100 REM            ***  THE INVISIBLE PASSWORD  ***
                        BY MICHAEL A. CONLEY
110 REM
                    WRITTEN FOR TRS-80 DISK BASIC
                         AND APPARAT NEWDOS

120 ON ERROR GOTO 280
130 CLS:CMD"DIR"
140 C$ = "" : B$ = ""
150 PRINT@778,"ENTER PASSWORD:"
160 FOR X = 1 TO 8
170 A$ = INKEY$:IF A$ = "" THEN 170
180 IF ASC(A$)= 13 THEN 210
190 B$ = B$ + A$
200 NEXT X
210 PRINT@906, "WHAT PROGRAM NAME:";
220 FOR X = 1 TO 12
230 A$ = INKEY$: IF A$ = "" THEN 230
240 IF ASC(A$) = 13 THEN 270
250 C$ = C$ + A$:PRINT@926,C$;CHR$(30)
260 NEXT X
270 CLS:PRINT@468,"ONE MOMENT ...":RUN C$ + "." + B$
280 PRINT@463, "INVALID ENTRY - BEGIN AGAIN."
    :FOR X = 1 TO 1800 : NEXT X : RESUME 130
290 END
```

Program Listing.

A Word of Caution

The Apparat NEWDOS system is sold with its password function disabled, but the documentation explains a simple procedure to re-enable its password protection.

If you're using this program under TRSDOS 2.2 or 2.3, you'll have to change or eliminate line 130, which calls the directory under NEWDOS. But that won't stop you from using the program.

Using the AUTO command under NEWDOS, simply boot the disk and type, AUTO BASIC RUN "PWDINVIS" (or whatever filename you give this password program when you save it to disk). Then, when you boot the system, NEWDOS automatically loads BASIC, loads the program, the display, the directory and then prompts you to input the password.

And those prying eyes won't have a chance of stealing your secrets! ■

Reader Service index—see page 194

Make sure you know your O's from your zeros with this machine code subroutine.

Slash Zero

Robert M. Richardson
Drawer 1065
Chautauqua Lake, NY 14722

The uppercase Os and numeric zeros on many printers appear virtually identical unless closely scanned with a magnifying glass. The following assembly language program will let your printer slash its zeros, even if it's not equipped to do so.

The source code program in Program Listing 1 was written using the TRS-80 Editor/Assembler (either Radio Shack cassette version or Apparat NEWDOS + version—both are excellent) and printed on a Western I/O Selectric Printer terminal that does not have the slash-zero type.

Assembly Language

For those readers unfamiliar with assembly language programming, a few words about source and object codes and what they accomplish are in order.

After grasping the basics of Level II, the next step is to begin studying how to converse with your TRS-80's Z-80 microprocessor in its own language. It speaks Zilog machine language, which is somewhat easier to learn than Russian, and, for many, almost on a par with learning Latin when only a few hundred words of vocabulary are required.

It is much quicker to speak to someone in his own language than it is to use an interpreter (BASIC).

Machine language programs invariably run 300 to 400 times faster than a program in BASIC, Fortran or Cobol high level languages. Furthermore, machine language programs require only 1/10 the memory of a program written in a higher level language, perhaps 1/7 the memory, if you use Pascal.

The TRS-80 editor/assembler allows you to write assembly language programs in source code that uses the Zilog standard mnemonics (LD = load, CP = compare, RET = return, etc.) rather than in 8-bit binary or its decimal equivalent.

After the source code has been written (see Listing 1), the editor/assembler program (originally written by Zilog) then makes two passes through the program, both editing and assembling it after the "A" command, ENTER. The obvious errors are printed out as well as the object code for the program, illustrated in Program Listing 2.

The left column is the memory position in hexadecimal and is keyed on the number you input in line 100 of the source program. The second most left column is the complete instruction (opcode + operand) translated into 1, 2 or 3, but rarely 4, bytes of object code in hex which will be loaded into your TRS-80's memory in binary format.

The first two-digit hex number in the second column is the opcode. There are 157 fundamental opcodes, or instructions, for the Z-80 and 547 additional variations for a total instruction set of 694.

If you were a real masochist, you could manually load each object code hex byte, after converting the hex into decimal, via the BASIC POKE instruction.

Program Flow

The REMarks section of Listing 1 briefly explains each line's function, but for those who wish to run through the program flow in detail, be seated, just like you were in Assembly Language 101 class.

We started the print zero subroutine in line 140 at memory location 32533, so that another small print subroutine allowing the user to set the line at any number could be tacked on later. Print zero only requires 53 bytes of memory (7F41 – 7F15 = 53 decimal), so it may be set exactly at the high end of your TRS-80's memory minus 53, if desired.

If you are using disk and have plenty of memory, it would be wise to place it about 200 bytes from the top, since some disk operating systems use the top few bytes for sundry purposes.

The address may be in decimal (32533) or hex (7F15H) as the assembler will automatically change any number not ending in H to hex. Just remember, any hex number beginning with a letter—A, B, C, D, E or F—must be preceded by a zero, or an error will be printed when you assemble the program.

Line 150, the START label, be-

```
00100 ; SOURCE CODE PROGRAM TO PRINT ALL ZEROS WITH A SLASH
00110
00120 ; BY ROBERT M. RICHARDSON W4UCH/2
00130
00140          ORG     7F15H     ;32533 DECIMAL
00150 START    PUSH    AF        ;SAVE AF BC DE HL REGISTERS
00160          PUSH    BC
00170          PUSH    DE
00180          PUSH    HL
00190          LD      A,C       ;NEXT CHAR. TO ACCUM.
00200          CP      030H      ;30H = ASCII 0: IS IT A 0?
00210          JP      Z,ZERO    ;IF 0 GOTO ZERO SUBROUTINE
00220          JP      FINIS     ;IF NOT 0 CONTINUE PRINTING
00230 ZERO     CALL    TEST      ;READY TEST FOR PRINTER
00240          LD      A,02FH    ;ASCII SLASH
00250          LD      (37E8H),A       ;PRINT SLASH
00260          CALL    TEST      ;READY TEST FOR PRINTER
00270          LD      A,08H     ;08 = ASCII BACKSPACE
00280          LD      (37E8H),A       ;PRINT BACKSPACE
00290 FINIS    POP     HL
00300          POP     DE
00310          POP     BC
00320          POP     AF
00330          JP      0583DH    ;BACK TO ROM PRINT ROUTINE
00340 TEST     LD      A,(37E8H)       ;PRINTER STATUS
00360          CP      03FH      ;IS PRINTER READY?
00370          JR      NZ,TEST   ;LOOP TILL PRINTER READY.
00380          LD      C,0AH     ;INITIALIZE DELAY
00390 DELAY1   LD      B,0       ;LOOP TO ALLOW PRINT
00400 DELAY2   DJNZ    DELAY2    ;HEAD TIME TO SETTLE DOWN
00410          DEC     C         ;FROM BACKSPACE VIBRATION.
00420          JR      NZ,DELAY1       ;ABOUT 20 MILLISECS.
00430          RET               ;READY TO PRINT
00440          ORG     4026H     ;PRINTER DRIVER ADDRESS
00450          DEFW    START     ;WHERE TO BEGIN SUBROUTINE
00460
00470          END
```

Program Listing 1.

gins the subroutine. Modifying the line printer control block's driver address in memory locations 16422 and 16423 (is actually accomplished in lines 440 and 450).

The opcode, PUSH instructions from line 150 to 180 merely store, but do not change the values of your AF, BC, DE and HL registers in the stack. PUSHing all of them into the stack is unnecessary in this particular subroutine, but is a good habit when writing any subroutine. If critical data from your main program resides in any of the registers used in the subroutine, it will be lost. Saving the contents in these lines and restoring them in lines 290-320 is a most worthwhile habit.

The opcode LD and operand A,C transfers the contents of register C to register A, the accumulator in line 190. It just so happens that during any LLIST (list program output to printer) operation, register C contains the value of the NEXT character to be printed.

The opcode CP in line 200 and operand 30H (ASCII zero = 48 decimal = 30 hex) subtract 30 hex from the contents of the accumulator (next character to be printed) and set the Z-80's status flags accordingly. The result of the subtraction is discarded. If the result is zero, as when the next character to be printed is a zero, then the next instruction executes a jump to the line with the label ZERO, line 230.

The JP opcode followed by operand Z, ZERO in line 210 is exactly the same as the BASIC IF-THEN-GOTO statement. If the result of the simple binary subtraction in line 200 is not zero, the program falls through to the next statement in line 220, just as in BASIC. This line's unconditional JP says GOTO the line with the label FINIS (line 290).

In lines 290 to 320 the program restores the original values to the registers. Line 330 returns to the ROM program, memory location 58D hex = 1421 decimal. This is where the line printer control block driver addresses (16422 and 16423) told the program to go before being modified in lines 440 and 450.

Time Factor

How long a time period has the subroutine used to examine each non-zero character before returning to the regular printer routine? You have used 13 instructions, which at an average execution time of 4 cycles = 52 cycles. With a TRS-80 clock of 1.7 MHz, each cycle takes .5637 microseconds times 52 or approximately 29 microseconds. Does an 29 microsecond delay slow down our 15 character per second printer? No, at this subroutine speed the printer does not even know you are there.

If the result of the subtraction in line 200 is a zero, line 210 jumps to 230. The CALL opcode is exactly the same as a BASIC GOSUB with the place to go in the operand, TEST, line 340. The RETURN, which must terminate every GOSUB, is RET in line 430.

In lines 340 to 430, the program knows the next character to print is a zero and introduces a short delay.

After the I/O Selectric has completed a character and is ready for the next one, it places a 3F hex = 63 decimal = ASCII ? into memory location 14312 = 37E8 hex. It is saying, "OK, I printed what you sent me. What next?"

Line 340 then loads the value from memory location 37E8H into the accumulator. Line 360 subtracts 3F hex from it. In line 370, because the result is zero, the program falls through to the next line: another IF-THEN statement, just as in BASIC. The program uses a jump relative (JR) here, because it saves one byte of memory and can move 128 positions back or 127 forward, more than enough for our purposes.

Lines 380 to 420 provides a 20 millisecond delay that allows our Selectric printer time to settle down from the bone shaking that occurs when we backspace the device while printing multiple zeros.

The first two lines in Program Listing 3 show the program without this delay. The last three lines illustrate the 20 millisecond delay.

In line 410 the program returns to the line following the CALL, line 240. Line 240 loads the ASCII slash = 2FH = 47 decimal into the accumulator. (See page C/2 of the Level II Manual for ASCII codes in decimal and enter the hex equivalents next to each.)

Lines 250 and 260 place 2FH (the /) into memory location 37E8H (14312), which is the line printer's PRINT address and then awaits the line printer's "handshake", saying, "I printed the slash, and I'm ready for another character via the CALL TEST in line 260."

When the printer is ready, the program falls through to line 270. The accumulator is loaded with ASCII 8H, the backspace signal, while line 280 sends the slash to the printer.

Line 330 gives the instruction GOTO original print routine and print that zero on top of the slash, which was what this subroutine was all about!

As mentioned earlier, the subroutine's starting address is put into the line printer control block driver address at 16414 and 16415 by lines 440 and 450.

Conclusion

This mini-subroutine will certainly enhance any program listings you wish to print and give them a professional appearance when using a printer without the slash-zero typeface.

Before assembling the source code, remember to give it a name. This subroutine has been tested with Level II BASIC, DOS 2.1, DOS 2.2 and NEWDOS+ and works fine with all of them. ■

Appendix:

This program is from Chapter 8 of the author's *Disassembled Handbook for TRS-80 Volume I.*

```
10 REM 1000200030004000500060007000800090000
10 REM 1000200030004000500060007000800090000

10 REM 1000020000300004000050000600007000080000900000
10 REM 1000020000300004000050000600007000080000900000
10 REM 1000020000300004000050000600007000080000900000
```

Program Listing 3.

```
7F15            00140          ORG     7F15H
7F15 F5         00150 START    PUSH    AF
7F16 C5         00160          PUSH    BC
7F17 D5         00170          PUSH    DE
7F18 E5         00180          PUSH    HL
7F19 79         00190          LD      A,C
7F1A FE30       00200          CP      030H
7F1C CA227F     00210          JP      Z,ZERO
7F1F C3327F     00220          JP      FINIS
7F22 CD397F     00230 ZERO     CALL    TEST
7F25 3E2F       00240          LD      A,02FH
7F27 32E837     00250          LD      (37E8H),A
7F2A CD397F     00260          CALL    TEST
7F2D 3E08       00270          LD      A,08H
7F2F 32E837     00280          LD      (37E8H),A
7F32 E1         00290 FINIS    POP     HL
7F33 D1         00300          POP     DE
7F34 C1         00310          POP     BC
7F35 F1         00320          POP     AF
7F36 C38D05     00330          JP      058DH
7F39 3AE837     00340 TEST     LD      A,(37E8H)
7F3C FE3F       00360          CP      03FH
7F3E 20F9       00370          JR      NZ,TEST
7F40 0E0A       00380          LD      C,0AH
7F42 0600       00390 DELAY1   LD      B,0
7F44 10FE       00400 DELAY2   DJNZ    DELAY2
7F46 0D         00410          DEC     C
7F47 C2427F     00420          JP      NZ,DELAY1
7F4A C9         00430          RET
4026            00440          ORG     4026H
4026 157F       00450          DEFW    START
0000            00470          END
00000 TOTAL ERRORS

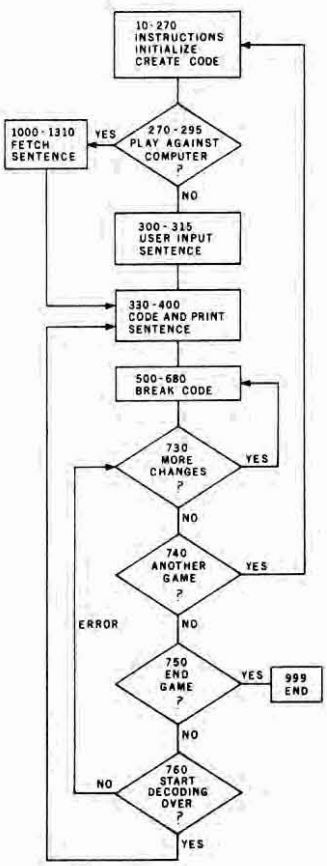
DELAY1 7F42 00390   00420
DELAY2 7F44 00400   00400
FINIS  7F32 00290   00220
START  7F15 00150   00450
TEST   7F39 00340   00230 00260 00370
ZERO   7F22 00230   00210
```

Program Listing 2.

Delve into the dark secrets of cryptanalysis.

Code Cracker

James P. Morgan
2386-B Ash Creek
Scott AFB IL 62225



General Flow Chart

On the morning of August 1, 1943 a bomber force of 178 American Liberators departed a Libyan airfield en route to the huge oil field complex at Ploesti, Rumania. To ensure safe passage over Allied defenses, a coded message was sent to units throughout the Mediterranean which identified the force as friendly.

Within minutes after takeoff, German cryptanalysts in Athens had intercepted and broken the coded message. The Ploesti air defenses were alerted and fifty-three American Liberators were shot down.

The secret war waged by the code clerks from back rooms once again influenced the outcome of a military operation.

The first use of code for military operations is credited to Julius Caesar. He devised the coded alphabet which worked on the principle of one-for-one direct letter substitution. You will find his code used in the cryptograms published in newspapers and periodicals to this day. It is still known as the Caeser Alphabet and is formed as shown in Fig. 1.

The standard alphabet is thus transposed randomly by direct substitution of a new, coded alphabet.

Moving from the days of the Roman legions to modern cryptography, a most significant development has been the introduction of the computer as the code-maker's and code-breaker's most powerful analytical tool.

I have set my micro to the task of creating and breaking codes and the following program may help you to discover yet another enjoyable application for your home computer.

Developing the Program

When I program, I find it most useful to establish a specific outline of the program's requirements. Each requirement is then developed and fulfilled separately, tested and merged into an overall program. My outline follows:

1. Develop a method of computer-created random Caesar alphabets.
2. Provide computer or user input of messages to be coded.
3. Computer coding and display of the coded message.
4. Provide user interaction with the computer in breaking the coded message.
   a. Input trial letter substitutions.
   b. Display results.
   c. Allow for further modification.
   d. Continue until solved with update every cycle.

What seemed at first glance a relatively easy programming task turned out to be quite difficult.

Program lines 10 through 100 print a general introduction to the program. The CLEAR 500 statement in line 20 reserves the string space required by later sections of the program.

Line 110 DIMensions the arrays which will store the codes at various stages. The A$(X) array holds the Caesar Alphabet. The J$ array is filled with the coded sentence. The K$ array is used to store the user's code-breaking efforts.

Lines 120 through 230 satisfy the first requirement of my outline. These lines automatically create the code. Line 120, the C$ string, sets the normal alphabet used for comparisons throughout the program. Lines 130 through 150 initialize the A$(X) at 0.

A random number is selected by line 160. Assume the number selected is five. A looping routine starts at line 170. The first time through, with an X value of one, line 180 fails the test, eg., A$(1) = 0 and MID$(C$,B,1) = E since B = 5.

Line 190 also fails the IF test since A$(1) equals 0 and the program drops to line 200. At line 200, A$(1) is assigned the value of the letter E. Line 210 counts N = 1 and line 220 sends the program back for another random

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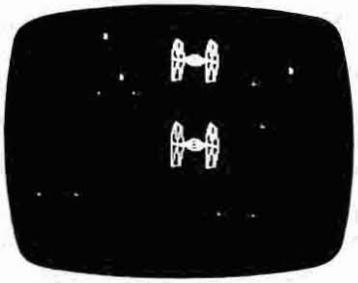

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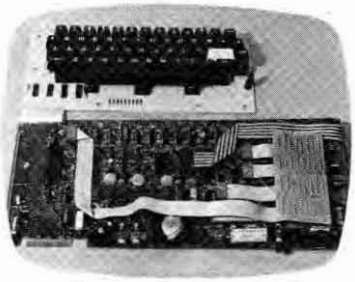

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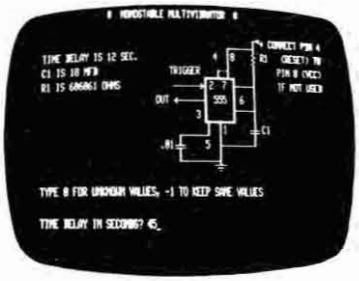

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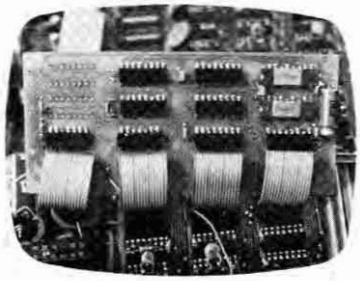

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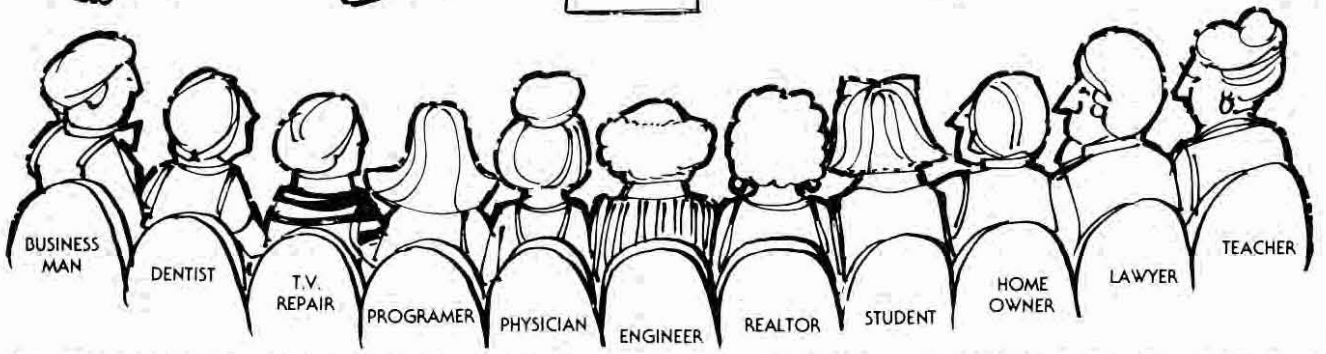

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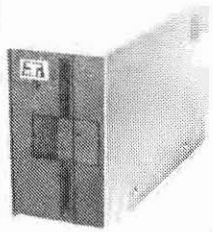

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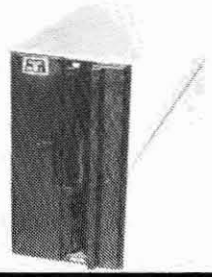

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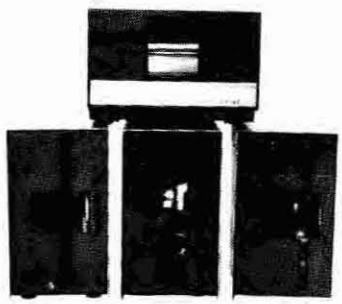

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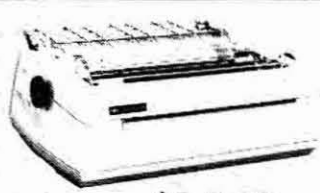

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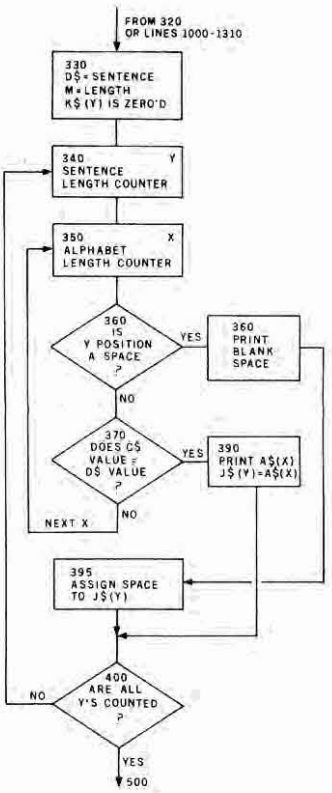
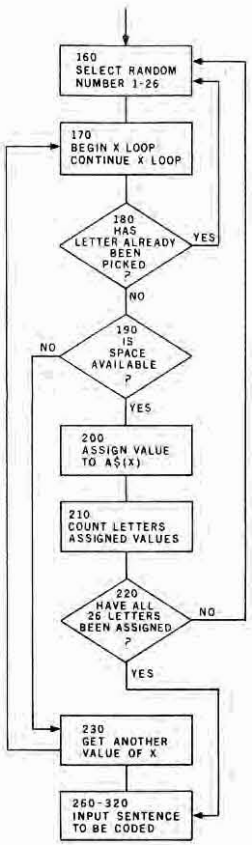


Print Sentence in Code



Create Code

number.

Assume the next random number selected is the number 3. A$(1) = E which fails the IF test at line 180 since 3 is the MID$(C$,B,1) value. At line 190, A$(1) is not 0 so the line branches to line 230 and then to line 170 where an X value of 2 is generated. Lines 180 and 190 fail the IF tests so the value of A$(2) becomes the letter C.

This section continues to select random numbers and loop through values of X until all 26 A$(X) values have been assigned random letters of the alphabet. This array now holds the code.

The Sentence

Lines 270 through 320 give the user the option of either manually entering a sentence to be coded or letting the computer select a sentence at random.

At line 330, the length of the sentence, including spaces between words, is derived from the M = LEN(D$) statement. The K$(Y) array is then set to " " or empty spaces for the entire length of the sentence.

Lines 340 through 400 print the sentence in code. This is done in the following manner.

At line 340 the Y counter selects the first position in the sentence. Line 350 selects the first X value and line 360 tests if the position in the D$ sentence string is a space. If not, the program goes to line 370 where the X value in the C$ is compared to the Y value in the D$. The X counter continues to loop until a match is made.

Let's assume the first letter in the sentence D$ is a C. The match occurs when X reaches a value of 3, since the third letter in the C$ string is C. The program jumps upon a match to line 390. The value of A$(3), which is a letter in the coded alphabet, is printed and also assigned to the J$(1) position. The coded sentence is thus built up letter by letter and stored in the J$(Y) array.

The program so far has created a code and applied that code to a sentence. All that remains is to provide a system of breaking the code. This is accomplished in lines 500 through 770. The user examines the coded sentence and determines potential substitutions. For example, a letter by itself is usually an A or an I.

At line 520 the coded letter to be changed is input as O$. The letter to be substituted is then input at line 535 as N$. The counter at line 540 sets up a scan of the entire coded sentence. At line 550 each value of J$(Y) which corresponds to the letter the user wants changed is flagged and sent to line 580. This line reassigns the value of K$(Y) to the new (N$) letter.

After each letter of space in the sentence is checked by the Y counter, the program then prints the results with lines 600 through 670. The IF statements at lines 630 and 660 cause the program to print a line of coded sentence, a line of changes, then two similar lines below.

Lines 700 through 770 provide for user options at each run through of the code-breaking attempts. Lines 1000 through 1410 store the computer generated sentences.

Conclusion

The program has gained instant popularity with family and neighbors alike. Once a person gets hooked as an amateur cryptanalyst, it is extremely hard to keep him away from the computer.

Although the code system used is not as complex as the one broken by the Germans during the Ploesti raid, it will provide a challenge to all who use the program. ZCCA FYPQ WOA GOXCN! ■

Program Listing.

```
10 CLS:PRINT@25,"CRYPTO"
20 PRINT:CLEAR 500
30 PRINT"THIS PROGRAM WILL CREATE SECRET MESSAGES USING
    A DIFFERENT
40 PRINT"CODE EACH TIME. TWO PLAYERS CAN PLAY OR ONE PL
   AYER CAN TEST
50 PRINT"HIS/HER CODE-BREAKING ABILITY AGAINST THE COMP
   UTER. THE GAME
60 PRINT"IS EXACTLY LIKE THOSE FOUND IN DAILY NEWSPAPER
   S AND MAGAZINES
70 PRINT"IN THAT A CODED SENTENCE IS PRESENTED AND THEN
    BROKEN BY
80 PRINT"ANALYSIS OF STRUCTURE AND LETTER SUBSTITUTION.
   ":PRINT
90 PRINT"THE COMPUTER IS BUSY COMPILING THE CODE AND WI
   LL SIGNAL
100 PRINT"YOU WHEN READY. IT TAKES LESS THAN 30 SECONDS
   ."
110 DIM A$(30),J$(150),K$(150):  A$(30)=" "
115 REM A$ IS CODE, J$ HOLDS CODED SENTENCE, K$ HOLDS C
   ODE BREAKING
120 C$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
125 REM SET A$ TO ZERO
130 FOR X=1 TO 26
140    A$(X)="0"
150 NEXT X
160 B=RND(26): REM SELECT RANDOM ALPHABET VALUE
170 FOR X=1 TO 26
180    IF A$(X)=MID$(C$,B,1) THEN 160: REM IS LETTER AL
   READY
PICKED?
190    IF A$(X)<>"0" THEN 230: REM IS THERE SPACE AVAIL
   ABLE?
200    A$(X)=MID$(C$,B,1): REM ASSIGNS CODED LETTER TO
   A$
210 N=N+1: IF N=26 THEN 260: REM COUNTS LETTERS PLAGINS
   TRD
220 GOTO 160
230 NEXT X
260 FOR X=1 TO 26:PRINTA$(X);:NEXT:REM CAN SEE CODE HER
   E IF
DESIRED
270 CLS:PRINT"OK,THE COMPUTER IS SET. TYPE 1 TO PLAY AG
   AINST THE
280 PRINT"COMPUTER, TYPE 2 FOR TWO PLAYERS."
290 Z$=INKEY$:IFZ$=""THEN290
295 IF Z$="1" THEN 1000
300 PRINT:PRINT"FIRST PLAYER, ENTER SENTENCE TO BE CODE
   D. DO NOT"
310 PRINT"SHOW TO THE OTHER PLAYER. DO NOT USE ANY PUNC
   TUATION.
315 PRINT"TYPE AND ENTER YOUR SENTENCE NOW..."
320 INPUT D$
330 CLS: M=LEN(D$): FOR Y=1 TO M: K$(Y)=" ": NEXT
335 REM THE ABOVE SETS THE CODED SENTENCE ARRAY (K$) TO
    BLANKS
340 FOR Y=1 TO M
350 FOR X=1 TO 26
355 REM IS THE LETTER OF THE D$ SENTENCE A SPACE BETWEE
   N WORDS?
360    IF MID$(D$,Y,1)=" "THEN PRINT" ";:GOTO 395
365 REM MATCH VALUE OF LETTER IN SENTENCE WITH NORMAL A
```

```
    LPHABET
370     IF MID$(C$,X,1)=MID$(D$,Y,1) THEN 390
380 NEXT X
390 PRINTA$(X);: J$(Y)=A$(X): GOTO 400:REM PRINT AND AS
    SIGN
CODES
395 J$(Y)=" ": REM ASSIGN BLANK SPACE BETWEEN WORDS
400 NEXT Y: REM GO BACK FOR ANOTHER LETTER
500 PRINT:PRINT"THE ABOVE SENTENCE CAN BE DECODED BY DI
    RECT SUBSTITUTION.
510 PRINT"SELECT LETTER TO BE CHANGED..."
520 INPUT"WHAT IS THE LETTER YOU WANT TO CHANGE";O$
530 PRINT"CHANGE " O$" TO WHAT LETTER? A DOUBLE QUOTE W
    ITH ONE
535 PRINT"SPACE IN BETWEEN THE QUOTES WILL PRINT A BLAN
    K SPACE.":INPUT N$
540 FOR Y=1 TO M
550     IF J$(Y)=O$ THEN 580:REM CHECK J$ FOR SELECTED L
    ETTER
560     IF K$(Y)=" " THEN 590:REM CHECK FOR EMPTY SPACE
570     K$(Y)=K$(Y): GOTO 590: REM HOLD VALUE
580     K$(Y)=N$: REM ASSIGN NEW LETTER TO CODED SENTENC
    E
590 NEXT Y
600 CLS:PRINT"HERE IS THE CODED SE-TENCE WITH YOUR SUBS
    TITUTIONS."
610 PRINT: N=1
620 FOR Y=N TO M: PRINTJ$(Y);:REM PRINT CODED SENTENCE
630 IF Y=64 THEN 650:REM CHECKS SCREEN LIMIT
640 NEXT Y:PRINT
650 FOR Y=N TO M: PRINTK$(Y);:REM PRINTS CHANGES
660 IF Y=64 THEN 680
670 NEXT Y: PRINT: GOTO 690
680 N=65: GOTO 620:REM SETS UP FOR NEXT LINES OF CODE A
    ND CHANGES
690 PRINT:PRINT"FOR FURTHER CHANGES TAP THE 'Y' KEY.
695 PRINT"TO START OVER WITH THIS CRYPTO, TAP THE 'N' K
    EY."
700 PRINT"FOR ANOTHER GAME TAP THE 'A' KEY.
710 PRINT"TO END THE GAME TAP THE 'E' KEY."
720 M$=INKEY$: IF M$="" THEN 720
730 IF M$="Y" THEN 500
740 IF M$="A" THEN 10
750 IF M$="E" THEN 999
760 IF M$="N" THEN 330
770 PRINT"I DON'T UNDERSTAND, TRY AGAIN. TAP Y,N,A, OR
    E.":GOTO720
999 CLS:PRINT"SO LONG FOR NOW." :END
1000 L=RND(2): REM SELECT RANDOM SENTENCE FOR CODING
1010 ON L GOTO 1100,1300
1100 L=RND(10)
1110 ON L GOTO 1120,1130,1140,1150,1160,1170,1180,1190,
    1200,1210
1120 D$="THE LOVE OF JUSTICE IN MOST MEN IS SIMPLY THE
    FEAR OF SUFFERING INJUSTICE":GOTO 330
1130 D$="SILENCE IS THE BEST TACTIC FOR HIM WHO DISTRUS
    TS HIMSELF":GOTO 330
1140 D$="THINGS ARE ALWAYS AT THEIR BEST IN THEIR BEGIN
    NING":GOTO 330
1150 D$="ALL MEN WOULD BE TYRANTS IF THEY COULD":GOTO 3
    30
1160 D$="ONCE A WOMAN HAS GIVEN YOU HER HEART YOU CAN N
    EVER GET RID OF HER":GOTO330
1170 D$="HE WAS A BOLD MAN THAT FIRST EAT AN OYSTER":GO
    TO 330
1180 D$="MAY YOU LIVE ALL THE DAYS OF YOUR LIFE":GOTO 3
    30
1190 D$="A BIRD IN THE HAND IS WORTH TWO IN THE BUSH":G
    OTO330
1200 D$="ASK NOT WHAT YOUR COUNTRY CAN DO FOR YOU BUT W
    HAT YOU CAN DO FOR YOUR COUNTRY":GOTO 330
1210 D$="EXPERIENCE IS THE NAME EVERYONE GIVES TO THEIR
     MISTAKES":GOTO 330
1300 L=RND(10)
1310 ON L GOTO 1320,1330,1340,1350,1360,1370,1380,1390,
    1400,1410
1320 D$="IT IS BETTER TO REMAIN SILENT AND BE THOUGHT O
    F AS A FOOL THAN TO SPEAK AND REMOVE ALL DOUBT":GO
    TO 330
1330 D$="THE APPLAUSE OF A SINGLE HUMAN BEING IS OF GRE
    AT CONSEQUENCE":GOTO 330
1340 D$="IT IS BETTER TO LIVE RICH THAN TO DIE RICH":GO
    TO 330
1350 D$="A PRETTY FOOT IS A GIFT OF NATURE": GOTO 330
1360 D$="A MEAL WITHOUT WINE IS LIKE A DAY WITHOUT SUNS
    HINE":GOTO 330
1370 D$="ASK YOURSELF IF YOU ARE HAPPY AND YOU WILL CEA
    SE TO BE SO": GOTO 330
1380 D$="GOSTRING$ MADE INTEGERS ALL ELSE IS THE WORK O
    F MAN":GOTO330
1390 D$="WAR IS MUCH TOO SERIOUS A MATTER TO BE ENTRUST
    ED TO THE MILITARY":GOTO 330
1400 D$="WHEN YOU ARE FLAT ON YOUR BACK THERE IS NO PLA
    CE TO LOOK BUT UP":GOTO 330
1410 D$="THE ONLY WAY TO GET RID OF A TEMPTATION IS TO
    YIELD TO IT": GOTO 330
```


✓Reader Service index—see page 194

A fine component interface for your television set.

Cheap Video

Paul C. Fowler, Jr.
Inland Motor IDD
609 Rock Road
Radford, VA 24141

Dennis J. Murray
1005 Chestnut Drive
Cristiansbury, VA 24075

A few months ago I bought a TRS-80 mainframe, hooked a video modulator to my old black and white and found at 64 characters per line I had only hieroglyphics. At 32 characters per line I could decipher words and letters satisfactorily.

After the initial excitement of having my own computer wore off, I needed to do something about my 64 characters per line problem, so I said good-bye to the indistinct world of modulators and found myself in the fuzzy world of direct video interface.

With a commercial direct interface device the resolution of 32 characters per line was just fine and 64 characters per line was readable but uncomfortable.

Nothing was wrong with my $25 interface device, but with all those capacitors and things in my video section my TV's slew rate was too slow. So, what to do? Break down and buy a monitor? There's got to be a better way. There is . . . ! And it's simple too.

After a lot of talking and experimenting, the co-author and I came up with the circuit in Fig. 1a.

How the Circuit Works

Transistor Q1 serves as an emitter follower whose quiescent state (and thus the white level) and relative gain is determined by the setting of R1, which interacts somewhat with the set's contrast and brightness controls.

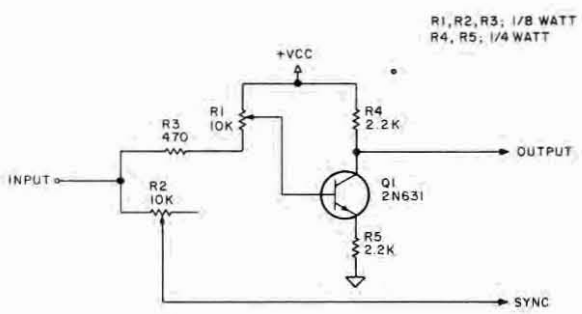


Fig. 1a

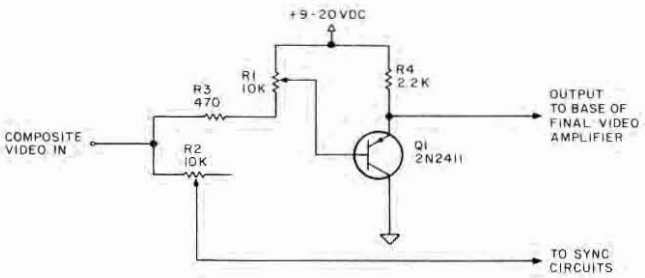


Fig. 1b

Potentiometer R2 adjusts the signal level passed to the TV's sync circuits avoiding synchronization problems caused by overdriving those stages.

Beautiful! Only five components to scrounge and the resolution is excellent. There is one drawback: The TV must be isolated. But one can buy an isolation transformer for just a few dollars and overcome this problem.

If an inverted video signal is desired, replace Q1 with an NPN and series its emitter to ground with a 2.2K resistor (Fig. 1b). Almost any small signal transistor will do.

A typical set is shown in Fig. 2. As good TV sets and good monitors are not usually compatible, I am assuming that this monitor will never again be a television.

Disable everything upstream from X1 and X2. Insert the interface output at X1, and the sync at X2. Vcc should be somewhere between 9 and 20 volts (I used 12 VDC on my Sony Model #TV-1104). You can tap this from one of your set's biasing supplies. Set P1 and P2 to the center positions and inject the composite video into the interface. Also, set your horizontal control and brightness controls for good definition.

To fine tune the picture, fill the screen with zeros. Adjust the height and vertical linearity controls until the characters are all equal size and they fill the screen from top to bottom.

You may find that the data lines do not properly fit on your TV's screen—either the lines are too short or too long. This can be remedied in several ways; if you are lucky you have an adjustable horizontal frequency coil in your set. Adjust it carefully with an insulated alignment tool until you reach a satisfactory line width. If you are unlucky your set has no ad-

justment.

Don't panic! Your horizontal oscillator must have some frequency determining network and it can be changed. Usually it is an L-C arrangement, although R-C networks aren't uncommon. By altering either one or both of those components, your scan frequency, and thus the line width, can be changed.

Another alternative is to change the horizontal scan frequency by changing the horizontal output stage time-constant. This is accomplished by adding or subtracting capacitance until the picture reaches the desired width (Fig. 3).

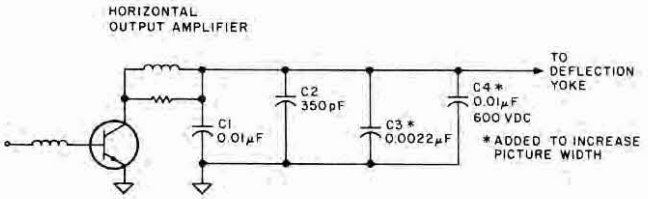


Fig. 3

Conclusion

Get a SAM'S PHOTO-FACS for your TV. Not having one is like exploring a cave in the dark. Use coax cable for all signal runs. To reduce stray capacitance, keep components as close together and as small as possible. I recommend using dual 10K pots in the 8 Pin Dip Package. Q1 is any moderate gain PNP transistor whose reverse breakdown voltage is greater than Vcc.

Finally, and most importantly —DON'T OPEN UP YOUR SET without some knowledge of what's going on inside. If you don't know how a TV works, get someone to help you. Otherwise, you may shake hands with the high voltage rectifier and see hieroglyphics for some time. ■

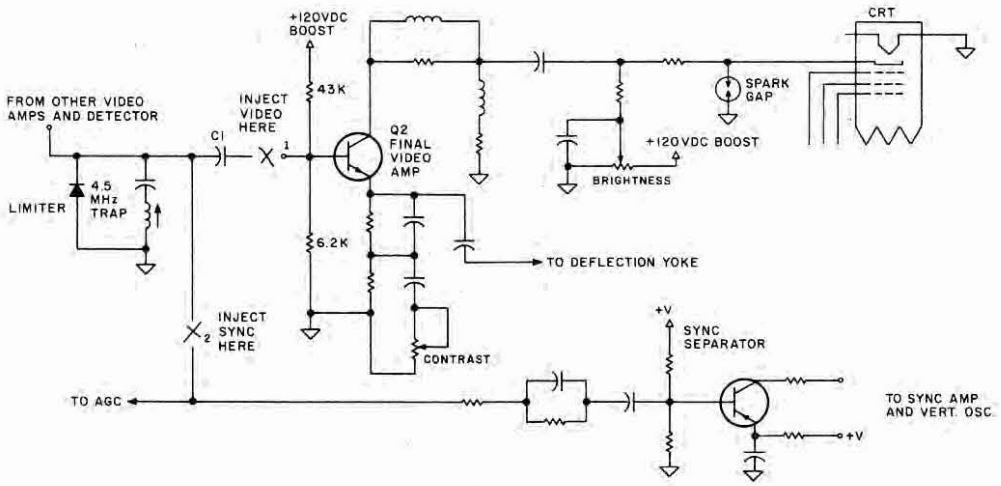


Fig. 2

✓Reader Service index—see page 194

Limit access to your machine code subroutine, with this software combination lock.

Software Lock

M. D. Kelleher
79 City View Way
San Francisco, CA 94131

For those TRS-80 users who enjoy working with machine language (and enjoy a little software intrigue on the side), this article describes a short utility subroutine that provides restricted access to your own machine language programs through the use of a predefined user code.

The subroutine, SOFTPROT, is written for 32K DOS and is automatically loaded into memory on power-up or reset using the TRSDOS AUTO function (Listing 1).

Software Theory

The theory of SOFTPROT is as simple as a James Bond movie. A user code (top secret, of course) is requested as the first step in each machine language program from which the SOFTPROT subroutine is called. This code request must be answered with the proper keyboard characters, and in the proper sequence, before the subroutine loop can be broken and the main program routines accessed.

Should the wrong code be entered, or the correct code be entered out of sequence, the SOFTPROT loop continues. (This should be frustration enough for even the most devious arch-criminal, if a complex code is used.)

SOFTPROT uses a three-level code requiring the input MDK, however, the routine can easily be expanded to accommodate any number of code levels. Once the correct code sequence is entered, SOFTPROT returns control to the user's machine language program by way of the assembler instruction RET.

The program is initialized at hex address BE00 but can easily be reconfigured for a 16K TRS-80 by assembling the subroutine with a hex starting address of 7E00.

In either configuration, make sure that the machine language program using SOFTPROT does not extend beyond hex BDFF in a 32K machine or 7DFF in a 16K machine. If so, SOFTPROT will be wiped out!

Here are the procedures for setting up SOFTPROT, depending upon your TRS-80 hardware configuration:

In a 32K DOS system, assemble the program using the editor/assembler and save the object file (the machine language code itself) to disk under the filename "SOFTPROT/CMD". Now, using the TRSDOS or NEWDOS+ AUTO function, enter this command:

```
AUTO LOAD SOFTPROT/CMD
```

from the DOS mode. Each time you power-up or reset the TRS-80 using this diskette, SOFTPROT will automatically be loaded into memory beginning at hex address BE00.

With a 16K DOS system the only changes you must make to SOFTPROT itself are in the first and last program lines (the ORG and END instructions). Change the addresses at these lines to hex 7E00. The remainder of the program uses relative jumps so that you may relocate it anywhere convenient in memory.

Putting SOFTPROT into Action

Once you have SOFTPROT assembled and ready to run, the rest of the operation is a piece of cake. To use SOFTPROT, add the following command as the first executable program statement of any machine language program:

```
CALL 0BE00H (for 32K machines)
or
CALL 07E00H (for 16K machines)
```

The result of this command is to call SOFTPROT before accessing the remainder of your machine language program. Once SOFTPROT is called, the proper user code must be entered from the keyboard before execution of the main program begins.

Experiment with SOFTPROT and you will find several ways in which to use it. Here are a few suggestions:

1) Try calling SOFTPROT from your BASIC programs by using the DEFUSR function. A typical Disk BASIC program might begin like this:

```
10 CLS
20 PRINT "SAMPLE PROGRAM"
30 DEFUSR 0 = &HBE00
40 X = USR 0(X)
```

This same format can be used in Level II machines by changing the DEFUSR statement address to the proper decimal equivalent for your version of SOFTPROT. If you're really wild about user codes, you can even find some very esoteric ways of hiding lines 30 and 40 with the ASC or STR functions of DISK or Level II BASIC.

2) Alter the required user code in different versions of SOFTPROT to match the particular machine language program you will be using it with.

3) Experiment with access codes using SOFTPROT. For example, establish a 5 or 6 level code (ABCDEFG) where the correct entry of, say, one half of the code allows access to a portion of your program; whereas, only the full code complement allows total program access.

4) And here's a finale for you 007 freaks. How about using SOFTPROT in such a way that a

certain character input from the keyboard cleared all memory locations occupied by your machine language program and then did a "self-destruct" on SOFTPROT itself. A sort of "Good morning, Mr. Phelps" operation.

At any rate, you should be able to come up with fascinating innovations between spy novels. If nothing else, SOFTPROT is an interesting introduction to the intrigue of machine language programming.

Good afternoon, Mr. Phelps. ■

```
                00056 ;       ***    SOFTPROT/CMD    ***
                00052 ;
                00054 ;       THIS PROGRAM VERSION IS DESIGNED FOR A 32K
                00056 ;       TRS-80 AND IS CALLED UPON INITIALIZATION
                00058 ;       BY 'AUTO' DOS COMMAND.
                00060 ;
4E00            00100         ORG     4E00H           ;PROGRAM START
4E02 3E20       00110         LD      A,20H           ;LOAD CR INTO A
4E04 CD2F0E     00120         CALL    DISPLY          ;DISPLAY CR
4E07 213E0E     00130 TELL1   LD      HL,MESS1        ;ADDRESS OF MESSAGE
4E0A 7E         00140 TELL2   LD      A,(HL)          ;GET MESSAGE CHARACTER
4E0B FE00       00150         CP      00H             ;IS IT A ZERO ?
4E0D 2006       00160         JR      Z,CODE          ;IF SO GOTO 'CODE'
4E0F CD2F0E     00170         CALL    DISPLY          ;IF=2 DISPLAY IT
4E12 23         00180         INC     HL              ;GET NEXT CHARACTER
4E13 18F5       00190         JR      TELL2           ;GO BACK AND REPEAT
4E15 3E0A       00200 CODE    LD      A,0AH           ;CR CHARACTER AGAIN
4E17 CD2F0E     00210         CALL    DISPLY          ;DISPLAY CR CHARACTER
4E1A CD4980     00220 CODE1   CALL    8049H           ;INPUT FROM KEYBOARD
4E1D FE4E       00230         CP      04EH            ;IS IT AN 'N'
4E1F 2853       00240         JR      NZ,CODE1        ;IF='N' GO BACK AGAIN
4E21 CD4980     00250 CODE2   CALL    8049H           ;IT WAS AN 'N' THEREFORE
                00260                                 ;GET NEXT KEYBOARD INPUT
4E24 FE44       00270         CP      044H            ;IS IT A 'D'
4E26 204F       00280         JR      NZ,CODE1        ;IF NOT, GOTO BEGINNING
4E28 CD4980     00290 CODE3   CALL    8049H           ;IT WAS A 'D' THEREFORE
                00300                                 ;GET NEXT KEYBOARD INPUT
4E2B FE4B       00310         CP      04BH            ;IS IT A 'K'
4E2D 20EB       00320         JR      NZ,CODE1        ;IF NOT, GOTO BEGINNING
4E2F 1808       00330         JR      FINIS           ;EVERYTHING OK !!!
4E31 D5         00340 DISPLY  PUSH    DE              ;THIS IS THE VIDEO ROUTINE
4E32 FDE5       00350         PUSH    IY
4E34 CD3300     00360         CALL    0033H
4E37 FDE1       00370         POP     IY
4E39 D1         00380         POP     DE
4E3A C9         00390         RET
4E3B C9         00400 FINIS   RET             ;PROGRAM FINISHED !!!
                00405 ;       ***     HERE IS THE VIDEO MESSAGE       ***
4E3C 50         00406 MESS1   DEFM    'PLEASE ENTER THE CORRECT USER CODE, IN PROP
ER SEQUENCE ?'
4E72 00         00490         DEFB    00H
4E00            00410         END     4E00H
00000 TOTAL ERRORS

CODE    4E17 00200    00150

CODE1   4E1A 00220    00240 00270 00300

CODE2   4E21 00250

CODE3   4E28 00290

DISPLY 4E2F 00320    00130 00170 00210

FINIS   4E3B 00390    00310

MESS1   4E3C 00390    00130

TELL1   4E07 00110

TELL2   4E0A 00140    00190
```

Program Listing. SOFTPROT

✓Reader Service index—see page 194

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Lowercase With Strings Attached

Milan D. Chepko, M.D.
119 Belleville Crt.
Thief River Falls, MN 56701

The original TRS-80 system uses only uppercase letters, which can be somewhat restrictive when typing text. The keyboard can generate the lowercase letters by using the shift key, but the screen and the Centronics 779 printer can display only the uppercase form, even though the ASCII code for the lowercase letter is stored in memory. That is why shifted letters can cause so much trouble in a program listing.

Some of the other line printers on the market can handle the lowercase code and produce acceptable text without any hardware modification. Unfortunately, it becomes confusing when you try to enter any significant amount of text, since you have to key it in just the opposite of a regular typewriter.

This simple subroutine eliminates at least some of the difficulty. In essence, it accepts a string from the keyboard, then inspects each of the characters to see which ones have been typed with the shift key. It then unshifts the shifted ones, and shifts the unshifted ones. If that sounds strange, remember that the TRS-80 considers any key typed without the shift to be an uppercase letter, while any key typed with the shift becomes a lowercase letter. This routine just reverses the process.

```
10000 '*** SUBROUTINE TO GENERATE LOWER-CASE CHARACTERS
10010 'BY MILAN D. CHEPKO, M.D.
10020 'THIEF RIVER FALLS, MN
10030 '
10040 'SUBROUTINE USES THE FOLLOWING VARIABLES:
10050 '  X$----CONTAINS THE STRING VARIABLE AS INPUT FROM THE KEYBOARD
10060 '  0$----CONTAINS THE STRING VARIABLE ON RETURN FROM THIS SUBROUTINE
10070 '  A-----THE NUMBER OF CHARACTERS IN THE INPUT STRING
10080 '  C-----USED TO HOLD EACH ELEMENT OF THE STRING SEQUENTIALLY
10090 '  B-----COUNTER
10100 '
10110 A=LEN(X$):0$="":IF X$="" RETURN
10120 FOR B=1 TO A:C=ASC(MID$(X$,B,1))
10130 IF C>64 AND C<91 THEN C=C+32:GOTO10150
10140 IF C>95 THEN C=C-32
10150 0$=0$+CHR$(C)
10160 NEXT B:RETURN
```

Subroutine to Generate Lowercase Letters.

Because it is written in BASIC, it tends to be a little slow, and you may notice a slight delay before the prompt appears for the next line of input. Also, be careful to select variables that don't appear in the program text, or you may lose data accidentally.

Be sure to CLEAR enough space for the extra strings at the beginning of the program. Call the subroutine with a GOSUB just after you INPUT X$, and, on returning, the modified string will be in 0$.■

Reader Service index—see page 194

Make your Editor/Assembler do the things you want it to—with this modification.

Custom EDTASM

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Norfolk, VA 23505

This article explains how to incorporate several changes in the Editor/Assembler from Radio Shack. I'll be talking about: An auto line and form feed option for printers using a 37E8H printer interface; how to change the "lines per page reference"; incorporating Small System Software's TRS-232 printer driver; adding a form feed routine to the TRS-232 printer program; letting EDTASM honor "protected memory"; changing the EXIT from EDTASM so BASIC is reentered without going to memory size; how to reenter EDTASM and maintain your source program text.

To modify the EDTASM you will need a monitor, such as RSM-1 or RMS-2D, MON3 or T-BUG. One caution: You must **not execute the EDTASM program if you are loading it to insert a modification**. There are two ways of modifying EDTASM.

First, you can load the EDTASM program using the SYSTEM command and then load your monitor. Since the monitor is the last program entered, when you type "<ENTER>", you will be in your monitor and ready to make any of the modifications.

Referring to the source listing of the modifications you wish to implement, delete (fill with zeros, 00H) the sections of the programs that are to be changed. Try the "Zero" command in your monitor. This will let you see easily where you are working or if you have run out of room. Enter the hex code for the desired modification. After inserting the new program, save the modified EDTASM program using the PUNCH command. The starting point for EDTASM is 4300H, its ending address is 5520H, and the entry point (cold start) is 468AH.

An alternative method is to write the various programs using the EDTASM and to save the source and object codes. Then, using the SYSTEM command, load the EDTASM program. Load the object code for the patch. (Because of the ORG statements, the modification will overwrite the required sections of coding.) Finally, load your monitor and PUNCH a copy of the modified EDTASM.

The Secret of Gaining Control

To modify any of the I/O routines (i.e., keyboard, video or printer) you must first take control of the EDTASM's old driver. Control can be taken from the old driver and linked or patched to the new routine by changing the address in the Device Control Block (DCB).

The EDTASM has its own DCB's, and its own CRT, keyboard and printer driver routines. The DCB's are located at:

1) 4300-4307H Keyboard
2) 4308-430FH Video
3) 4310-4317H Printer

The various drivers routines are located at:

1) 43EF-445FH Keyboard
2) 4460-45A9H Video
3) 45AA-45F5H Printer

The Device Control Blocks tell the system:

Byte	Description
0	Whether the DCB is an input or output function,
1-2	Address on the driver for that function,
3-5	Scratch pad memory for that function,
6-7	The ASCII name of that device (i.e., PR = printer).

These various Device Control Blocks are used by the routines in the EDTASM. As in BASIC, a General INPUT/OUTPUT driver, located 43CE-43EFH in the EDTASM and 03C2-03E3H in BASIC, saves the registers (EXCEPT the DE), then gets the address of the driver from the DCB, and jumps to the driver.

So by changing the address contained in the DCB the driver can be changed.

37E8H Printer/Interfaces

The biggest problem here is in the printer driver routine which does not insert a line feed after a carriage return, nor does it output a "top of form." In BASIC, a OCH can be outputted to give a top of form, but not in the EDTASM.

The printer driver which resides from 45AA to 45F5 (see Listing 1), is identical to that in ROMs. If you are using a printer interface which is located at 37E8(H), you can insert a line feed after a carriage return with a simple modification (see Listing 2).

Referring to Listing 1, if the character to be printed is a 0DH, <CR>, the program jumps to the "Output Character" (OUTCHR)

Listing 1. Dissembled Printer Driver.

```
                00100 ;*****************************************************
               00110 ;          EDTASM'S PRINTER DRIVER SOURCE                *
               00120 ;*****************************************************
               00130 ;
               00140 ;  DISASSEMBLED BY  JOHN T. BLAIR  WA4OHZ
               00150 ;
               00160 ;*************************************
               00161 ;*  ALL REG'S ARE SAVED (EXCEPT  *
               00162 ;* THE 'DE') BEFORE ENTERING    *
               00163 ;* THIS ROUTINE. THE CHARACTER  *
               00164 ;* TO BE PRINTED IS IN THE 'A'  *
               00165 ;*  REG.                        *
               00170 ;*  THE IX REG. IS SET TO 4310H  *
               00180 ;*BY THE CALLING ROUTINE. THIS   *
               00190 ;*IS THE PRINTER DEVICE CONTROL  *
               00200 ;*BLOCK, AND IS EQUIVILANT TO    *
               00201 ;*THE ONE LOCATED AT 4025H FOR   *
               00202 ;*ROMS. FOR MORE DETAILS SEE     *
               00203 ;*APPENDIX " D " IN THE LEVEL II *
               00204 ;*MANUAL.                       *
               00230 ;*************************************
               00233
45AA           00240          ORG     45AAH           ;STARTING LOCATION
45AA 79        00250          LD      A,C             ;GET CHAR TO BE PRINTED
45AB B7        00260          OR      A               ;CK IT FOR NULL (00H)
45AC 2840      00270          JR      Z,STATUS
45AE FE0B      00280          CP      0BH
45B0 280A      00290          JR      Z,45BCH
45B2 FE0C      00300          CP      0CH             ;IS IT <FF> FORM FEED?
45B4 201B      00310          JR      NZ,OUTCHR       ;JP TO OUTPUT CHAR
               00320
               00330 ;*******  FORM FEED SECTION  ********
               00340
45B6 AF        00350          XOR     A               ;CLEAR " A "
45B7 DDB603    00360          OR      (IX+03)         ;CHECK LINE/PAGE REF = 0?
45BA 2832      00370          JR      Z,STATUS
45BC DD7E03    00380          LD      A,(IX+03)       ;GET LINES/PAGE REF.
45BF DD9604    00390          SUB     (IX+04)         ;SUB. # LINES PRINTED
45C2 47        00400          LD      B,A             ;SET UP LOOP COUNTER
45C3 CDEE45    00410 AGN1     CALL    STATUS          ;IS PRINTER READY
45C6 20FB      00420          JR      NZ,AGN1         ;IF NOT GO BACK & CK AGN
45C8 3E0A      00430          LD      A,0AH           ;SET OUTPUT CHAR = <LF>
45CA 32E837    00440          LD      (37E8H),A       ;OUTPUT CHAR TO PRINTER
45CD 10F4      00450          DJNZ    AGN1            ;REPEAT TILL TOP OF FORM
45CF 1818      00460          JR      RSTLC           ;JP TO RESET LINE COUNTER
               00470
               00480 ;******** OUTPUT CHARACTER ROUTINE  *******
               00490
45D1 F5        00500 OUTCHR   PUSH    AF              ;SAVE CHAR
45D2 CDEE45    00510 AGN2     CALL    STATUS
45D5 20FB      00520          JR      NZ,AGN2
45D7 F1        00530          POP     AF              ;RESTORE OUTPUT CHAR
45D8 32E837    00540          LD      (37E8H),A       ;OUTPUT CHAR TO PRINTER
45DB FE0D      00550          CP      0DH             ;IS IT <CR>?
45DD C0        00560          RET     NZ              ;RETURN IF NOT
               00570
               00580 ;*******  CHECK FOR END OF PAGE  *******
               00590
45DE DD3404    00600          INC     (IX+04)         ;INC LINE COUNTER
45E1 DD7E04    00610          LD      A,(IX+04)       ;GET COUNT VALUE
45E4 DDBE03    00620          CP      (IX+03)         ;IS COUNTER = REFERENCE?
45E7 79        00630          LD      A,C             ;RESTORE CHAR BEFORE RET
45E8 C0        00640          RET     NZ              ;RETURN IF  L.C. <> REF.
45E9 DD360400  00650 RSTLC    LD      (IX+04),00      ;RESET LINE COUNTER
45ED C9        00660          RET
               00670
               00680 ;*******   STATUS  *******
               00690
45EE 3AE837    00700 STATUS   LD      A,(37E8H)       ;GET PRINTER INTERFACE
               00710                                  ; STATUS WORD
45F1 E6F0      00720          AND     0F0H            ;MASK OUT L.S.B.
45F3 FE30      00730          CP      30H             ;IS PRINTER READY?
45F5 C9        00740          RET

AGN1    45C3    AGN2    45D2    OUTCHR  0000    OUTCHR  45D1    RSTDC
        45E1

        STATUS  45EE
```

Listing 2. Patch for EDTASM.

```
               00100 ;*****************************************************
               00110 ;*          (LF) ON (CR) PATCH FOR EDTASM                *
```


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```
                00120 ;*************************************************************
                00130
                00140 ; BY  JOHN T. BLAIR  WA4OHZ
                00150
                00160 ;       THIS PATCH IS DESIGNED TO WORK WITH THE EDTASM
                00170 ; PROGRAM AND A PRINTER / INTERFACE LOCATED AT 37E8H.
                00180 ; THE MAIN PORTION OF THE PROGRAM IS THE PRINTER DRIVER
                00190 ; IN EDTASM WHICH RESIDES FROM 45AAH - 45F5H. WHICH IS
                00200 ; IDENTICAL TO THE ONE IN ROMS  058DH - 05D8H.
                00210 ;       THE PATCH  INSERTS THE <LF> IF A <CR> WAS THE
                00220 ; LAST CHARACTER OUTPUTTED. IT THEN CHECKS THE LINE
                00230 ; COUNTER LOCATED AT 4314H AND COMPARES IT TO A
                00240 ; ** CONSTANT ** (52D) REFERENCE TO DETERMINE IF A <FF> IS
                00250 ; NEEDED. IF NOT IT THEN INCREMENTS THE LINE COUNTER AT
                00260 ; 4314H.
                00270 ; NOTE: THE " IX " REG. = 4310H. THEREFORE, (IX+03)
                00280 ; CONTAINS THE TOTAL NUMBER OF LINES A PAGE WILL HOLD.
                00290 ; THIS IS SET TO 66 DECIMAL. IF PAGE LENGTH IS LESS THAN
                00300 ; 66 THIS CELL MUST BE CHANGED. THIS CONTROLS THE NUMBER
                00310 ; OF <LF>S OUTPUTTED FOR A <FF>.
                00320 ;       THE <LF> PATCH IS INSERTED IN THE EDTASM'S
                00330 ; KEYBOARD DRIVER ROUTINE WHICH RESIDES FROM 43EFH-445FH.
                00340 ; THE EDTASM'S KEYBOARD DRIVER IS REPLACED WITH A CALL
                00350 ; TO THE LEVEL II ROMS.
                00360 ;       THE ENTIRE PRINTER DRIVER WAS NOT CALLED FROM
                00370 ; ROMS BECAUSE IT COULD NOT BE EASILY MODIFYED FOR THE
                00380 ; <LF> AFTER <CR>, NOR COULD YOU GET A <FF> AT THE END OF
                00390 ; " X " NUMBER OF LINES.
                00400
                00410
                00420 ;*************************************************************
                00430 ;*       " LINK " TO AUTO LINE FEED AND FORM FEED            *
                00440 ;*************************************************************
                00450
                00460 PATCH   EQU     4400H           ;STARTING ADDRESS OF THE
                00470                                 ;<LF> PATCH.
                00480
                00490         ORG     45DDH           ;REPLACE ALL AFTER THE
                00500                                 ;"CP  0DH " INSTRUCTION
                00510                                 ;NEAR THE END OF EDTASM'S
                00520                                 ;PRINTER DRIVER WITH 00H.
                00530
                00540         JP      Z,PATCH         ;JUMP TO THE PATCH IF THE
                00550                                 ;<CR> WAS SENT.
                00560         RET
                00570
                00580
                00590 ;*************************************************************
                00600 ;*          KEYBOARD DRIVER PATCH                            *
                00610 ;*************************************************************
                00620
                00630 KYBRD   EQU     03E3H           ;ROM KEYBOARD ROUTINE
                00640
                00650         ORG     43EFH   ;START OF KEYBOARD DRIVER PATCH
43EF C3E303     00660         JP      KYBRD   ;CALL ROM KEYBOARD ROUTINE
43F2 00         00670         NOP
43F3 00         00680         NOP
                00690
                00700
                00710 ;*************************************************************
                00720 ;*            LINE FEED PATCH                                *
                00730 ;*************************************************************
                00740
45EE            00750 STATUS  EQU     45EEH           ;PRINTER READY CHECK.
45B6            00760 GENFF   EQU     45B6H           ;FORM FEED FROM EDTASM
                00770
4400            00780         ORG     4400H           ;START OF <LF> PATCH
                00790
4400 CDEE45     00800 AGN1    CALL    STATUS          ;IS PRINTER READY? THIS
                00810                                 ;SECTION CALLED "STATUS"
                00820                                 ;FROM THE EDTASM PRINTER
                00830                                 ;DRIVER ROUTINE.
4403 20FB       00840         JR      NZ,AGN1         ;IF NO  CHECK TILL READY
4405 3E0A       00850         LD      A,0AH           ;SET OUTPUT CHAR = <LF>
4407 32E837     00860         LD      (37E8H),A       ;OUTPUT CHAR TO PRINTER
440A DD3404     00870         INC     (IX+04)         ;INC. THE LINE COUNTER
440D DD7E04     00880         LD      A,(IX+04)       ;GET VAL OF LINE COUNTER
4410 FE32       00890         CP      50D             ;THIS IS THE * CONSTANT *
                00900                                 ;WHICH SET THE NUMBER OF
                00910                                 ;LINES PER PAGE.
4412 79         00920         LD      A,C             ;RESTORE PRINT CHAR FOR
                00930                                 ;EXIT
4413 C0         00940         RET     NZ              ;RETURN IF NO
                00950
                00960
                00970 ;*************************************************************
                00980 ;*                        FORM FEED                          *
                00990 ;*************************************************************
                01000
                01010 ;       THERE ARE TWO FORM FEED OPTIONS PRESENTED HERE.
                01020 ;  1)  THE ROUTINE AT LINE 1070 IS FOR A PRINTER LIKE THE
                01030 ; DATEL 1030 WHICH "DOES NOT" RECOGNIZE A <FF>.
                01040 ;  2)  THE ROUTINE AT LINE 1120 IS FOR A PRINTER LIKE THE
                01050 ; HEATH H-14 WHICH "DOES" RECOGINZE A <FF>  0CH.
                01060
                01070 ;       ******  MANUAL FORM FEED  ******
                01080
```

section. After every character is printed OUTCHR is checked to see if a <CR> was sent. If not it returns to the calling program. If the last character is a <CR> then the line counter is incremented. This is where a Jump (JP) to the patch will be inserted (the "LINK" section in Listing 2). Next a block of unused memory is needed in which to store the line and form feed patch.

Unfortunately, there is no spare memory in the EDTASM. Consequently, the space must be generated. Since the keyboard routine (43EF-445FH) is also located down in ROM, the EDTASM's can be zeroed. Because the EDTASM calls the keyboard driver, a Jump to the keyboard is used. (See Listing 2, Keyboard Driver Patch.) All that remains is to insert the line and form feed patch. (Refer to Listing 2, Line Feed Patch.)

There are two form feed routines provided. The first is manual, and outputs line feeds using the top of form coding in the EDTASM printer driver. This is for printers that do not recognize a form feed (0CH). The second is an automatic routine for printers that recognize a <FF>, and simply outputs a 0CH to the printer.

Number of Lines to a Page

To change the number of lines to a page using the manual form feed above, the contents of 4313H must be changed. It is preset to 66 in the EDTASM program. Using the monitor examine the contents of 4313H and change it to the desired value.

The auto form feed outputs a 0CH command to the printer. Therefore, consult the printer manual for instruction on how to change the length of a page.

TRS-232 Interface

For the readers still thinking about a printer and interface, let me say a word about the TRS-232 interface by Small System Software. It is designed to be plugged into the audio output cable from the TRS-80, and drive a slow, RS-232, serial input printer, like a model 33 teletype. It sells for about $50 ready to run with cassette for the software.

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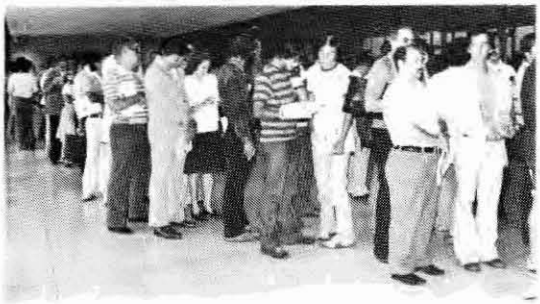

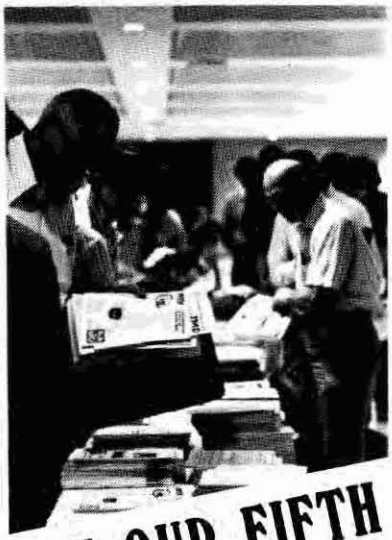

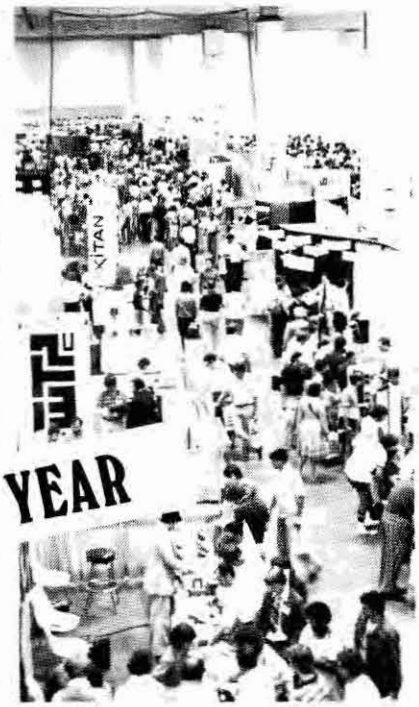

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✓Reader Service index—see page 194

there is no handshake between the printer and the TRS-80. This means that if the baud rate gets too high, the printer misses data during the head-retract. (NOTE: This article was written, and so were the listings, using Electric Pencil, EDTASM and the TRS-232 interface at 600 baud.)

The interface is housed in a small box with a power cord to a transformer which plugs into an AC outlet and a DB-25 connector to attach to your printer. The interface consists of an OP-AMP used as a level shifter from Transistor Transistor Logic (TTL), 0 to 5 Volts DC, to RS-232, +12 to −12 Volts DC. The parallel to serial conversion is performed with a software driver, which honors the LLIST and LPRINT commands in BASIC, and resides in high core memory. However, the EDTASM does not honor Protected Memory, and consequently the TRS-232 software must be jammed into some area of the EDTASM program.

As before, the EDTASM's keyboard routine is deleted to

```
4414 CDB645   01090          CALL    GENFF    ;CALL <FF> FROM EDTASM
4417 C9       01100          RET
              01110
              01120 ;        ******  AUTO FORM FEED  ******
4418 CDEE45   01130 AGN2     CALL    STATUS           ;IS PRINTER READY?
441B 20FB     01140          JR      NZ,AGN2          ;NO  CK TILL READY
441D 3E0C     01150          LD      A,0CH            ;SET OUTPUT CHAR = <FF>
441F 32E837   01160          LD      (37E8H),A        ;OUTPUT CHAR TO PRINTER
4422 79       01170          LD      A,C              ;RESTORE PRINTER CHAR
4423 C9       01180          RET
              01190
0000          01200          END
00000 TOTAL ERRORS

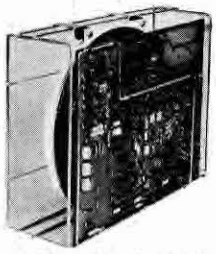
AGN1    4400     AGN2    4418     GENFF   45B6     KYBRD   03E3     PATC@   0000

PATC@   4400     PATCH   4400     STATUS  45EE
```

Listing 3. TRS-232 Printer Driver Incorporated into EDTASM.

```
00100 ;*****************************************************
00110 ;*   MODIFICATION TO EDTASM INCORPORATING THE TRS-232   *
00120 ;*                PRINTER DRIVER ROUTINE               *
00130 ;*****************************************************
00140
00150 ; MODIFICATION BY JOHN T. BLAIR WA4OHZ
00160
00170 ;        THIS PATCH IS DESIGNED TO INCORPORATE THE TRS-232
00180 ; PRINTER DRIVER ROUTINE INTO THE EDTASM.  THE KEYBOARD
00190 ; ROUTINE IS REPLACED BY USING THE ONE IN ROM. THE TRS-232
00200 ; DRIVER IS THEN STORED IN THE REMAINING KEYBOARD ROUTINE
00210
00220
00230 ;*****************************************************
00240 ;*               KEYBOARD DRIVER PATCH                *
00250 ;*****************************************************
00260
00270
```

PRIAM Hard Disks Now Available from SIRIUS SYSTEMS!



PRIAM's high-performance, low-cost Winchester disc drives speed up throughput and expand data storage from 20 megabytes to 154 megabytes. And a single controller can be used to operate 14-inch-disc drives with capacities of 33, 66, or 154 megabytes or floppy-disc-size drives holding 20 and 34 megabytes. So it's easy to move up in capacity, or reduce package size, without changing important system elements or performance.

- *Fast, Linear Voice Coil Positioning*
- *10 ms track-to-track positioning*
- *Fully servoed head positioning*
- *Dedicated servo tracks*
- *DC Power required only!*
- *Simple, parallel Interface*
- *Optional SMD Interface*
- *50 ms Average Positioning time*
- *90 ms Maximum Positioning Time*
- *6.4 ms Average Latency*

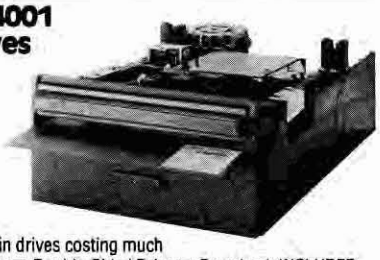
THE PRIAM LINEUP

Model/Disc Size	Capacity	Size	Weight	Price
DISKOS 3350 (14")	33Mbytes	7" × 17" × 20"	33 lbs.	$2995
DISKOS 6650 (14")	66 Mbytes	7" × 17" × 20"	33 lbs.	$3749
DISKOS 15450 (14")	154 Mbytes	7" × 17" × 20"	33 lbs.	$4695
DISKOS 2050 (8")	20 Mbytes	4.62" × 8.55" × 14.25"	20 lbs.	$2995
DISKOS 3450 (8")	34 Mbytes	4.62" × 8.55" × 14.25"	20 lbs.	$3745
DISKOS 570	5.3 Mbytes	floppy-size	(low)	(low)
DISKOS 1070	10.6 Mbytes	floppy-size	(low)	(low)

All PRIAM DISKOS Drives have a Transfer Rate of 1.03 Mbytes/Sec.
Optional SMD interface available for $150.

SIRIUS SYTEMS offer cases and enclosures for all PRIAM Hard Disk Drives. All 14" Winchester Drives will mount in our 14" Standard Case. The 8" Winchesters have two alternatives: a single drive case and a dual drive case. All SIRIUS SYSTEMS Winchester drive cases include Power Supply, internal cabling, switches, fan, extra AC outlet (not switched, but fused) and possess very adequate ventilation. Drive addressing is done on the rear of the Case and not on the drive iteself to provide ease of use during operation. All WINCHESTER DRIVE Cases are Warranted for a full year and come in our standard blue-black color scheme. Consult us for current availability and pricing.

Remex RFD 4000/4001 8" Floppy Disc Drives Double sided . . . Double density!!



$549.95

RFD 4001, $569.95

Offers quality and features found in drives costing much more! ■ Single or Double Density ■ Double-Sided Drive ■ Door Lock INCLUDED ■ Write-Protect INCLUDED ■ 180 Day Warranty ■ Compatible with Shugart 850/851 ■ Low Power Operation ensures LONGER LIFE!! ■ Model RFD 4001 offers Data and Sector Separator

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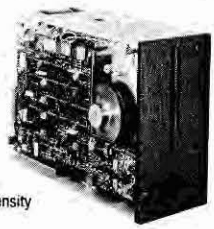
Remex 1000B . . . If you've been looking for a less expensive floppy disc drive, but not wanting to sacrifice quality — this is it!



$419.95

You get both in the Remex 1000B! For only $419.95 look at what you get: ■ 8" Floppy Drive ■ Single or Double Density ■ Hard or Soft Sectoring ■ Media Protection Feature ■ Single Density Data Separator ■ 180 Day Factory Warranty

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SIRIUS 80+

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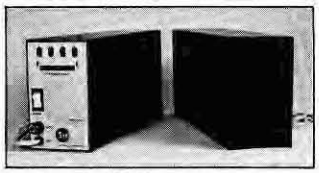

The SIRIUS SYSTEMS 80+ Series of Floppy Disk add-ons are designed to provide unmatched versatility and performance for your computer. Consisting of four different add-ons, there is a 80+ Series Floppy Disk to meet your need. All 80+ Series Floppy Disk are compatible with the TRS-80* and come ready to plug in!

COMMON CHARACTERISTICS

- *5 ms track-to-track access time*
- *Auto-eject*
- *180 day WARRANTY*
- *Exceptional speed stability — 1½%*
- *Single density (FM) or double density (MFM/M²FM)*
- *Ultra high reliability*
- *2 year Power Supply Warranty*
- *Mix any or all 80+ Series on the same cable!*
- *Includes user accessible plugboard for drive reconfiguring*

SPECIFIC CHARACTERISTICS

The **SIRIUS 80+1** is a single sided, 40 track, highly reliable Floppy Disk add-on. Offering 5 more tracks than the Radio Shack model, it cost $140 less! Formatted data storage is 102K/20K bytes single/double density.

SIRIUS 80+1 . . . . . **$359.95**

The **SIRIUS 80+2** is a dual sided, 70 track (35 per side), highly versatile Floppy Disk unit. It appears to the TRS-80* as TWO 35 track drives, yet COST LESS THAN HALF THE PRICE! Even greater savings result, since data is recorded on both sides of the media instead of only a single side. Using the plug board, it may be reconfigured for other computer systems! (The 80+2 operates as Drive 0 and any of the other three addresses (with the sandard Radio Shack Cable) or as any of four drives (with the SS Standad Cable).) Formatted data storage is 80.6K/161.2K bytes single/double density.

SIRIUS 80+2 . . . . . **$449.95**

The **SIRIUS 80+3** is a single sided, 80 track, "Quad" density Floppy Disk unit. Offering 2⅓ times the storage of a Standard Radio Shack drive, the 80+3 greatly reduces the need for diskettes correspondingly. Additionally, because of the increased storage and faster track-to-track access time, the 80+3 allows tremendously increased throughput for disk based programs!!! The 80+3 INCLUDES SIRIUS's TRAKS-PATCH on Diskette. Formatted data storage is 204K/40K8 bytes single/double density.

SIRIUS 80+3 . . . . . **$489.95**

The **SIRIUS 80+4** Floppy Disk add-on is a double sided, 160 track (80 per side), 5¼" monster! The ultimate in state-of-the-art 5¼" Floppy Disk technology, to 80+4 is seen by the TRS-80* as two single sided disk drives, each with 80 tracks. Thus, in terms of capacity one 80+4 is equivalent to 4⅔ standard Radio Shack drives — a savings of over 73% (not to mention diskettes!!!). (With a double density converter, the available memory is huge!) The 80+4 is similar to the 80+2 in that it arrives configured as Drive 0 and any of the other three addresses (with the standard Radio Shack Cable) or as any of four drives (with the SS Standard Cable). The 80+4 INCLUDES TRAKS-PATCH on Diskette. (The plug board is also included.) Formatted data storage is 408K single density or 816K bytes double density.

SIRIUS 80+4 . . . . . **$624.95**

All 80+ Series Floppy Disk add-ons operate a 5 milliseconds track-to-track access time (eight times faster than the SA 400) but are Expansion Interface Limited to 12 milli-seconds for the TRS-80*.

*TRS-80© Tandy Corp.

MPI 51/52 . . .

A Great Reliable Mini-Drive!

- *Fast! 5ms track to track access*
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MPI 51
(Single Head, 40 tracks, 120K/240K bytes Single/Double Density**) **$259.95**

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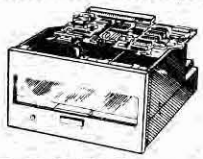
(Dual Head, 70 tracks, (35/side), 218.8K/437.5K Single/Double Density**) **$349.95**



MPI 91/92 . . . NEW STATE-OF-THE-ART DISK DRIVE!

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(Single Head, 80 tracks, 240K/480K Single/Double Density**) **$389.95**

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The SIRIUS OMEGA Series Controller Module utilizes an **on-board microprocessor** to mediate data transfer to a wide variety of peripherals from an equally wide variety of host computer systems. Up to four Winchester Hard Disks (8" or 14"), four 5¼" Floppy Disks Drives and/or up to eight 8" Floppy Disk Drives may be **in use at one time.** Host systems interfacing is accomplished via a parallel or a serial interface. With the additon of a Personality module, the OMEGA Series Controller Module is directly **compatible with many popular computer systems** (among them the TRS-80*, Apple, Heath, and others). Provision is made for the addition of a streaming tape drive, also.

SPECIFIC HARDWARE FEATURES INCLUDE:

- *Control of up to twelve Floppy Disk Drives (eight 8" and/or four 5¼")*
  - *8" and/or 5¼" Disk Drive Utilization*
  - *Single (FM) or Double (MFM) density data storage*
  - *Hard or Soft sectored diskette usage*
  - *Utilization of "Quad" density (96 tpi) 8" or 5¼" Disk Drives*
- *Control of up to four WINCHESTER type PRIAM DISKOS Disk Drives*
  - *8" or 14" may intermix on the same cable*
  - *Accommodates 8" and/or 14" drives of 5.3Mbytes to 154Mbytes*
  - *Ultra-Fast data transfers*
- *Extremely flexible host-controller interfacing*

SPECIFIC SOFTWARE FEATURES INCLUDE:

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Dedicated systems cards are also available on a limited basis for the STD-BUS and the S 100. These cards feature shared memory also (again, software selectable) in addition to the regular OMEGA Series Controller Module features. Consult SIRIUS SYTEMS for current price and availability for the entire line of OMEGA Series Memory Units and Controllers. **Dealer inquiries are invited.**

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SIRIUS SYSTEMS

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```
03E3            00280 KYBRD   EQU     03E3H   ;ROM KEYBOARD ROUTINE
                00290
43EF            00300         ORG     43EFH   ;START OF KEYBOARD DRIVER PATCH
                00310
43EF C3E303     00320         JP      KYBRD   ;TRANSFER TO ROM KEYBOARD ROUTINE
                00330
                00340
                00350 ;*****************************************************
                00360 ;*                TRS-232 PRINTER DRIVER             *
                00370 ;*****************************************************
                00380
                00390
                00400 ;       THE TRS-232 PRINTER DRIVER SHOULD BE PLACED HERE.
                00410 ; DO NOT FORGET THAT THIS PROGRAM PROVIDES SELECTABLE:
                00420 ;       1) LINE FEED ON CARRIAGE RET
                00430 ;       2) HEAD RETRACT DELAY
                00440 ;       3) LINE SPACING
                00450 ;       4) BAUD RATE
                00455
                00460         ;BE SURE THAT YOU CONSULT THE TRS-232 MANUAL AND
                00470 ; INCORPORATE THE PROVISIONS YOU DESIRE.
                00480
                00490 ;*****************************************************
                00500 ;*             " LINK "   TO NEW PRINTER DRIVER      *
                00510 ;*****************************************************
                00520
                00530
43F5            00540 PATCH   EQU     43F5H   ;STARTING ADDRESS OF TRS-232
                00550
                00560
45AA            00570         ORG     45AAH   ;STARTING ADDRESS OF " LINK "
                00580
45AA C3F543     00590         JP      PATCH   ;TRANSFER TO TRS-232
                00600
                00610
0000            00620         END
00000 TOTAL ERRORS
CYBRD   0000     CYBRD   03E3     CYBRD   03E3     PATC@   43F5
```

give you the needed memory area for the TRS-232 printer driver. A Jump to 03E3H is inserted at 43EF as the first instruction of the EDTASM keyboard routine (Listing 3). This transfers the program flow down to the ROMs for the keyboard driver.

Now comes the hard work. Enter the object code for the TRS-232 printer driver routine starting at 43F5H. Don't forget to insert the proper hex code for your desired baud rate from the hex table on page 5 of the TRS-232 manual. You should have three bytes of 00H at 43F2-43F5H and one byte at 445FH that are still NOPs (00H). Boy, that was close.

All that is left to do is link the new driver routine to the printer routine in the EDTASM program.

To link the new printer driver to the old one in the EDTASM, zero the old printer driver. It resides from 45AA-45F5H. Examine 45AB-45ADH and replace the 00Hs with a jump to 43F5: C3 F5 43.

Now that wasn't so bad, he said, as the sweat rolls off his forehead. All that is left to do is save a copy of this modified version of EDTASM, using the PUNCH command of your monitor.

The only shortcoming of this modification is that it cannot generate a form feed.

Form Feed for EDTASM/TRS-232

A program that gives you a form feed can be located where the EDTASM's original printer driver was located. Refer to Listing 4 for the source of this modification.

Again, as in all modifications, you must link from the main program to the patch. This is accomplished by the LINK section, by replacing the CP CR and the JRZ,NULLS instructions with a jump to the form feed patch.

The first two instructions in the form feed routine must be the two instructions we replace by the LINK. If the last character printed is not a <CR>, the program flow is transferred back to the TRS-232 program. If the last character is a <CR>, the line counter (established at 4029H,

Listing 4. Form Feed for TRS-232.

```
                00100 ;*****************************************************
                00110 ;*            FORM FEED  FOR EDTASM / TRS-232        *
                00120 ;*****************************************************
                00130
                00140 ;BY  JOHN T. BLAIR  WA4OHZ
                00150
                00160
                00170 ;       THIS PROGRAM IS DESIGNED TO GIVE THE TRS-232
                00180 ; PRINTER DRIVER THE CAPABILITY OF GIVING A FORM FEED
                00190 ; AFTER A PRESET NUMBER OF LINES.
                00200
                00210
                00220 ;*****************************************************
                00230 ;*                 " LINK "   TO FORM FEED           *
                00240 ;*****************************************************
                00250
                00260 ;       THIS SECTION IS USED TO  " LINK " TO THE FORM
                00270 ; FEED PATCH.
                00280
                00290
4454            00300         ORG     4454H           ;REPLACES THE " CP <CR> "
                00310                                 ;AT LINE 1750.
4454 C38045     00320         JP      FRMFED          ;GOTO FORM FEED
4457 00         00330         NOP
                00340
                00350
                00360 ;*****************************************************
                00370 ;*                      FRMFED                       *
                00380 ;*****************************************************
                00390
                00400
                00410 ;       THIS SECTION GENERATES A FORM FEED AFTER A <CR>
                00420 ; IF THE CORRECT NUMBER OF LINES HAVE BEEN PRINTED. THE
                00430 ; NUMBER OF LINES PRINTED CAN BE CHANGED IN LINE 600
                00440 ; AND THE NUMBER OF LINES BETWEEN PAGES CAN BE CHANGE IN
                00450 ; LINE 670.
                00460
441E            00470 NULLS   EQU     441EH           ;LINE 1430 IN TRS-232
43FE            00480 COUNT   EQU     43FEH           ;LINE 1220 IN TRS-232
445B            00490 EXIT    EQU     445BH           ;LINE 1790 IN TRS-232
                00500
45B0            00510         ORG     45B0H
                00520
45B0 FE0D       00530 FRMFED  CP      0DH             ;THESE ARE THE TWO LINES
45B2 C25844     00540         JP      NZ,4458H        ;REPLACED BY THE JP IN
                00550                                  ;TRS-232 BY THE " LINK "
                00560 ; RETURN TO TRS-232 AT LINE 1770
                00570
45B5 3A2940     00580         LD      A,(4029H)       ;GET LINE COUNTER
```

the L.C. for the ROM printer driver) is incremented and checked against a constant.

This constant controls the number of printed lines on the page. In the source listing it is set to 54 lines per page. If the end of page is not reached, program control returns to the TRS-232. When the end of a page is reached, line XXXX controls the number of line feeds sent to space between pages.

After the top of form has been executed the line counter is reset. This completes the printer modifications to the EDTASM.

EDTASM and Protected Memory

The ENTRY point (cold start) to EDTASM is 468AH, and the execution of this coding checks the memory, sets up the stack and some of the pointers (See Listing 5).

The text buffer, where text can start, is the first item taken off. It is 5CF9H and this value is stored in cell 4115H. The memory test resides at 4693-469FH, and the end of memory

```
45B8 3C        00590          INC     A                ;BUMP COUNTER BY 1
45B9 FE22      00600          CP      34D              ;54 LINES PRINTED?
45BB 2806      00610          JR      Z,GENFF
45BD 322940    00620          LD      (4029H),A        ;STORE NEW COUNTER VALUE
45C0 C31E44    00630          JP      NULLS            ;RETURN TO TRS-232 AND
               00640                                   ;OUTPUT NULLS IF REQUIRED
               00650 ;******** GENFF  ********
               00660
45C3 060E      00670 GENFF    LD      B,14D             ;SET # OF <LF> BETWEEN
               00680                                    ;PAGES
45C5 C5        00690 AGN      PUSH    BC                ;SAVE LOOP COUNTER
45C6 3E0A      00700          LD      A,0AH             ;SET OUTPUT CHAR = <LF>
45C8 CDFE43    00710          CALL    COUNT             ;TRS-232 OUTPUTS CHAR
45CB 3E00      00720          LD      A,00H             ;SET OUTPUT CHAR = 00
               00730                                    ;AS A DELAY FOR MECHANICS
45CD CDFE43    00740          CALL    COUNT             ;OUTPUT CHAR
45D0 C1        00750          POP     BC                ;RESTORE LOOP COUNTER
45D1 10F2      00760          DJNZ    AGN               ;REPEAT FOR # OF <LF>
45D3 3E00      00770          LD      A,00H             ;RESET THE LINE COUNTER
45D5 322940    00780          LD      (4029H),A         ;TO ZERO
45D8 C35B44    00790          JP      EXIT              ;EXIT TRS-232
               00800
0000           00810          END
00000 TOTAL ERRORS
AGN     45C5    COUNT   43FE    EXIT    445B    FRMFED  45B0    FUDDS   4416
FUDLS   441E    GEFFF   45C3
```

```
               00100 ;*****************************************************
               00110 ;*                EDTASM   INITIALIZATION            *
               00120 ;*****************************************************
               00130
               00140 ;   DOCUMENTED  BY  JOHN T. BLAIR  WA4OHZ
               00150
               00160
468A           00170          ORG     468AH   ;COLD START, INITALIZATION
               00180
468A 21F95C    00190          LD      HL,5CF9H          ;START OF TEXT ADDRESS
468D 221541    00200          LD      (4115H),HL        ; START OF TEXT POINTER
```


✓Reader Service index—see page 194

```
4690 36FF      00210          LD      (HL),0FFH       ;FILL ALL BITS WITH 1'S
4692 23        00220          INC     HL              ;BUMP MEMORY POINTER
4693 36FF      00230          LD      (HL),0FFH
               00234
               00236 ;        ******  MEMORY TEST  ******
               00238
4695 23        00240 AGN1     INC     HL              ;BUMP MEM POINTER
4696 7E        00250          LD      A,(HL)          ;GET CHAR FROM MEM
4697 47        00260          LD      B,A             ;*  " B " = TEMP
               00261                                  ;STORAGE OF CHAR
4698 2F        00270          CPL                     ;A = A*  CHANGE ALL 1'S
               00280                                  ;TO 0'S & ALL 0'S TO 1'S
4699 77        00290          LD      (HL),A          ;STORE " A " IN MEM
469A BE        00300          CP      (HL)            ;A = A*?  ALL BITS CHANGE
               00302                                  ;INDICATING GOOD MEM CELL
               00304                                  ;IF NO MEM CELL PRESENT
               00306                                  ;CHAR = FFH.
469B 70        00310          LD      (HL),B          ;RESTORE ORG. CONTENTS
               00320                                  ;OF THAT MEM CELL
469C 28F7      00330          JR      Z,AGN1          ;GOOD CELL  CONTINUE CK
469E 2B        00340          DEC     HL              ;BACK UP POINTER TO LAST
               00350                                  ;GOOD MEM CELL.
469F 221110    00360          LD      (4113),HL       ;SET END OF MEM POINTER
               00370
               00380
46A2 210A00    00390          LD      HL,000AH        ;NOT SURE WHAT IS GOING
               00392                                  ;ON HERE.
46A5 221510    00400          LD      (4117),HL       ;       "
46A8 210041    00410          LD      HL,4100H        ;       "
46AB 3601      00420          LD      (HL),01H        ;       "
46AD 23        00430          INC     HL              ;       "
46AE 360D      00440          LD      (HL),0DH        ;       "
46B0 31FE42    00450          LD      SP,42FEH        ;SET STACK POINTER
46B3 AF        00460          XOR     A               ;CLEAR  " A"
46B4 32BA41    00470          LD      (41BAH),A
46B7 32BC41    00480          LD      (41BCH),A
46BA 32E437    00490          LD      (37E4H),A
46BD 322840    00500          LD      (4028H),A       ;CASSETTE CONTROL STORAGE
46C0 D3FF      00510          OUT     (0FFH),A        ;SET 64 CHAR./LINE VIDEO
46C2 3E1C      00520          LD      A,1CH           ;HOME COURSOR
46C4 CD3947    00530          CALL    4739H
46C7 3E1F      00540          LD      A,1FH           ;CLEAR SCREE
46C9 CD3947    00550          CALL    4739H
46CC 3E0E      00560          LD      A,0EH           ;TURN ON CURSOR
46CE CD3947    00570          CALL    4739H
46D1 21C948    00580          LD      HL,48C9H        ;POINT TO START OF SIGN
               00590                                  ;ON  MESSAGE.
46D4 CD2F47    00600          CALL    472FH           ;OUTPUT MESSAGE
46D7 CD3747    00610          CALL    4737H
46DA 31FE42    00620          LD      SP,42FEH        ;**** WARM START ****
               00630                                  ;END OF INITIALIZATION
               00640                                  ;ROUTINE.
0000           00650          END
00000 TOTAL ERRORS

AGN1  4595
```

Listing 5. EDTASM's Initialization.

```
               00100 ;*****************************************************
               00110 ;*                EDTASM PROTECTED MEMORY                *
               00120 ;*****************************************************
               00130
               00140 ;        BY  JOHN T. BLAIR  WA4OHZ
               00150
               00160 ;        THIS PROGRAM WILL ALLOW EDTASM TO HONOR PROTECTED
               00170 ; MEMORY. THE MEMORY SIZE IS SET ON POWER UP IN BASIC.
               00175
               00180 ;        THIS PROGRAM REPLACES THE EDTASM'S MEMORY CHECK.
               00190
4693           00200          ORG     4693H
               00210
4693 21B140    00220          LD      HL,40B1H        ;POINT TO BASIC'S
               00230                                  ;PROTECTED MEMORY POINTER
4696 111341    00240          LD      DE,4113H        ;EDTASM'S END OF MEMORY
               00250                                  ;POINTER
4699 7E        00260          LD      A,(HL)          ;GET LEAST SIGNIFICANT
               00270                                  ;BYTE OF THE ADDRESS
469A 12        00280          LD      (DE),A          ;STORE IT
469B 2C        00290          INC     L               ;POINT TO NEXT BYTE
469C 1C        00300          INC     E               ;BUMP EDTASM'S POINTER
469D 7E        00310          LD      A,(HL)          ;GET NEXT BYTE OF ADDRESS
469E 12        00320          LD      (DE),A          ;STORE IT
               00330
0000           00340          END
00000 TOTAL ERRORS
```

Listing 6. EDTASM and Protected Memory.

pointer is cell 4113H. As you can see, the EDTASM uses the reserved section of RAM, but unfortunately the pointers for BASIC are 40B1/40B2H and 40D6/40D7H.

To get the EDTASM to honor protected memory, you must delete its memory test, 4693-469FH. (Normally, this is not a very good idea, but when the TRS-80 is powered up the ROMs do a memory test.) Then insert the patch in Listing 6. All this routine does is copy the contents of 40B1 and 40B2H into 4113 and 4114H.

Reentering BASIC

When the B key is entered in the EDTASM, the program jumps to the address contained at cells 4930 and 4931H. Since, the warm start, reentry point, for BASIC is 1A19H, all that is required is to change the contents of 4930 to 19 and the contents of 4931 to 1AH. (Remember that the Z-80 CPU always reads the first byte of an address as the Least Significant Byte.)

If you are using a monitor and wish to work on the EDTASM, then Jump back to your monitor, instead of reentering BASIC at 4930 and 4931H, insert the starting point of the monitor.

Reentering EDTASM

Have you ever accidently jumped out of the EDTASM, or gotten a power glitch and returned to "MEMORY SIZE"? This is frustrating especially after working for an hour or more on a program. Wouldn't it be nice if you could reenter EDTASM and still have your text?

EDTASM's warm restart is located at 46DAH. At this point the only pointer that is reset is the STACK, therefore, all of the text pointers are intact. To reenter EDTASM from BASIC, enter SYSTEM <ENTER>, then after it prompts " *? " enter /18141<ENTER>.

From monitor, use its GO (G) or Jump (J) instruction and jump to 46DAH. If you did not enter the program in Listing 6, you can replace EDTASM's memory check with the program in Listing 7. This program will load the SYSTEM entry pointer (40DF and 40E0H) with the warm re-

	EDTASM	BASIC	Description
1.	4318H	01D9H	Baud rate generator
2.	4338H	01F8H	Turn off cassette
3.	433DH	0215H	
4.	4346H	021EH	
5.	4354H	022CH	Flash asterisk
6.	435DH	0235H	Input 1 byte
7.	4369H	0241H	
8.	4389H	0264H	Output 1 byte
9.	43A9H	0284H	Turn on cassette
10.	43B8H	0293H	Find leader & sync byte

start vector. Now any time you exit EDTASM to BASIC, enter SYSTEM, and after the prompt " *? " enter / <ENTER>.

EDTASM's Device Control Block

1) 4300-4307H Keyboard
2) 4308-430FH Video
3) 4310-4317H Printer

The various driver routines are located at:

1) 43EF-445FH Keyboard
2) 4460-45A9H Video
3) 45AA-45F5H Printer

To replace all of the drivers, change the contents of 4615H to C2 and 4616H to 03. All of the coding between 43CEH and 45F6H can now be replaced by NOPs, leaving about 512 bytes for other modifications.

To gain another 400 bytes the cassette routines can also be deleted by calling the ROMs. This will require a little more work and a monitor with a Find (F) or Word (W) command. These commands search memory and find a 2-byte sequence. The calls to the various cassette routines must be found and replaced by the respective calls to ROM. The EDTASM to BASIC cassettes calls are:

The EDTASM routines that call the above starting addresses have to be found. Then the corresponding BASIC addresses have to be substituted.

Once the D.C.B.s and the CRT keyboard and printer drivers are replaced by ROM calls, the memory from 4300H to 45F5H can be deleted and is available for further EDTASM modifications.

The old cliché "Necessity is the Mother of Invention" is so very true. I use all the routines just described in some form or another. I have both a Datel 1030 IBM-based Selectric and a Heath H-14 printer on line to my TRS-80. Both are RS-232, serial printers.

The Datel is driven by a homebrew printer interface that provides both line feed on carriage return and adjustable head retract delay time.

The H-14 is presently driven by a TRS-232 interface. Although these printer programs don't cure all the printer ills, they sure go a long way to provide hard copy from the EDTASM. ■

```
                00100 ;*****************************************************
                00110 ;*                AUTO REENTERY TO EDTASM            *
                00120 ;*****************************************************
                00130
                00140 ;  BY  JOHN T. BLAIR WA4OHZ
                00160
                00170 ;        THIS PROGRAM IS USED TO INSERT THE WARM RESTART
                00180 ; VECTOR INTO THE ENTERY POINT POINTER, ALLOWING REENTERY
                00190 ; TO EDTASM WITHOUT LOSING ANY TEXT ALREADY IN THE BUFFER.
                00200 ;        TO REENTER EDTASM TYPE:
                00210 ;        " SYSTEM " <ENTER>
                00220 ;          *?   " / " <ENTER>
                00230
                00240
4693            00250          ORG     4693H
                00260
4693 21DA46     00270          LD      HL,46DAH        ;WARM RESTART ADDRESS
4696 22DF40     00280          LD      (40DFH),HL      ;STORE RESTART VECTOR IN
                00290                                  ;ENTERY POINT POINTER
4699 00         00300          NOP
469A 00         00310          NOP
469B 00         00320          NOP
469C 00         00330          NOP
469D 00         00340          NOP
469E 00         00350          NOP
0000            00360          END
00000 TOTAL ERRORS
```

Listing 7. Auto Reentry to EDTASM.

✓Reader Service index—see page 194

Use a BASIC program to take some of the pain out of machine code programming.

AUTOPOKE

Jasper E. Kump
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Pyatt AR 72672

One of the many advantages of TRS-80 Level II BASIC over Level I BASIC is the ability to use machine-language routines in conjunction with BASIC routines. Although it is a relatively easy language in which to write programs, in some cases, BASIC is inconveniently slow. On the other hand, machine-language routines will run fast enough for almost any purpose, but it is a much more difficult language to use.

In most programs the good features of both can be taken advantage of by combining the two. You can write the major part of the program in the much easier BASIC, using the much faster machine-language only for what would be, in BASIC, the time-consuming sections. I found that this system works very well. A few problems had to be solved first though.

Loading Machine Language

Normally, a machine-language program must be loaded using the SYSTEM command, but using both loaded methods would have been inconvenient. So I devised a loading method to load the machine-language routines with a BASIC routine and avoid the necessity of using the SYSTEM command. It would have been inconvenient also to have to load the T-BUG program every time I wanted to check and perhaps change a few locations in memory or write a machine-language routine.

The PEEK and POKE commands are too slow and cumbersome for this purpose. Besides, converting Z-80 instructions from hex to decimal for more than a number or two is a chore. I wrote the AUTOPOKE program as a solution to this problem and as an aid in writing the loading routine.

The method of loading machine-language routines with a BASIC routine requires writing data strings, which are prone to error. The second part to AUTOPOKE provides samples of what the data strings should look like—exact in the location of every letter, number and punctuation mark so that when you are writing a data string using the sample as a guide it is easy to spot some types of errors.

For example, if the last character on your line does not

```
64000 PRINT"    ALL ENTRIES IN THIS PROGRAM MUST BE IN
      HEXIDECIMAL NOTATION EXCEPT THE LINE NUMBER OF THE
       FIRST DATA STRING."
64010 PRINT:PRINT"IF YOU WANT TO ENTER A NEW LINE NUMBE
      R, ENTER X.
IF YOU WANT TO JUMP TO THE DATA STRING
       FORMAT SECTION, ENTER XX."
64100 PRINT:INPUT"ENTER THE ADDRESS YOU WANT TO EXAMINE
       OR CHANGE";A$:GOSUB64300:CLS
64110 D=Z:GOSUB64400:PRINTH$;" ";:D=PEEK(Z):GOSUB64400:
      PRINTH$;" ";:A$="":INPUTA$:IFA$=""THENZ=Z+1:GOTO64
      110
64120 IFA$="X"THEN64100
64130 IFA$="XX"THEN64200
64140 N=Z:GOSUB64300:POKEN,Z:Z=N+1:GOTO64110
64200 INPUT"ENTER THE FIRST ADDRESS OF THE ROUTINE.";A$
      :GOSUB64300:M=Z:INPUT"AND THE LAST ADDRESS.";A$:GO
      SUB64300:INPUT"ENTER THE DECIMAL LINE NUMBER OF TH
      E FIRST DATA STRING.";D$
64210 PRINT"THE DECIMAL STARTING ADDRESS IS";M:PRINT"TO
      TAL BYTES IN THE ROUTINE:";Z-M+1:INPUT"PRESS ENTER
       FOR THE LISTING OF THE FIRST 60 BYTES OF THE
ROUT
      INE EXACTLY AS IT SHOULD APPEAR IN A DATA STRING.";
      X:J=M:CLS
64220 PRINT">";D$;"DATA";:FORI=JTOJ+59:N=PEEK(I):IFI>ZT
      HEN64290
64230 IFN>99P$=RIGHT$(STR$(N),3):GOTO64260
64240 IFN>9P$=RIGHT$(STR$(N),2):GOTO64260
64250 P$=RIGHT$(STR$(N),1)
64260 PRINTP$;:IFI<J+59ANDI<ZPRINT",";
64270 NEXT:PRINT:INPUT"PRESS ENTER FOR THE NEXT 60 BYTE
      S.";A:J=J+60:X=VAL(D$)+10:Y=LEN(D$):D$=RIGHT$(STR$
      (X),Y):GOTO64220
64290 END
64300 F=16:Z=0:J=LEN(A$):FORK=1TOJ:B$(K)=MID$(A$,K,1):X
      =VAL(B$(K)):IFX>0THEN64330
64310 IFB$(K)="0"THEN64360
64320 X=ASC(B$(K))-55
64330 P=J-K
64340 IFP>0THENX=X*F:P=P-1:GOTO64340
64350 Z=Z+X
64360 NEXT:RETURN
64400 N=1:IFD>255N=3
64410 H$="":FORI=NTO0STEP-1:K=INT(D/F[I):D=D-K*F[I:IFK>
      9THENH$=H$+CHR$(K+55):NEXTELSEH$=H$+RIGHT$(CHR$(K+
      48),1):NEXT
64420 RETURN
```

Program listing

PROFESSIONAL

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↙Reader Service index—see page 194

match the last character on the corresponding line of the sample, you will know immediately that an error has been made. This will not detect a mistyped number, naturally, but it does detect errors of omission and keybounce. To check for mistyped numbers, stop the program after the machine language loading routine and then use AUTOPOKE to run through what was loaded and check it against your listing.

Two other pieces of information you will need for the loading routine are also supplied by AUTOPOKE. They are the decimal starting address of the routine and the number of bytes in the routine. Example 1 illustrates how to write the BASIC routine for this loading method.

The object code for the routine, in decimal form, is written in one or more data strings. The FOR-NEXT loop on the next line reads the data strings and pokes the object code into its proper place.

There is a handy by-product of this method of loading. If you were using the normal method of loading a machine-language routine, such as T-BUG or AUTOPOKE, and one or more bytes had to be inserted into the routine, every byte from the point of the insertion to the end of the routine would have to be retyped to relocate it. Not with this loading system!

All you have to do is insert the additions into the data string at the proper place and increase the number of bytes to be read by the FOR-NEXT loop. The next time the routine is loaded, your additions will be loaded into their addresses and the remainder of the routine will be automatically relocated according to the number of bytes that were added. The only other thing you have to do is take care of any jump or call addresses that might have been affected.

I have used the word "routines" a number of times. The Level II BASIC manual says that there is only one USR call allowed unless you have Level II Disk BASIC. Although this is true, it does not limit you to one machine-language routine! It only limits you to one address that you can call with the USR command. If, at that one address, you have a routine to jump to the starting addresses of other routines according to some sort of coding, you can use as many machine-language routines as you need. Example 2 shows how such a routine might be written. Immediately before each USR call in your BASIC program, POKE into address 7D01 (32001 decimal) the number of the routine you want to use at that time.

I hope you find the AUTOPOKE program and this method of loading machine-language routines as helpful as I have.■

```
1000  DATA33,0,50,31,4,175,119,35,254,255,294,6,112,29,194,5,112,201
1010  FOR I = 28872 TO 28689:READJ:POKEI,J:NEXT
```

Example 1.

```
7CD0 3E 00      LD A,N          Address 7D01, shown here as 00 will be
                                loaded in BASIC with the number of a routine.
7D02 FE 01      CP N    01      See if A = 1
7D04 C2 00 70   JP Z    7000    If it does jump to 7000
7D07 FE 02      CP N    02      See if A = 2
7D09 C2 A4 70   JP Z    70A4    If it does jump to 70A4
Etc.
```

Example 2.

✓Reader Service index—see page 194

Utilize the unused ICs in your TRS-80 and turn it into a half duplex terminal.

300 Baud Terminal

Timothy Loos
50 Depot St.
Athens OH 45701

It's easy to add I/O to the TRS-80 using its unused ICs: just cut a few foils and add a few jumpers. This will give you a single input and output port. Big deal, you might say, but with a little software they can be used as serial input and output ports. To illustrate what can be done with serial I/O, this article will tell you how to turn your TRS-80 into a 300-baud half-duplex terminal. The best part of this project is that no extra hardware is needed; there is no need for a fancy and expensive interface unit.

The schematic for the I/O ports is given in Fig. 1. (For more information about the internal workings of the TRS-80 refer to the TRS-80 *Microcomputer Technical Reference Handbook*, RS catalog no. 26-2103.)

You must first carefully take apart your TRS-80 and expose the main PC board. Find ICZ60. All the ICs are well marked. Photo 1 shows the bottom of the main PC board. The small board on the lower right is the Level II ROM board. It is covering up half of ICZ60. Unsolder Z60 and cut the foils connecting pins 12,14,15 together to ground. Now is a good time to put in a socket for ICZ60. (Molex pins are actually preferable, since they enable you to get to the foils under the IC.)

Next, cut the foils on ICZ7 that connect pins 10,11,12,13 together to ground. The foils are on the bottom side of the PC board so that you do not need to unsolder the IC.

Make the following connections on the bottom side of the PC board (i.e., the side the ICs are not on):

1. Connect pins 1,10,13 of Z7 together.
2. Connect pins 13 of Z24 to pin 11 of ICZ7.
3. Connect pin 11 of Z44 to pin

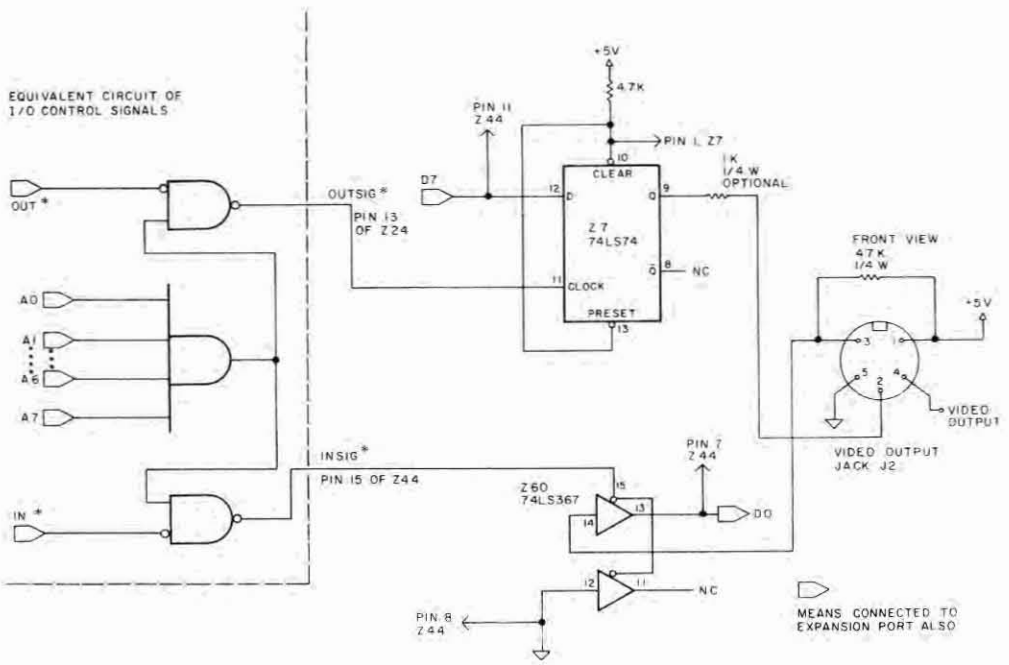


Fig. 1. TRS-80 input/output port schematic.

Table 1.

```
10  '***
100 ' STARTING LOCATION IS 4E00 HEX =19968 DECIMAL
101 ' THIS PROGRAM LOADS OCTAL VALUES INTO MEMORY
200   'POKING PROGRAM INTO MEMORY
210 GOSUB8000
400   'POKING USR(0) STARTING ADDRESS
500 'POKE 16526,182 : POKE 16527,78
600   'POKING NEW LINE PRINTER DRIVER ADDRESS
680 'POKE 16442,160 : POKE 16443,78
700   'MACHINE LANGUAGE PROGRAM IS NOW ENTERED
710   Y= USR(0) : STOP
5000 'INITIALIZE  :  OCTAL TO DECIMAL CONVERSION
5005 M=INT(U/100):U=U-M*100
5010 N=INT(  U-L*10)
5015 L=L*64+M*8+N
5020 RETURN
5050  '116-000 = OUTPUT SUBROUTINE
5060 DATA305,325,345,247,352,111,116,356
5070 DATA200,127,666,010,257,323,377,001
5071 DATA214,000,315,061,116,172,315,163
5072 DATA116,000,001,214,000,315,061,116
5073 DATA035,302,025,116,076,200,323,377
5080 DATA301,214,000,315,061,116,341,321
5085 DATA303,170,311,017,127,346,200,323
5090 DATA327,311
5250 'THIS IS TIMER 2 SUB. STORE AT 116-061
5255 DATA013,333,377,346,001,171,260,302
5260 DATA061,116,311
5261  'UART INPUT ROUTINE STARTS AT 116-000
5270 DATA305,325,345,025,010,000,333,377
5275 DATA346,001,302,006,116,001,322,000
5280 DATA315,061,116,333,377,346,001,202
5285 DATA017,127,001,214,000,315,061,116
6690 DATA035,302,023,116,172,000,000,000
6695 DATA000,346,177,341,321,301,311,000
7001 START=19968
7010 AD=100:NB=58:GOSUB8000
7070 AD=061:NB=11:GOSUB8000
7091 AD=000:NB=48:GOSUB8000:GOTO8030
8000 O=AD:GOSUB5000:DAD=D
8010 FORI=1TONB:READO:GOSUB5000:VL=D:POKESTART+DAD-1+I,VL:NEXT
8015 RETURN
8030  'INPUT A CHARACTER DRIVER ROUTINE START116-200
8035 DATA315,000,116,376,015,312,222,116
8040 DATA376,021,310,000,000,376,040,372
8045 DATA200,116,325,375,345,315,063,000
8050 DATA375,341,321,303,200,116
8060 NB=30:AD=200:GOSUB8000
8070 'OUTPUT A CHARACTER DRIVER ROUTINE 116-275 ADDRESS
8071 DATA315,053,000
8075 DATA267,312,315,116,376,033,310,315
8080 DATA323,116,303,275,116,315,346,116
8085 DATA303,275,116,000,107,315,100,116
8090 DATA325,375,345,315,063,000,375,341
8095 DATA321,376,015,314,200,116,333,377
8096 DATA346,001,314,200,116,311,000,000
8097 DATA315,177,012,175,315,324,116,311
8165 AD=275:NB=56:GOSUB8000
8200 DATA341,321,021,035,100,325,345,335
8210 DATA041,035,100,305,315,130,004,301
8220 DATA 341,101,107,315,100,116,315,341
8230 DATA 116,303,335,003
8240 AD=240 : NB=28 : GOSUB 8000
9000 PRINTEND OF MEMORY WRITE:RETURN
```

Program listing.

12 of Z7.

4. Connect pin 9 of Z7 to pin 2 of the video output jack, through a 1k ¼ Watt resistor. (Omit resistor and direct connect if you are going to use LSTTL circuitry instead of the optoisolator circuitry given in Fig. 2.)
5. Connect pins 1 and 3 of the video output jack together through a 4.7k Ohm ¼ Watt resistor.
6. Connect pin 14 of Z60 to video output jack pin 3.
7. Connect pin 15 of Z60 to pin 15 of Z44.
8. Connect pin 13 of Z60 to Z44 pin 7.
9. Connect pin 12 of Z60 to pin 8 of Z44.

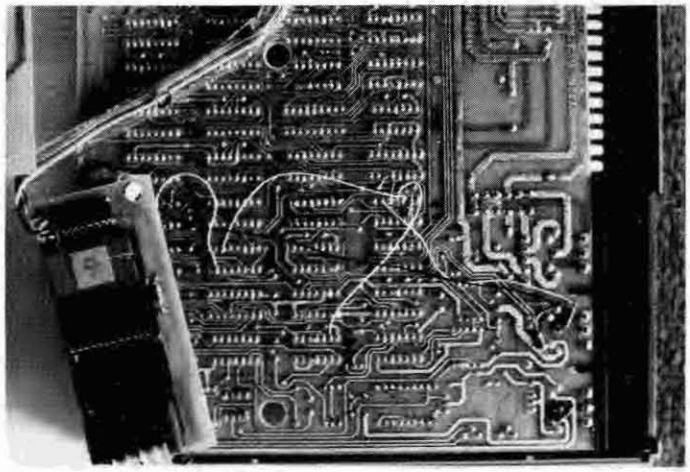
Phew . . . you are now finished. Reassemble the TRS-80.

The last thing you must do is make extra connections on pins 2,3 and 5 of the DIN connector that plugs into the video output jack. Pin 2 is the port output. Pin 3 is the port input and pin 5 is ground. Be careful with all connections, since it is possible to short out the +5 supply (pin 1) and the video output (pin 4). If you have the Radio Shack video monitor you might have to buy another DIN connector, since they are premolded assemblies and might be hard to take apart. Radio Shack stores sell DIN connectors.

Controlling the Ports

To read the input port in Level II BASIC, use the statement Y = INP(225). The lowest bit, D0, of Y will be the input port bit. In machine language, use the command IN FF, fol-

```
116-  0    333 IN      0          PORT VALUE
116-  2    377
116-  3    345 ANI     1          MASK TO SELECT DO BIT
116-  5      1
116-  6    302 JNZ     8          LOOP UNTIL START BIT
116-  7      8                     IS FOUND
116-  8    116
116-  9      1 LXI B               DELAY VALUE
116- 10      0                     (002-103 FOR 110 BAUD)
116- 11    315 CALL               TIMER DELAY SUBROUTINE
116- 12     61
116- 13    116
116- 14    333 IN                 MASK TO READ DO BIT
116- 15    377
116- 16    345 ANI     1
116- 17      1
116- 18    202 ADD D              SHIFT A TO RIGHT
116- 19     17 RRC                 SAVE A IN D
116- 20    127 MOV D,A
116- 21      1 LXI B               DELAY VALUE
116- 22    214                    (002-202 FOR 110 BAUD)
116- 23      0
116- 24    315 CALL               CALL TIMER SUB.
116- 25     61
116- 26    116
116- 27     35 DCR E              DECREMENT BIT COUNTER
116- 28    302 JNZ                ALL BITS IN?
116- 29     23                    GO FETCH ANOTHER
116- 30    116
116- 31    172 MOV A,D            PUT CHAR BACK INTO A
116- 32      0 NOPS
116- 33      0
116- 34      0
116- 35      0
116- 36    345 ANI     177        STRIP PARITY BIT AWAY
116- 37    177
116- 38    341 POP H              RESTORE REGISTERS
116- 39    321 POP D
116- 40    301 POP B
116- 41    311 RET
116- 42      0 NOPS
116- 43      0
116- 44  ********************************************
116- 45  TIMER DELAY SUBROUTINE
116- 46  ********************************************
116- 47
116- 48     13 DCX B              DECREMENT LOOP COUNTER
116- 49    333 IN                 DELAY INSTRUCTION ONLY
116- 50    377
116- 51    345 ANI     1          INSTRUCTION FOR DELAY ONLY
116- 52      1
116- 53    171 ORA B              INSTRUCTION FOR DELAY ONLY
116- 54    260
116- 55    302 JNZ                IS BC 0?
116- 56     61                    LOOP UNTIL FINISHED
116- 57    116
116- 58    311 RET
116- 59  ********************************************
116- 60  OUTPUT UART ROUTINE
116- 61    305 PUSH B
116- 62    325 PUSH D
116- 63    345 PUSH H             SET PARITY FLAGS
116- 64    247 ANA A              IF EVEN PARITY JUMP
116- 65    352 JPE
116- 66    111
116- 67    116
116- 68    356 XRI     200        MAKE A REG EVEN PARITY
116- 69    200
116- 70    127 MOV D,A            SAVE A IN D
116- 71     36 MVI E              NO OF WORD BITS IN E
116- 72     10
116- 73    257 XRA A              ZERO A REG
116- 74    323 OUT                OUTPUT START BIT
116- 75    377 PORT
116- 76      1 LXI B               (002-202 FOR 110 BAUD)
116- 77    234
116- 78      0
116- 79    315 CALL               TIMER DELAY SUB.
116- 80     61
116- 81    116
116- 82    172 MOV A,D            MOV CHAR TO A
```



Underside of the TRS-80 main PC board, showing the locations of ICs and the video output jack.

lowed by AND A immediate with 01. This will input D0 into the A register.

The output port is controlled by the BASIC statements OUT 255,0 to output a 0 and OUT 255,128 to output a 1. Note that setting bits D0 and D1 under the OUT 255 command activates the cassette output, setting bit D2 activates the tape relay and D3 activates the double-sized characters. Therefore, make sure you set bit D7 only. The machine language commands are LDA 80, OUT FF to output a 1 and LDA 00, OUT FF to output a 0.

Fig. 2 shows an optoisolator circuit that can be used with the input and output port. The circuit provides isolation between the TRS-80 and the external circuitry. This circuit is optional, but I think that it is a good idea to have such a circuit since your TRS-80 is isolated from your I/O external circuitry. If your external device accidently shorts out or applies the wrong voltage, your TRS-80 will be safe. It also helps eliminate ground loops, etc.

UART Program Description

The software necessary to operate the input and output port as a 300 baud serial input and serial output port is listed in Table 1. This program is adapted from Dan Stogdill's article, "Experiments in Software" (May, 1978 *Kilobaud*, p. 44). For a Level II, 4K system the program is stored in memory at location 116-000 octal. The program is designed to be called using the USR(n) function of Level II BASIC. Alternately, it can be run by typing SYSTEM followed by /20157, the decimal starting address of the machine-language program.

The program is divided into five routines:

Routine A—The output UART

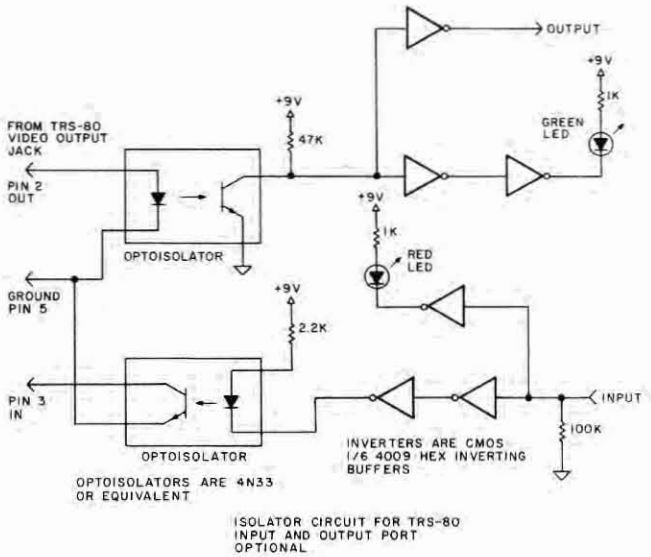


Fig. 2. An optional isolator circuit for TRS-80 input and output port. Optoisolators are 4N33 or equivalent. Inverters are CMOS 1/6 4009 hex inverting buffers.

```
116- 126  315 CALL     PROGRAM PATCH
116- 127  163
116- 130  116
116- 131    0 NOP
116- 132    1 LXI B
116- 133  214          (002-202 FOR 110 BAUD)
116- 134    0
116- 135  315 CALL     CALL TIMER DELAY SUB.
116- 136   61
116- 137  116
116- 140   35 DCR E    LOOP IF ALL BITS NOT SENT
116- 141  302 JNZ
116- 142  125
116- 143  116
116- 144   76 MVI A    PUT 1 AS STOP BIT
116- 145  200          D7 IS OUPUTTED BIT
116- 146  323 OUT      PORT
116- 147  377
116- 150    1 LXI B    (003-000 FOR 110 BAUD)
116- 151  214
116- 152    0
116- 153  315 CALL     TIMER DELAY
116- 154   61
116- 155  116
116- 156  341 POP H
116- 157  321 POP D
116- 160  301 POP B
116- 161  170 MOV A,B   RESTORE A REG
116- 162  311 RET
** PROGRAM PATCH **
116- 163   17 RRC      SHIFT A TO RIGHT SO THAT BIT D0 IS IN D7
116- 164  127 MOV D,A   SAVE SHIFTED A IN D
116- 165  345 ANI      MASK SO THAT BIT D7 IS OUTPUT
116- 166  200
116- 167  323 OUT      PORT
116- 170  377
116- 171  311 RET      GO TO 116-131
**********************************
INPUT UART DRIVER ROUTINE
CHECKS TO SEE VALID CHARACTER
IS TO BE DISPLAYED
A DC1 CONTROL CHARACTER CAUSES
TO EXIT THIS ROUTINE AND GO INTO
TRANSMIT MODE

116- 200  315 CALL     CALL INPUT UART ROUTINE
116- 201    0
116- 202  116
116- 203  376 CPI      CARRIAGE RETURN
116- 204   15
116- 205  312 JZ       CALL DISPLAY ROUTINE
116- 206  222          IF IT IS A CR
116- 207  116
116- 210  376 CPI      DC1 CONTROL CHARACTER
116- 211   21          GO TO OUTPUT MODE IF DC1 RECEIVED
116- 212  310 RZ
116- 213    0 NOP
116- 214    0 NOP
116- 215  376 CPI      CHECK TO SEE IF IT IS A CONTROL CHAR.
116- 216   40
116- 217  372 JM       READ ANOTHER CHARACTER IN
116- 220  200
116- 221  116
116- 222  325 PUSH D   TRS80 DISPLAY ROUTINE IN LEVEL II
116- 223  375 PUSH IY
116- 224  345
116- 225  315 CALL
116- 226   63
116- 227    0
116- 230  375 POP IY
116- 231  341
116- 232  321 POP D
116- 233  303 JMP      JUMP TO START OF ROUTINE
116- 234  200
116- 235  116
**********************************
READ FROM KEYBOARD OUTPUT UARTDRIVER ROUTINE

116- 275  315 CALL     CALL TRS-80 KEYBOARD INPUT ROUTINE
116- 276   53          ROUTINE RETURNS PRESSED KEY IN A REG.
116- 277    0          A=0 IF NO KEY PRESSED
116- 300  267 ORA,A    SET FLAGS
116- 301  312 JNZ
```

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subroutine starts at 116-000. This routine serially outputs seven bits in the A register, adding start, stop and parity bits.

Routine B—The input UART routine starts at 116-100. A 7-bit word is read in from the input port and returned in the A register.

Routine C—The input UART program—driver subroutine starts at 116-200. This routine displays received characters on the TV screen of the TRS-80. If the character is a DC1 control character (you might want to change this character for your particular application), this signifies the end of the transmitted message and a machine language RETURN is executed.

Routine D—The program starting at 116-275 is the entry point from BASIC that puts the TRS-80 into the terminal mode. Whatever you type at the keyboard is displayed on the screen and transmitted serially from the output port. When you type ENTER (i.e., carriage return), the TRS-80 goes into the listen mode (subroutine at 116-200 is executed) and the output is displayed on the screen until a DC1 is received, causing the program to go back into the transmit mode. If a character is received while transmitting, the program automatically goes into the listen mode. If you type a shift arrow (↑), the program will return to BASIC.

Routine E—The routine starting at 116-240 allows Level II systems to use the LList and LPRINT line printer commands to output to the serial output port and to the TV screen. This implementation directs the TRS-80 into the listen mode waiting for a DC1 control character after it transmits a carriage return before it can print the next line. The routine requires that 160 be POKEd into memory at 16442 and 78 at 16443. This sets the line printer driver address (i.e., the program that the line printer commands call) equal to the Routine E starting address.

```
5       STORE MACHINE LANGUAGE PROGRAM OCTAL
7       BYTES FROM FIGURE 4 IN DATA STATEMENTS
10   DATA 305,325,345,021,000,333,377,ETC.........
20   DATA...............
      .  .  .  .
      .  .  .  .
990   ' NO IS THE NUMBER OF BYTES TO BE STORED
995   ' MACHINE LANGUAGE PROGRAM IS POKED IN MEMORY
999  START = 16998:' START IS ADDRESS TO STORE
PROGRAM
1000 FOR I=1 TO NO
1001 READ O :GOSUB 5000 :POKE START+I-1,D : NEXT I
1005   POKE STARTING ADDRESS AND
       NEW LINE PRINTER DRIVER ADDRESS
1006  POKE 16526,189 : POKE 16527,78 : POKE 16442,160
1007 POKE 16443,78
1008 ' MACHINE LANGUAGE PROGRAM IS NOW ENTERED
1009 Y=USR(0):END
5000 ' OCTAL TO DECIMAL CONVERSION
5001 D1=INT(O/100) : D2=INT((O-D1*100) /10)
5002 D3=INT(O-D1*100-D2*10)
5003 D=D1*64+D2*8+D3:RETURN
```

Program A.

Modifications

The program listing is used with a Level II, 4K system. Make sure to reserve memory for the program by typing 19967 when asked for the memory size. Also make sure to POKE the starting address of the program in locations 16526 and 16527 decimal (low-order byte in 16526). For Level II 16K systems, the program should be relocated to a starting location of 175-000 in order to make use of the extra memory available. Memory size 31999.

For Level I systems you must relocate the program and change the entry points for the keyboard-scan routine and the display to screen. The program must also run under a monitor similar to T-BUG. If you have a Level II system, you can load the machine-language program under BASIC. The instructions in octal can be stored in DATA statements, converted to decimal and then POKEd into memory. Program A illustrates how it is done.

The advantages of serial I/O are many, but the best part is that you do not need extra hardware or parts . . . only a few for the optoisolator circuit. Also, you only need three lines from the TRS-80 to the external device.

If you need the serial data from the TRS-80 converted into parallel data and the data from the external device converted into serial data, refer to "Build a Serial to Parallel Converter" (November 1978 *Kilobaud*, p. 84). This article describes an easy circuit to do just that. ■

```
116- 302   315               CHECK TO SEE IF START BIT IS TRANSMITTED
116- 303   116
116- 304   376 CPI           SEE IF KEY IS A  SHIFT ARROW
116- 305    33               SHIFT ARROW
116- 306   310 RZ            RETURN TO BASIC IF SHIFT ARROW
116- 307   315 CALL
116- 310   323               CALL OUTPUT A CHAR.
116- 311   116
116- 312   303 JMP
116- 313   275               GOAND READ KEYBOARD AGAIN
116- 314   116
116- 315   315 CALL
116- 316   345               CHECK TO SEE IF RECEIVING START BIT
116- 317   116
116- 320   303 JMP
116- 321   275               READ KEYBOARD AGAIN
116- 322   116
116- 323     0 NOP
116- 324   107 MOV B,A
116- 325   315 CALL
116- 326   100               OUT UART
116- 327   116
116- 330   325 PUSH D        SAVE REGS
116- 331   375 PUSH IY
116- 332   345
116- 333   315 CALL
116- 334    63               TRS80 DISPLAY ROUTINE
116- 335     0               DISPLAYS CHAR IN A REG.
116- 336   375 POP IY
116- 337   341
116- 340   321 POP D
116- 341   376 CPI
116- 342    15               CARRIAGE RETURN
116- 343   314 CZ            CALL INPUT UART ROUTINE IF
116- 344   200               CARRIAGE RETURN GO TO LISTEN MODE
116- 345   116
116- 346   333 IN            CHECK TO SEE IF RECEIVING START BIT
116- 347   377               PORT
116- 350   345 ANI           CHECK BIT D0
116- 351     1
116- 352   314 CZ            IF RECEIVE START BIT GO TO LISTEN MODE
116- 353   200               INPUT UART IS CALLED
116- 354   116
116- 355   311 RET
********************************************
ROUTINE TO MAKE LPRINT AND LLIST COMMANDS OUTPUT
TO SERIAL OUTPUT PORT AND DISPLAY. THIS IS DONE
BY CHANGING THE DRIVER ADDRESS FOR THE
LINE PRINTER TO 116-240 AND MANIPULATING
THE REGISTER VALUES AND CALLING
VIDEO DISPLAY ROUTINES.
 116- 240    341 POP H
 116- 241    321 POP D
 116- 242    021 LXI D       REPLACE DE ON STACK
 116- 243    035             WITH 401DH, THE VIDEO
 116- 244    100             DISPLAY BLOCK ADDRESS
 116- 245    325 PUSH D      PUT DE BACK ON STACK
 116- 246    345 PUSH H      PUT HL BACK ON STACK
 116- 247    335 LD IX,401DH   SET IX TO 401DH ALSO
 116- 250    041
 116- 251    035
 116- 252    100
 116- 253    305 PUSH B     SAVE BC
 116- 254    315 CALL        TRS-80 DISPLAY ROUTINE
 116- 255    130             DRIVER ADDRESS FOR
 116- 256    004             VIDEO DISPLAY BLOCK
 116- 257    301 POP B       GET B OFF STACK
 116- 260    341 POP H       CLEAR 03DDH OFF STACK ,IT IS RETURN ADDRESS
 116- 261    101 MOV B,C     GET REGS. READY FOR OUT UART
 116- 262    107 MOV B,A
 116- 263    315 CALL        OUT UART ROUTINE
 116- 264    100
 116- 265    116
 116- 266    315 CALL        ROUTINE CHECKS IF CR TRANSMITTED
 116- 267    341             GOTO LISTEN MODE AND WAIT FOR DC1 IF SO
 116- 270    116
 116- 271    303 JMP         POP ALL REGISTERS AND RETURN
 116- 272    335
 116- 273    003
**************************************
```

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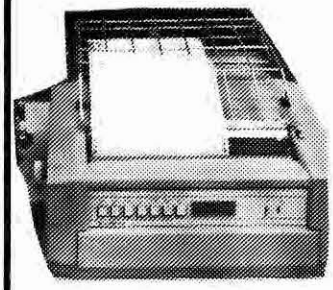

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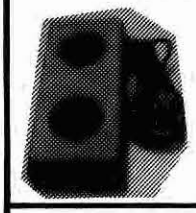

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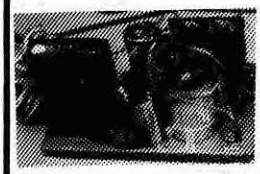

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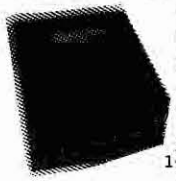

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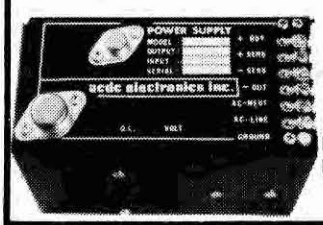

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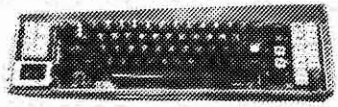

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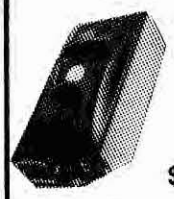

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The next logical step.

Towards Machine Language

Allan S. Joffe W3KBM
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Sooner or later you will have had your TRS-80 long enough to feel comfortable with BASIC. When this plateau is reached, the urge to explore machine language is not too far behind.

If you take a look at the instruction set for the Z-80, you might decide that BASIC is better than ever. Still, you know that machine language is fast and the mastery of some of its mysteries has got to make you a more complete programmer.

What You'll Need

Before you tread the maze of this new discipline, face the fact that hexadecimal is a necessity and learn or relearn it. You'll need a monitor program, which allows you to communicate with your computer at its gut level. There are a number of different monitors around, my own choice being T-BUG by Radio Shack. It's both flexible and easy to use.

Also you'll need a guide book that gives you machine language fundamentals. I can recommend *TRS-80 Assembly-Language Programming* by William Barden, Jr. for its clarity.

If you can possibly get hold of the Z-80 instruction manual by Zilog you will have a much more informative map of the instruction set.

Your window to the world of the TRS-80 innards is going to be memory locations 3C00 to 3FFF, the video memory.

I'm going to assume that you have bought a copy of T-BUG and the Barden book. One of its sample programs on page 77 takes a character, loads it into a register and makes the character appear in the center of your monitor.

```
4A00    3E31
4A02    32203E
4A05    C3054A
```

To RUN this program you would execute a J4A00.

This program works like a charm and locks itself tightly into a loop that can only be broken by RESET.

The problem is in the third line, a LOOP instruction. We can make a simple change, 4A05 C38043, which will make the program run as before, but will return to the start of T-BUG. This avoids your having to use the RESET button and go through the T-BUG entry routine each time you run a change.

To phrase a computer happening in Capitol Hill overtones, the C3 instruction in memory location 4A05 is "the moral equivalent of a BASIC GOTO command".

BASIC Parallels

If you wrote in BASIC, 10 GOTO 10, you would have created a parallel situation, namely a loop. The same is true for any number of machine language codes. Thus C9 is a RETURN, C3 is a JP NN where JP stands for JUMP (or GOTO) and the NN represents the address to be JUMPed to in hex notation.

Let's go back to the little program and examine certain notation conventions and peculiarities that can give the machine language tyro a case of the "undecideds."

Taking one memory cell at a time 4A00 3E is an LD A,N instruction which can be read: Load the A register with N, N being a hex value for the desired character, in this case 31H which will produce the numeral 1 on the screen.

Notice that while we are only delineating the memory cell value for the first entry, that by convention it is understood that 4A00 3E 31 is placing the 3E in memory location 4A00 and that memory location 4A01 gets the value of 31 placed into it. This saves writing many location numbers, if indeed, you know what is being done. This may sound simple, but I have yet to see the person born with the proverbial silver spoon of machine language in his or her mouth.

If you wanted the letter A instead of the numeral 1, you would substitute 41H and the character on the screen becomes an A.

4A02 32 20 3E now begins to make a bit more visual sense when you realize that these items represent the contents of the next three memory cells in the program.

The contents of memory location 4A02 is a 32 instruction—LD(NN),A—that can be read: LOAD location in memory specified by NN with the contents of the A register. Now we have to specify into what memory locations the information in the A register is to go.

The program defines this location as 20 3E, which brings up a bit of a sore point. Your TRS-80 window to the world is the part of memory dedicated to lighting the monitor screen. This runs from 3C00H to 3FFFH. You have guessed that 203E must fall within this window, but something does not look right.

If you remember that the lowest part of the address goes in first and the highest part of the address goes in last, then mentally you can turn 203E into 3E20, which is how the computer visualizes it.

When you do this, a little calculation will show you that 3E20 is just about in the middle of the window range of 3C00H to 3FFFH. The decimal value of 3C00H is 15360 and the decimal value of 3FFFH is 16383.

4A05 C3 8043 starts to make a bit more sense. The C3 JUMP instruction is followed by the address to jump to and once more we see the last first, first last, reversal of the address. The real address is 4380, which is the start of T-BUG.

F3 42	These are the program "pointers."
0A 00	This is the line number in hex which is entered in last-first, first-last style. In actual human terms it is 000A which translates to 10.
B2	This is the compact code used for all of the TRS-80 reserved words. They are all 80H and higher. B2 is PRINT,80 is END,81 is FOR . . etc.
20	This is the ASCII code for the space between the T in PRINT and the " preceding the X.
22	This is the ASCII code for the " preceding X.
58	This is the ASCII code for the letter X
22	This is the ASCII code for the closing " after X

Example 1.

Now if you run this program and execute a J4A00 using T-BUG, everything rolls up off the screen, and you are left with a clean display with a numeral 1 in the center of the screen and the # sign in the upper left hand corner, indicating T-BUG is standing by, ready to execute your orders.

Using T-BUG

You can go from T-BUG back to BASIC with a J 1A19, which will bring up the READY that you are used to seeing when BASIC is hot to trot. Remember this fact of life. When you write a BASIC program in the usual fashion, the first memory location that this program uses is 42E9H or 17129 decimal.

T-BUG starts at 4380H or 17280 decimal, so if T-BUG is in residence you don't have many memory locations between the start of BASIC and the point where a BASIC program would be busy wiping out the T-BUG program.

It would have been nice, if the folks who created T-BUG would also have rewritten a version that resided in high memory. This would free RAM in low memory for BASIC programming.

Another small housekeeping hint when clearing a screen full of data. You have at least two options. You can execute a J 4380 or a J 40A4 with T-BUG, either of which will clean up the screen leaving you with the # sign in the upper left hand corner.

Before going on to another machine language program let us examine a line of BASIC programming using T-BUG, which may provide you with some answers and certainly raise many more questions about this new vista of machine language.

Assume that you have loaded T-BUG into your TRS-80 and then have executed a J1A19 that gets you back to BASIC. Clear the screen, and type in this line: 10 PRINT "X". Now return to T-BUG, and using the M command, we find the items in memory locations 42E9 to 42F1 inclusive in Example 1.

Machine Code LISTING

There is a world of information to be learned on just how and in what form your TRS-80 does its thing. It's annoying that Tandy Corporation makes it so hard to come by this information. It is tough to figure why any information that makes a product easier to use by its purchaser is so cloaked in proprietary secrecy.

Using T-BUG, punch in this series of commands starting at memory location 5000: CD # F6 F6 04 3E 31 32 20 3E 76.

Now jump to J 5000. Interesting, isn't it?

All of the information on the screen is in the large print format. What you have done is call an instruction in the ROM, which is located at memory location 04F6, and, presto, you have a very handy routine. There are literally hundreds of these "instant" machine language routines locked away in your Level II ROM. All you need to know is their starting address and their functions.

To help your programming make up a card that shows you which CPU register is which, when you use the R command of T-BUG to display the contents of these registers. It will make life simpler

Block Transfer

Let's examine one of four very

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D9	ABS	A4	GET	A1	ON	BF	USING
D2	AND	91	GOSUB	A2	OPEN	C1	USR
E4	ATN						
		8F	IF	E5	PEEK	F5	VAL
F1	CDBL	C9	INKEY$	C6	POINT	C0	VARPTR
F7	CHR$	DB	INP	B1	POKE		
EF	CINT	89	INPUT	DC	POS		
B8	CLEAR	C5	INSTR	B2	PRINT		
A6	CLOSE	D8	INT	A5	PUT		
84	CLS						
85	CMD	AA	KILL	86	RANDOM		
B3	CONT			8B	READ		
E1	COS	F8	LEFT$	93	REM		
F0	CSNG	8C	LET	82	RESET		
E8	CVD	AB	LSET	90	RESTORE		
E6	CVI	F3	LEN	9F	RESUME		
E7	CVS	9C	LINE	92	RETURN		
		B4	LIST	F9	RIGHT$		
88	DATA	A7	LOAD	DE	RND		
9B	DEFDBL	EA	LOC				
		EB	LOF	AD	SAVE		
99	DEFINT	DF	LOG	83	SET		
9A	DEFSNG			D7	SGN		
		C8	MEM	E2	SIN		
98	DEFSTR	A8	MERGE	DD	SQR		
B6	DELETE	FA	MID$	CC	STEP		
8A	DIM	EE	MKD$	94	STOP		
		EC	MKI$	C4	STRING$		
90	EDIT	ED	MKS$				
95	ELSE			BC	TAB		
80	END	A9	NAME	E3	TAN		
C2	ERL	BB	NEW	CA	THEN		
C3	ERR	87	NEXT	C7	TIME$		
94	ERROR	CB	NOT	97	TROFF		
E0	EXP			96	TRON		
A3	FIELD						
F2	FIX						
81	FOR						
DA	FRE						

Table 1. Codes for List of Reserved Words in Level II Manual.

nice Z-80 processor commands that come under the general heading of block transfer, a series of commands that move existing information in one part of memory to another quickly and easily.

Let's look at LDIR. Think of it as Load, Increment and Repeat. Three sets of registers have to be initialized. The instruction must know where the data is in memory that you want moved; to where you want it transferred; and, finally, just how many bytes of data are to be transferred.

The HL registers, used as a coupled pair, are loaded with the starting address of WHERE THE DATA IS COMING FROM (source).

The DE registers, used as a coupled pair, are loaded with the starting address of WHERE THE DATA IS TO GO (destination).

The BC registers, used as a coupled pair, is loaded with a hex value that gives the total byte count that you want to move.

Here is a simple demonstration program of the LDIR command.

Starting with memory location 5000, load the following:

```
11 20 3E 21 00 60 01 0C 00 ED B0
```

Let's examine what this series of memory contents is to do.

- 11 loads the DE register pair with the hex values 203E. This address is in the middle of the video memory window.
- 21 loads the HL register pair with the hex value of the address where the information is stored. In this case the value is 00 60, which, in human terms, is 6000.
- 01 loads the BC register pair with the value 0C00 which translates to 000CH or 12 in decimal. This is the total number of bytes we are going to transfer.

The final two bits of information, namely EDB0, are machine code for "execute the block transfer, please." Now, all we

have to do is put the planned 12 bytes of data into the memory location we have designated, which starts at location 6000H.

Again using T-BUG, load the following memory information starting at 6000H.

```
44 41 4E 20 49 53 20 53 4D 41 52 54 C3 80 43
```

This simple message reads: DAN IS SMART and appears in the middle of your screen when you execute a J5000. All the values with the exception of the last three (C3 80 43) are ASCII values that represent the letters making up the message. The numeral 20 is the ASCII code for a space.

The C3 80 43 is the command that sends the program back to the start of T-BUG after running the program. In this manner you are ready to re-program, if you wish, without having to break out of a loop which you might need to hold the message on the screen.

Conclusion

Naturally, you are not limited to alphanumerics here. The graphics character set corresponds to ASCII codes 81 through BF (hex, naturally), so if you replace the 12 bytes in the 6000 section of memory with any of the ASCII graphics symbol codes, you will see them displayed on your screen.

When you get ambitious, you will want to move many more than 12 bytes, but if the move is into the video memory window don't "over-byte" outside the window limits or you will find your computer doing strange things. You will have transgressed into dedicated memory areas.

Machine language is worthwhile, if, for no other reason, than to learn to admire all the people who worked so hard to develop it. If you are interested in speedy graphics, then it is a must. Just remember to be logical and not paint yourself into a corner. ■

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Switching from Model I to Model II.

Rites of Passage

Dan Keen
Dave Dischert
RFD 1 Box 432
State Highway 83
Cape May Courthouse, NJ 08210

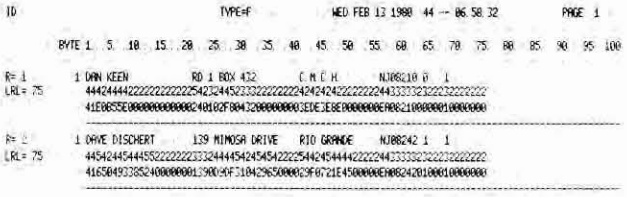


Fig. 1.

Model I owners, hold on to your hats. With the advent of Radio Shack's TRS-80 Model II, there are new things to learn and old habits to break.

Just sit down at the Model II keyboard to get started. Surprise! The backspace, @, (,), ", *, and : are in different positions because the keyboard is laid out like a standardized typewriter.

Other key changes include a TAB which replaces →. The ESCape key is substituted for SHIFT plus ↑ to exit the line EDIT mode. There's a repeat key which is another useful editing tool. Hold down the space bar or backspace in conjunction with the repeat key and you speed across a line.

SHIFT and LOCK keys are provided for typing all capital letters. The LOCK is important when you enter DOS commands, since they require uppercase. BASIC isn't so fussy; upper or lowercase commands are both valid.

In both BASIC and DOS the CLS command is used in place of the CLEAR key of the Model I. Instead of holding SHIFT plus @, a new key, HOLD, stops scrolling of a display listing.

Besides these key changes, several commands have been altered. Most of the commands and functions for the Model II are the same as Model I's TRSDOS, so it's a fairly smooth transition. For instance, EDIT is the same, and the CMD command has merely been renamed SYSTEM. Other commands and changes have been more radical.

Using LIST on the Model I requires contents to be SAVEd in ASCII. With the Model II, you no longer have to worry about storing your program in ASCII. You also have an option to LIST the data on the screen or on a printer. The Model II LIST displays each byte position in the buffer, the character, the hexadecimal number and other parameters such as record number or LRL. Fig. 1 shows a LIST of a file from a short mailing program.

DIR gives you a whole screen of information: file name, creation date, ATTRB (password protection status), number of logical records in that file, number of extents (how many segments have been added to the file), space allocated and space used, number of sectors and end of file byte (the starting position in the last written sector).

SET and RESET are not supported by the Model II. Instead there is a shape table and graphics are drawn using CHR$. To position graphic shapes or any character on the screen you can use PRINT @ as before, or the (x,y) coordinates. For example, PRINT @ (X,Y),CHR$(159).

Different ASCII characters are used to turn the flashing cursor on and off to determine upper and lowercase and to create graphics.

There are dozens of supervisor calls, which would take several articles to cover. It's worth mentioning that some of these cover the functions of Model I's PEEK and POKE.

Several DOS commands have been added. A synopsis of some of them follows: AGAIN tells DOS to re-execute the last command. If you only have one drive and have to check the DIR of several disks by swapping them around, this command will save you steps.

BUILD could be described as a superior AUTO command. With it you can make a file of many DOS commands that will automatically be executed with a DO command.

PURGE makes it possible to delete files en mass. You specify the type of files you want deleted: system, machine language, data or all. It can be dangerous in the wrong hands.

Getting DIR from BASIC

Now let's shoot down to Disk BASIC. To accomplish this you must go through a pain-in-the-neck sequence: Type BASIC, a space, –F (for FILES), and the number of files you want open.

One great improvement is the ability of this Disk BASIC to execute some DOS commands. You can get a DIR listing from BASIC, just like you can with Apparat's NewDOS + for the Model I. And typing NEW doesn't clear the screen.

Since there is no ROM, power up requires waiting for the machine's brains to be loaded from disk to the RAM. You're used to DOS READY coming up pretty fast on our Model I, but this takes a while.

Apparently the disk directory is stored in RAM until you are done, when you must type I, and the directory data writes on the disk. A Radio Shack newsletter warns that to change any diskette to another drive requires the I TRSDOS command. If you don't use I, disks will have the wrong directory and it is possible that you will write over programs and data.

We are extremely pleased with the Model II. There are only a few negative things that

the electric pencil II™

for the TRS-80 Model II* Computer

The Electric Pencil is a Character Oriented Word Processing System. This means that text is entered as a continuous string of characters and is manipulated as such. This allows the user enormous freedom and ease in the movement and handling of text. Since lines are not delineated, any number of characters, words, lines or paragraphs may be inserted or deleted anywhere in the text. The entirety of the text shifts and opens up or closes as needed in full view of the user. Carriage returns as well as word hyphenation are not required since each line of text is formatted automatically.

As text is typed and the end of a screen line is reached, a partially completed word is shifted to the beginning of the following line. Whenever text is inserted or deleted, existing text is pushed down or pulled up in a wrap around fashion. Everything appears on the video display screen as it occurs thereby eliminating any guesswork. Text may be reviewed at will by variable speed or page-at-a-time scrolling both in the forward and reverse directions. By using the search or the search and replace function, any string of characters may be located and/or replaced with any other string of characters as desired. Specific sets of characters within encoded strings may also be located.

When text is printed, The Electric Pencil automatically inserts carriage returns where they are needed. Numerous combinations of Line Length, Page Length, Character Spacing, Line Spacing and Page Spacing allow for any form to be handled. Right justification gives right-hand margins that are even. Pages may be numbered as well as titled.

the electric pencil

—a Proven Word Processing System

The TRSDOS versions of The Electric Pencil II are our best ever! You can now type as fast as you like without losing any characters. New TRSDOS features include word left, word right, word delete, bottom of page numbering as well as extended cursor controls for greater user flexibility. BASIC files may also be written and simply edited without additional software.

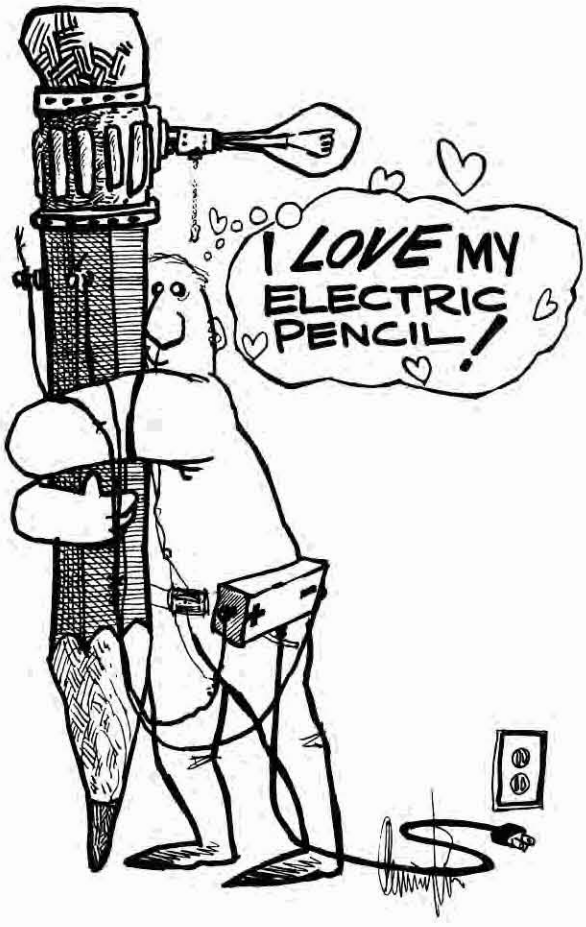
Our CP/M versions are the same as we have been distributing for several years and allow the CP/M user to edit CP/M files with the addition of our CONVERT utility for an additional $35.00. CONVERT is not required if only quick and easy word processing is required. A keyboard buffer permits fast typing without character loss.

	CP/M	TRSDOS
Serial Diablo, NEC, Qume	$ 300.00	$ 350.00
All other printers	$ 275.00	$ 325.00

The Electric Pencil I is still available for TRS-80 Model I users. Although not as sophisticated as Electric Pencil II, it is still an extremely easy to use and powerful word processing system. The software has been designed to be used with both Level I (16K system) and Level II models of the TRS-80. Two versions, one for use with cassette, and one for use with disk, are available on cassette. The TRS-80 disk version is easily transferred to disk and is fully interactive with the READ, WRITE, DIR, and KILL routines of TRSDOS.

TRC	Cassette	$ 100.00
TRD	Disk	$ 150.00

✓255



Features

TRSDOS or CP/M Compatible * Supports Four Disk Drives * Dynamic Print Formatting * Diablo, NEC & Qume Print Packages * Multi-Column Printing * Print Value Chaining * Page-at-a-time Scrolling * Bidirectional Multispeed Scrolling * Subsystem with Print Value Scoreboard * Automatic Word & Record Number Tally * Global Search & Replace * Full Margin Control * End of Page Control * Non Printing Text Commenting * Line & Paragraph Indentation * Centering * Underlining * Boldface

VISA

master charge THE INTERBANK CARD

*TRS-80 is a registered trade mark of Radio Shack, a division of Tandy Corp.

ms

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1198 Los Robles Dr.
Palm Springs, CA. 92262
(714) 323-1400

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deserve comment.

The initialization seems a bit long. On top of that, every time you reboot you have to re-type a lot of information (BASIC, number of files, time, date, etc.); and only time will accept ENTER as a default. This is really aggravating to the person who is writting or debugging a program by line and must Ping-Pong between DOS and BASIC or reboot frequently.

A big fat reset button is located precariously close to the keyboard – just asking for trouble. And since there appears to be no way to restore your BASIC program (BASIC * is not supported), there is constant fear of loosing the current version of a program. You must SAVE frequently – even when you've made the smallest of modifications.

There are some good, detailed graphic characters, but we wish Tandy could have incorporated more.

There is no cassette hookup, only disk.

After paying several thousand dollars, we think the operator is entitled to a few words when the machine runs into an error. But not Tandy: It's back to the manual to find error codes again, just like Level II before DOS.

We miss the clear key. If you've ever written a game using string packing techniques (like Android Nim), you know what a mess it is to list on screen because control characters within the packed string cause scrolling, carriage returns and the like. The clear button was handy for this application allowing you to list several lines at a time without overprinting previously listed lines, giving you a screen full of unintelligible characters.

Conclusion

This is a well-designed, slightly heavy unit. The keyboard disconnects from the main section via a small cable. The system is more portable than Model I since everything is housed in one cabinet, except for the keyboard.

The keyboard is comfortable to the touch and it responds very quickly.

Radio Shack must have been in a hurry to get their machine on the market because shortly after its appearance there was already a new version of DOS (1.2). Along with the disk came a thick stack of pages to be added to the loose-leaf owner's manual. About 90% of these pages were for the utility section.

The Model II is a well-priced machine, capable of all that Radio Shack claims. We highly recommend it. ■

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How to connect up a SWTPC printer to your system.

PR-40 Printer Interface

John W. Hise
67727 SR 13
Millersburg IN 46543

When something with the impact of the TRS-80 comes along—so different in physical make-up and software requirements from the typical hobbyist's S-100 system—it is difficult to explore state of the art hardware and software without purchasing a new system.

Because of all the interest generated by the TRS-80 I had decided to buy a Level II unit with 4K of RAM which I have since raised to 16K, and the expansion interface. With some work, I could interface the many peripherals I already owned—a 22-slot IMSAI, a North Star disk system, two video terminals, a teletype and a PR-40 printer.

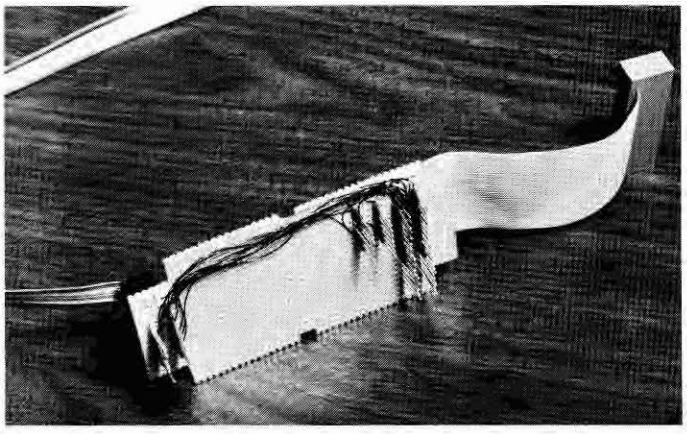

Photo 1. Underside of the connector interface showing wirewrap connections.

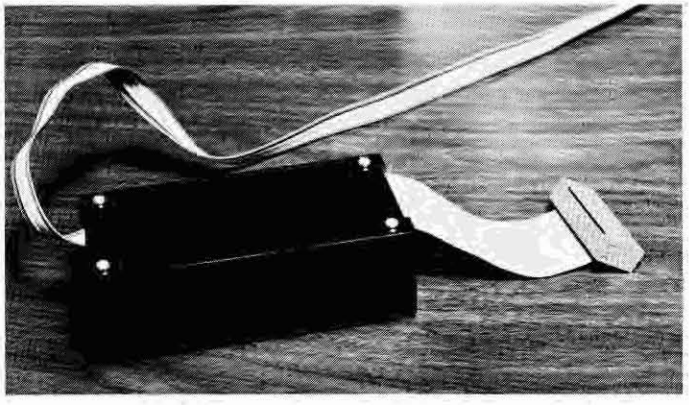

Photo 2. Finished interface cable in its enclosure.

What's Missing?

One of the first things I missed as I began to explore the TRS-80 was hardcopy output. However, an inexpensive printer of non-Radio Shack manufacture provided a solution. This article describes the trials and tribulations of interfacing the SWTPC PR-40 printer to the TRS-80. I hope my experience is valuable to others who, like myself, cannot afford a one to 2,000 dollar printer.

Either hardware or software can resolve incompatibility between an expansion interface output port and a printer input port. To keep everything simple, I would have liked to connect a cable from the printer to the TRS-80 and seen everything take off and run properly just by entering LPRINT or LLIST statements. But it dosen't work that way.

The South West Technical Products Corp., or SWTPC (219 W. Rhapsody, San Antonio, TX 78216), PR-40 is a five by seven dot matrix impact printer that prints the 64 character uppercase ASCII set. It prints up to 40 characters per line (as opposed to the Radio Shack printer's 132) at a rate of 75 lines per minute, on readily available 3-7/8" rolls of adding machine paper.

A line is printed when either the internal 40 character line buffer is full or upon receipt of a carriage return. The PR-40 accepts data as fast as one character per microsecond. All inputs and outputs are TTL compatible and interface via a 12 pin nylon connector.

The signals expected by the printer are D0-D6, representing ASCII data and an input data strobe signal. The printer will then send a status signal to the TRS-80 when it's time to send data. Hardware inside the printer decodes a carriage return, ODH, and prints when it is received with data. A line feed is automatic whenever a carriage return is forced or decoded.

PR-40 timing is shown in Fig. 1. All signals represent positive logic; +5 VDC is equivalent to a one.

At point A on the descending edge of the signal the printer looks at the data, D0-D6, to see if a carriage return, ODH, is present.

At point B on the rising edge of the strobe pulse data, D0-D6, are parallel loaded into a 40-character line buffer. At C a control character, ODH, has been detected. The status signal goes low until the carriage return is physically completed. At D the status signal remains low indicating that the printer is busy.

MARK GORDON COMPUTERS

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15 Kenwood Street, Cambridge, Massachusetts 02139, (617) 491-7505 ↙270

SORT-80

Produced exclusively for Mark Gordon Computers by SBSG

TRS-80* disk files may be sorted and merged using SORT-80, the general purpose, machine language, sort program. Written in assembly language for the Z-80 microprocessor, it can:

- Sort files one disk in length
- Sort Direct Access, Sequential Access and Basic Sequential Access files
- Reblock and print records
- Recontrol files from disk
- Be executed from DOS
- Be executed from BASIC
- Be inserted in the job stream
- Allow parameter specification
  - input/output file specification
  - input/output record size
  - lower/upper record limit
  - print contents of output file
  - input/output file key specifiers

The minimum requirement is a 32K TRS-80* Level II computer with one disk drive or a single drive Model II computer. It will operate on 35, 40 and 77 track drives, and has been tested on TRSDOS 2.1, 2.2, 2.3, NEWDOS 2.1, 3.0, and VTOS 3.0.1. It is compatible with most machine language printer drivers. Sort time is fast; for example, a 32K file will sort in approximately 40 seconds. **$59**.

PCS

Program Catalog System from SBSG

This menu driven system provides the TRS-80* user with a computerized method to keep track of all programs and data files. The idea is to build and maintain on a file a disk detailing each program including program name, size, creation date, and a brief narrative as to function. Programs are provided to:

- create, update, or display
- print in disk number order
- print in alphabetical order
- print file listing
- create a file automatically

With a 32K system you can catalog 150 programs; with a 48K system you can catalog 300 programs; or you can catalog 650 programs without sort. **$29**

*TRS-80 is a registered trademark of Radio Shack, a division of Tandy Corp.

InfoBox

The information manager

InfoBox is the easiest-to-use information manager available for the TRS-80*. It's ideal for keeping track of notes to yourself, phone numbers, birthdays, inventories, bibliographies, computer programs, music tapes, and much more. This fast assembly language program lets you enter free-format data, variable length items and lets you look up items by specifiying a string of characters or words that you want to find. You can also edit and delete items. Items entered into InfoBox can be written to and read from cassette and disk files. All or selected items can be printed on a parallel or serial printer. InfoBox occupies 3K. Specify cassette or disk version. Special introductory price **$24.95** until June 15; **$29.95** after.

DBUG+

The ultimate monitor/disassembler

Compare the features and price of **DBUG+** with other monitor/disassembler programs. It offers nine true, single-byte breakpoints, single step program execution, hex and decimal arithmetic including multiply and divide and conversions, ASCII dump that distinguishes all 256 codes, disassembly to screen and printer in full Zilog mnemonics, and register set command. It also has the usual port I/O, hex and decimal memory dump, change, move, copy and exchange memory features offered by others. Ideal for the user who wants to experiement with assembly language or to write subroutines to call from BASIC; essential for the serious programmer. Special introductory price **$24.95** to June 15; **$29.95** after.

FMS

File Management System by SBSG

This menu driven program allows you to define and create files for your own use. You can:

- sort these files in:
  - ascending order
  - descending order
  - on up to 3 seperate fields
- scan the files
- summarize any numeric or dollar data fields
- print the field records
- create, add to or delete field records

$49.00

Model II versions of SBSG software available. Dealer inquiries invited.

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The pinout of the 12-pin connector, J-4, shown in Fig. 2 is the link to the TRS-80.

Parallel In/Out Port

The TRS-80 expansion interface has an eight-bit parallel output port. This memory-mapped output port that is addressed like a software memory element, is located at 37E8H, 14312D. To output to this port, an eight-bit byte of data is written to the address.

Also located at this address is a memory-mapped four-bit input port. Data is input to this port by reading memory location 37E8H. The four bits of data read in D4-D7, are used to indicate the following:

D7—printer busy
D6—printer out of paper
D5—unit selected?
D4—fault condition

Data elements D0-D3 are not wired up in hardware and can only be input as ones. Of the above signals, most applications will require only D7 to indicate if the printer is ready to receive data. Inputs D4-D6 must be terminated, if not used, to be compatible with the Radio Shack line printer software routine.

Each time a byte of data is sent to memory address 37E8H, the MWRITE pulse generates the data strobe pulse for the printer. The data strobe pulse is a one microsecond pulse to ground.

The parallel output port can be written to or read from at least three different ways. First, you can write and enter a machine language program that manipulates memory location 37E8H.

A second way uses the BASIC statements—POKE to output data and PEEK to input data. For example, POKE 14312,255 enters a binary 1111 1111B into memory location 37E8H (in reality the line printer output port latch). Any data, 0-255D, can thus be POKEd.

Similarly, to input this port, A = PEEK(14312) returns the printer status data, the four upper bits, D4-D7, as the value of A. Remember that the lower four bits, D0-D3, are not supported in hardware and are always input as ones.

The third way to utilize this port is via the LLIST and LPRINT statements. Enter LLIST and a carriage return. The status bits are input at 37E8H and bit D7 is checked to see if the printer is busy. If not, the status bit D7 will be low - indicating the printer is ready for data. See Fig. 3.

If no printer has been hooked up, D7 will be high, indicating the printer is busy, and the TRS-80 will lock up. There is no termination provided in the expansion interface.

Fig. 4 shows the connections, required by the printer of the expansion interface.

Constructing a Cable

With the signal timing and voltage relationships in hand, we can construct cable with the 34 pin expansion interface connector on one end and the 12 pin PR-40 printer connector on the other (Photo 1).

In order to connect the cables easily and keep the printer compatible with my IMSAI, I used the 16 pin dip header and plug. The perforated board also allowed me to wire any required hardware circuit. (See Parts List.)

To install the 34 pin Alpha connector, I carefully attached the 34-ribbon wire to the connector. I then put the connector into

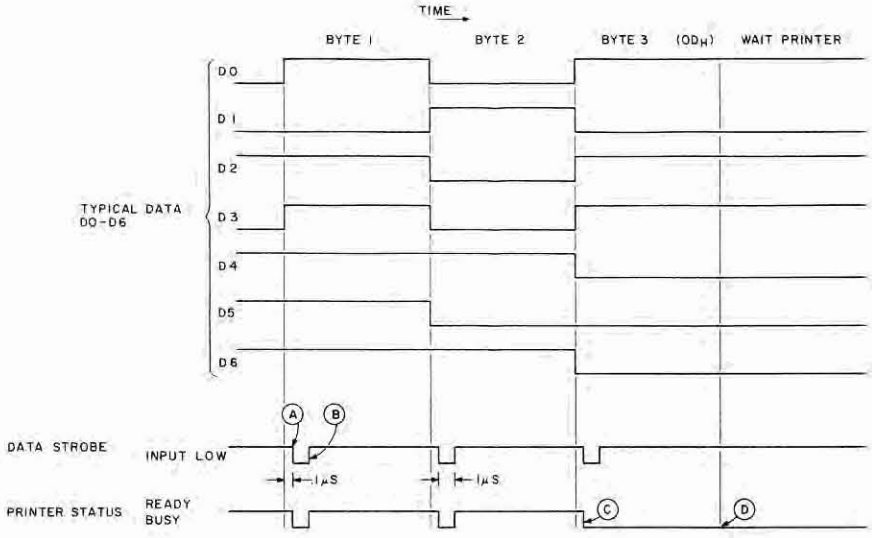
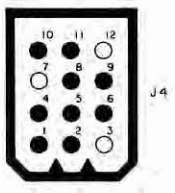


Fig. 1. PR-40 signal input timing requirements.



1 GND
2 STATUS
3 INPUT STROBE
4 GND
5 D5
6 D6
7 NOT USED BY PR-40 (IS USED IN HARDWARE INTERFACE)
8 D3
9 D4
10 D0
11 D1
12 D2

PINOUT DESIGNATION OF THE 12 PIN CONNECTOR IN THE PR-40 USED FOR CONNECTION TO THE TRS-80

Fig. 2. Pinout of the PR-40 12 pin designation.

Decimal address	Mnemonic	Hex code	Decimal value
32750	LDA	3A	58
32751	E8	E8	232
32752	37	37	55
32753	AND n	E6	230
32754	80	80	128
32755	JR Z	28	40
32756	F9	F9	249
32757	LDA,C	79	121
32758	LDA	32	50
32759	E8	E8	232
32760	37	37	55
32761	CP	FE	254
32762	0D	0D	13
32763	RET NZ	C0	192
32764	LDA	32	50
32765	E8	E8	232
32766	37	37	55
32767	RET	C9	201

Table 1. Machine language code listing of software.

Quan.	Description	Source
1	Perforated circuit board cat. #276-1379	Radio Shack
1	Mounting box 2⅝x5⅛x1½	Radio Shack
1	16 pin WW IC socket	Jameco Electronics
1	16 pin WW dip plug w/cover	Jameco Electronics
34	Vector T44 miniwrap terminals	Jameco Electronics
6"	34 conductor cable .1" center	Jameco Electronics
1	Alpha 34 pin connector part #FCC-170	Pioneer Electronics

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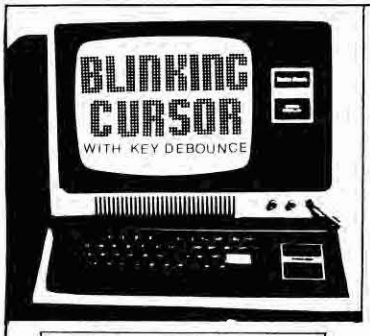

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TRS 80*

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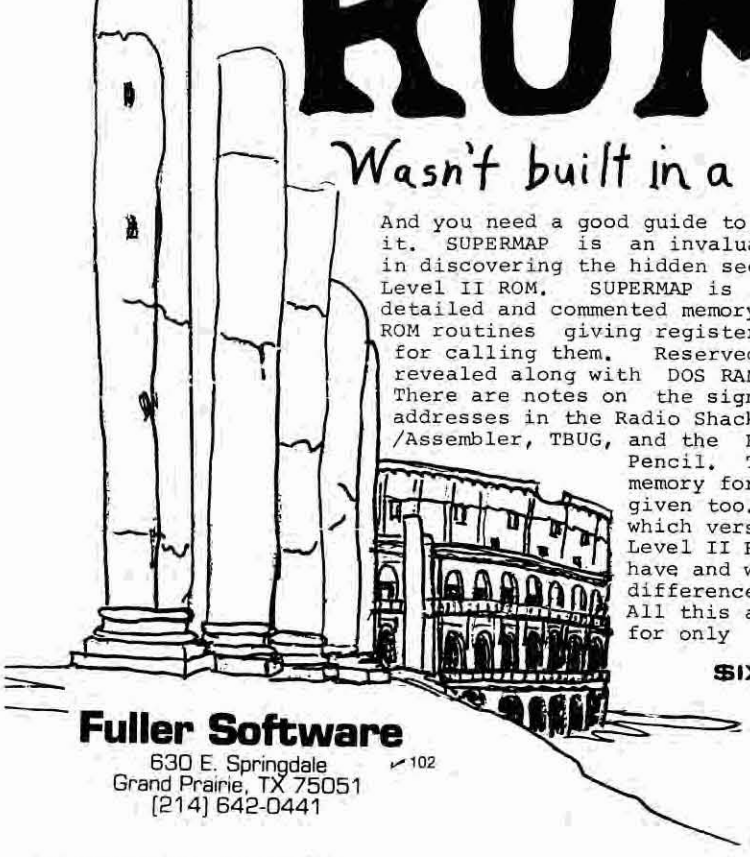

And you need a good guide to explore it. SUPERMAP is an invaluable aid in discovering the hidden secrets of Level II ROM. SUPERMAP is a long detailed and commented memory map of ROM routines giving register setups for calling them. Reserved RAM is revealed along with DOS RAM usage. There are notes on the significant addresses in the Radio Shack Editor /Assembler, TBUG, and the Electric Pencil. Tape and memory format are given too. Learn which version of Level II ROM you have and what the differences are. All this and more for only

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Whether you are experienced or just beginning in assembly language programming you will recognize the need for at least three types of programming aids: an editor/assembler, a monitor and a disassembler.

DISK*MOD will read in your Radio Shack editor/assembler, modify it, and write the improved version to disk. This new E/A will not only allow you to display the directory on the screen but gives you the disk space used by each file and the remaining free granules. DISK*MOD can display the number of bytes used by your text buffer and how many remain free. You can kill a file from a mounted disk. All cassette operations remain functional. DISK*MOD improves manual scrolling by allowing a full fifteen lines of text to be displayed instead of only seven as in the original E/A. The 'DEFM' output is altered to 8 bytes per line instead of only one. Output to the prin er is paged at 56 lines per page with optional paper change prompting. The 'B' command branches to any address you choose instead of 0000H. The symbol table is sorted alphanumerically and output five across. You can protect high memory for monitors, drivers, et cetera and recover from reboots with your text buffer intact. You can move blocks of text which will allow you to keep and use a library of subroutines on disk. The global change feature becomes highly desirable when you have a disassembler which generates symbolic labels.

The next tool a programmer needs is a monitor to examine, modify, and debug programs. **TUTIL** has many useful features. You can display memory simultaneously in ASCII and HEX. Output can also be directed to the printer. Blocks of memory may be compared byte for byte or a search might be done for a particular sequence of bytes. The Z-80 registers can be displayed and altered. You can fill blocks of memory with a given byte or change a single byte. Alphanumeric data can be entered directly into memory from the keyboard. Blocks of memory can be moved, breakpoints set or reset, and addition and subtraction done in hexadecimal. You can load SYSTEM tapes into memory, execute or verify them, and punch out new SYSTEM tapes. The best part is that an E/A modify program for tape users is also included in the TUTIL package. Although not providing all the features of the DISK*MOD, it does allow you to protect memory and recover from resets. Since BASIC's pointers are not destroyed you may go back and forth to the E/A without having to reload it or your source text. **DUTIL** has all the above commands plus the ability to scroll through a disk drive sector by sector, load and save sectors from a buffer and enable/disable interrupts.

The third tool is a disassembler. **DISASSEMBLER 1.2** not only disassembles to video or printer but also outputs to tape in a format compatible with E/A. Now you can take apart someone else's code and modify it for your needs. The real beauty of DISASSEMBLER 1.2 is the symbolic labels and equates that this two pass program produces. DISK*MOD users can easily change all the Z1A19 labels to BASIC, for example. Output to printer is 50 lines per page with optional paper change prompting. A source file may be written to disk with **DISASSEMBLER 2.0**.

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✓Reader Service index—see page 194

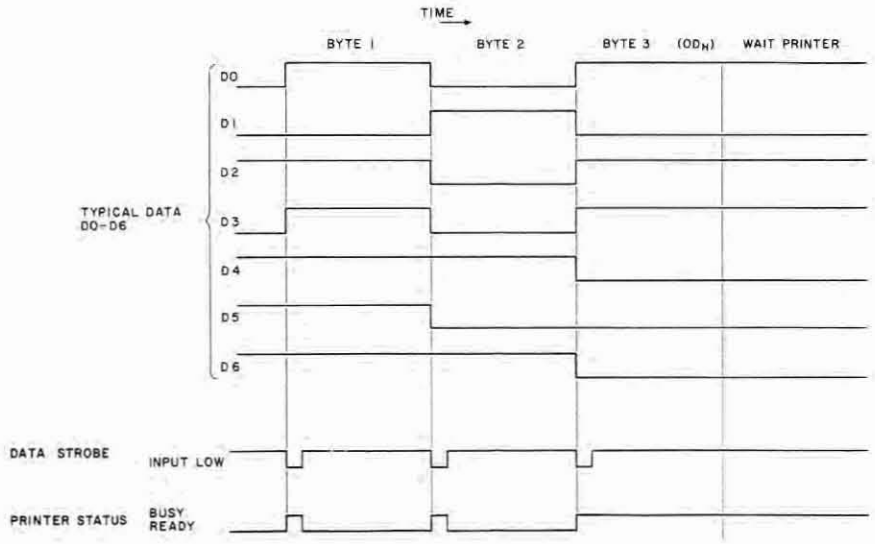

Fig. 3. TRS-80 signal output specifications and expected status signal.

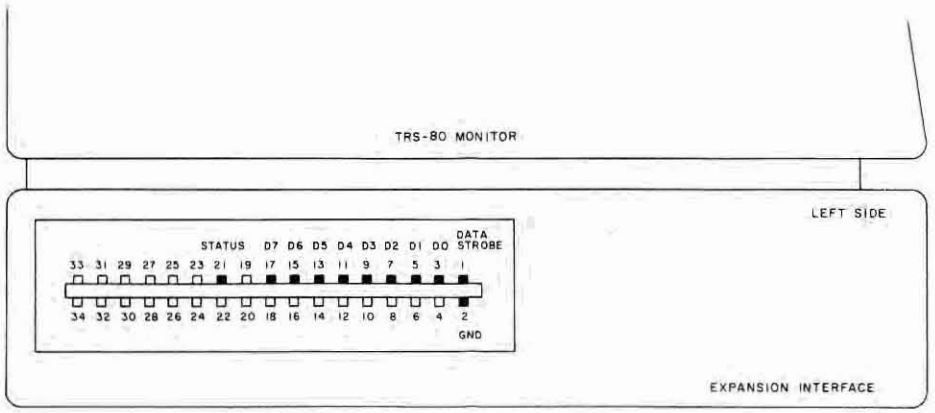

Fig. 4. Circuit card pin designations on expansion interface.

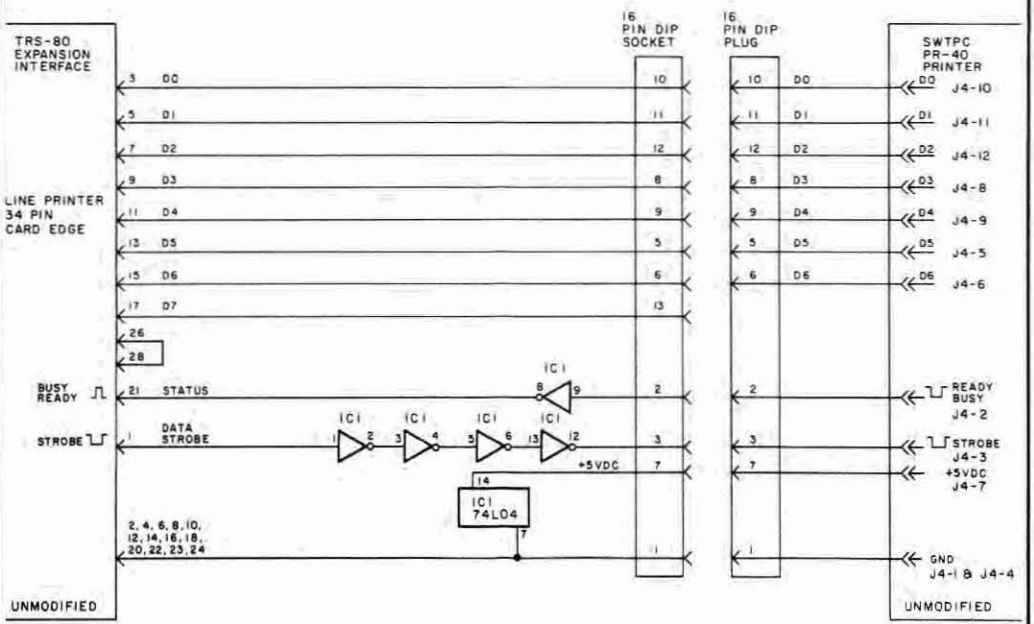

Fig. 5. Interface schematic-hardware method.

a bench vise and completed the crimp.

With a hardware interface the PR-40 printer will electrically resemble a Radio Shack line printer.

Fig. 5 and the signal timing diagrams for the PR-40 and the TRS-80 show that the status (busy) signal of the PR-40 is the opposite of what the TRS-80 expects.

Inverter IC1, wired into the status signal, corrects that situation and provides the TRS-80 software with the expected signal.

This would seem to be all that is needed. However, when only this is done and the LLIST statement is utilized, all carriage returns in the program listing are ignored. Careful study of the Radio Shack printer manual and the PR-40 circuit description finally revealed the problem.

The PR-40 recognizes control codes (like the carriage return) on the falling edge of the strobe pulse (Fig. 1), while the TRS-80 data to be output, D0-D7, is not valid on the falling edge (Fig. 3).

However, in Fig. 6 (from the Radio Shack printer manual), the specifications indicate the falling edge of the strobe pulse should occur a minimum of one microsecond after valid data is present on data lines D0-D7. If the TRS-80 had output data to the printer per its own specifications instead of those in Fig. 3, there would have been no problem. (Alphanumeric data isn't affected because the printer recognizes it one microsecond after it is valid on data lines D0-D7 on the rising edge of the strobe pulse.) But since ODH, a carriage return, is a control character, it will never show up as valid data at the right time during the TRS-80 line printer output cycle.

The strobe pulse had to be delayed just long enough for valid data to exist on lines D0-D7 before the strobe pulse went to ground. I did this by using four inverters in series as shown in Fig. 5. This was no problem as the IC was needed to invert the printer status signal anyway.

I used a 74L04 to provide maximum signal delay per gate—about one-half as fast as a

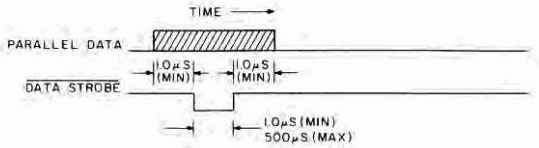

Fig. 6. Required timing of the parallel data and strobe pulse.

regular 7404 inverter. At approximately nanoseconds delay per gate, the strobe signal is delayed .1 to .2 microseconds, enough for the PR-40 to act on the control characters.

The IC1 needed +5VDC, so I decided to get it from the PR-40 via unused pin #7 in the J4 connector, as shown in Fig. 7.

The finished cable is shown encased in Photo 2.

Software Interface

One of the intriguing aspects of microprocessors is that there are many ways to do any one thing. An equally successful way to interface the TRS-80/PR-40 is to wire the two units together as shown in Fig. 8. Note that IC1 is totally eliminated by using software.

The machine language routines that actually drive the lineprinter are found by PEEKing memory locations 16422D and 16423D for the hex address, —058DH. These driver routines contain the desired output byte in the C register.

The busy signal from the printer must be checked by inputting the status bits at memory-mapped location 37E8H to see if bit D7 is high. If it is, the printer is busy and the TRS-80 goes into a loop. If bit D7 is low, the data is written to 37E8H along with a strobe signal to the printer. A carriage return signals the completion of the printed line.

By changing the machine language driver address at 16422D and 16423D to some other RAM address near the top of memory, a new driver routine can allow for the inverted busy signal and eliminate the strobe pulse timing problem. The rapid strobe pulse, encountered in the hardware interface, can be solved by sending two carriage returns to the PR40. Though the printer always misses the first return because of the timing problem, the code is latched at the output port. The second carriage return now finds stable data when the strobe pulse goes to ground.

The assembly language code for this line print driver is shown in Table 1. Written in Z-80 code, it can be located anywhere in RAM. Since the end of RAM in my 16K system is at decimal 32767, the 18 byte assembly language program, should be located in 32750D to 32767D. A BASIC program that changes the line print driver address to RAM locations 32750D to 32767D is shown in Listing 1.

Changing line 10 enables other TRS-80 RAM configurations to use the same program.

```
5 REM  THE PROGRAM STORES A LINEPRINTER
6 REM  OUTPUT ROUTINE IN RAM MEMORY
7 REM  JOHN HISE   8/30/79
10 M=16:REM =SIZE OF MEMORY IN "K"
20 N=M*4+63
30 S=1024*M+16383
40 PRINT "IN RESPONSE TO MEMORY SIZE?"
50 PRINT "ENTER: ";S-19;" FOR A ";M;"K S
YSTEM"
60 IF S>32767 THEN S=S-65536
70 POKE 16421,2:POKE 16422,236:POKE 1642
3,N
80 FOR X=S-17 TO S
90 READ Y
100 POKE X,Y
110 NEXT
120 END
130 DATA 58,232,55,230,128,40,249,121,50
,232,55,254
140 DATA 13,192,50,232,55,201
```

Program Listing 1. BASIC program for software interface.

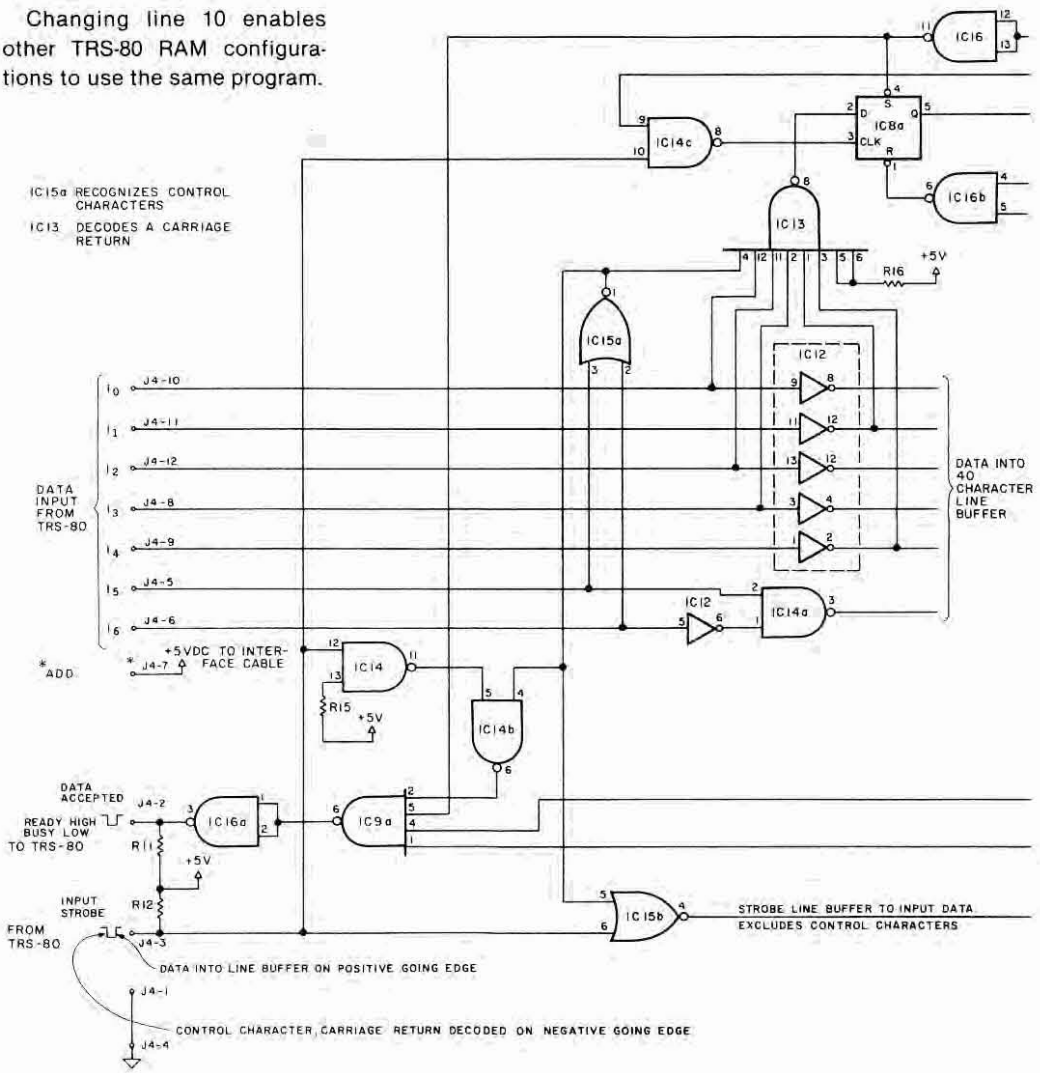

Fig. 7. PR-40 schematic showing signal inputs and outputs.

4K system use	10M = 4
16K system use	10M = 16
32K system use	10M = 32
48K system use	10M = 48

Enter the following, appropriate to your memory size, after power up:

4K system enter	20460
16K system enter	32748
32K system enter	49132
48K system enter	65516

The system is now ready for the LLIST and LPRINT commands. When outputting control codes to the printer via CHR$( ) or POKE, all are ignored except 10D and 13D. To manually force a carriage return enter either LPRINT or POKE 14312,13. CHR$(10) or CHR$(13) imbedded in the LPRINT statement forces a carriage return/line feed within the statement in addition to the one at the end of the statement. For example if A = 2 and B = 3:

```
LPRINT A;CHR$(13);B;CHR$(13);
"TOTAL A + B = ";A + B
```

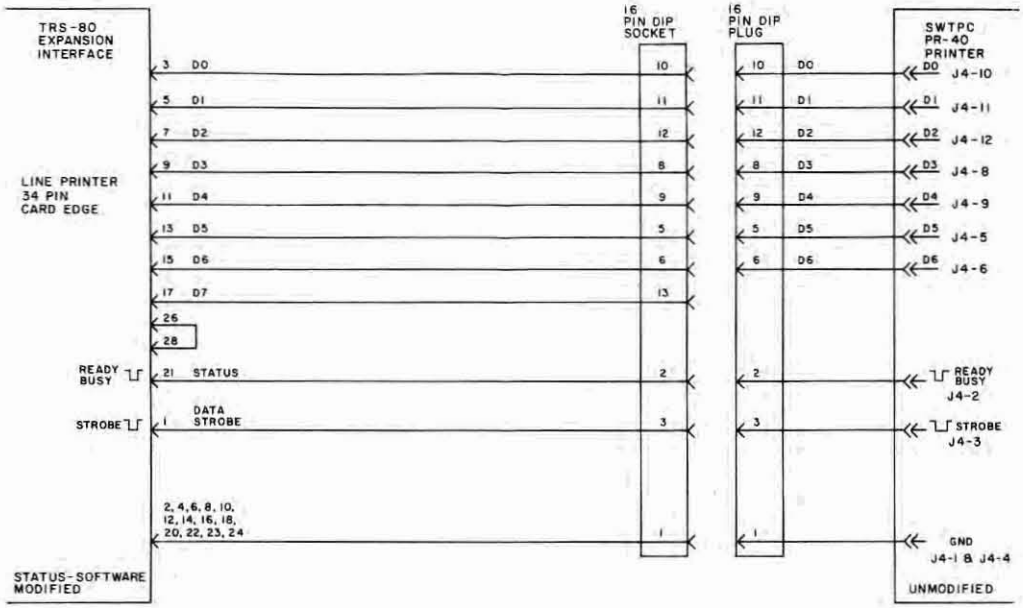

Fig. 8. Interface schematic-software method.

The following would be output on the line printer when ENTER is depressed:

0
0

Total A + B = 5 ■

References

Bordeau, Denis, *How to use the PR-40 Printer*, Kilobaud Microcomputing, January 1977.

Cowan, Robert, *A Look at TRS-80 Peripherals*, Kilobaud Microcomputing, April 1979.

Domuret, Allan J, *TRS-80 Selectric Word Processor*, Kilobaud Microcomputing, June 1979.

Morr, David G., *Teleprinter Output for the TRS-80, Kilobaud Microcomputing*, August 1979.

✓Reader Service index—see page 194

An electronic video worksheet.

The Graphics Coder

```
7 CLEAR
10 DIMC(200),D(200),S(200)
20 Y=15360:A=0:F=0
30 CLS
40 POKEY+A,45:B=A:B=A:PRINT@960,A;B;
50 A$=INKEY$
60 IFA$=""THENGOTO50ELSE200

100 F=F+1:C(F)=G:D(F)=Y+A:S(F)=A
110 CLS
120 FORBA=1TOF:POKED(BA),C(BA)
130 NEXTBA
140 POKEY+A+1,45:A=A+1:GOSUB1000:PRINT@960,CHR$(30);:PRINT@960,A;
    B;:GOTO50
150 CLS:PRINT"THESE POKE LOCATIONS AND GRAPHIC CODES WERE USED:"
160 PRINTTAB(5)"POKE LOCATION";TAB(25)"GRAPHIC CODE";TAB(45)"PRIN
    T LOCATION"
170 FORT=1TOF
180 PRINTTAB(10)D(T);TAB(30)C(T);TAB(50)S(T)
185 E=E+1:IFE=14THENINPUT"PRESS ENTER TO CONTINUE";B$:E=0
190 NEXTT:GOTO600

200 IFASC(A$)=9THENA=A+1:GOSUB1000:IFA>1023THENGOTO500ELSEPOKEY+A
    -1,32:POKEY+A,45:PRINT@960,CHR$(30);:PRINT@960,A;B;:GOTO50
210 IFASC(A$)=10THENA=A+64:GOSUB1000:IFA>1023THENGOTO500ELSEPOKEY
    +A-64,32:POKEY+A,45:PRINT@960,CHR$(30);:PRINT@960,A;B;:GOTO5
    0
220 IFASC(A$)=91THENA=A-64:GOSUB1000:IFA<0THENGOTO500ELSEPOKEY+A+
    64,32:POKEY+A,45:PRINT@960,CHR$(30);:PRINT@960,A;B;:GOTO50
225 IFA$=CHR$(68)THENGOTO1700
230 IFASC(A$)=8THENA=A-1:GOSUB1000:IFA<0THENGOTO500ELSEPOKEY+A+1,
    32:POKEY+A,45:PRINT@960,CHR$(30);:PRINT@960,A;B;:GOTO50
235 IFA$=CHR$(82)THENGOTO1800
240 IFA$=CHR$(32)THENIFA>880THENPRINT@256,"";:INPUT"CODE";G:GOTO1
    500
250 IFA$=CHR$(32)THENPRINT@896,"";:INPUT"CODE";G:GOTO1500
260 IFA$=CHR$(81)THENGOTO150
270 GOTO50

500 CLS:PRINTCHR$(23):PRINT@512,"THAT POSITION IS NOT":PRINT"ON T
    HE SCREEN"
510 FORX=1TO1000:NEXTX:A=0:GOTO110

600 INPUT"DO YOU WISH TO DO MORE GRAPHICS";Q$
610 IFLEFT$(Q$,1)="Y"THENGOTO650
620 STOP
650 INPUT"DO YOU WISH TO CLEAR THE RESIDENT GRAPHICS";Q$
655 IFLEFT$(Q$,1)="Y"THENGOTO7
660 GOTO110

1000 B=A
1010 IFA>63THENH=INT(A/64):B=A-(64*H)
1020 RETURN

1500 FORT=1TOF
1510 IFD(T)=Y+ATHENGOTO1540
1520 NEXTT
1530 GOTO100

1540 C(T)=G:CLS:GOTO120
1700 FORT=1TOF
1710 IFD(T)=Y+ATHENC(T)=32:GOTO110
1720 NEXTT
1730 GOTO110
1800 A=D(F)-Y
1810 IFA<0THENA=0
1820 CLS:GOTO120
```

Program Listing.

U. F. Racine
2520 S.E. Alexander Drive
Topeka, KS 66605

When programming on the TRS-80, I utilize graphics as often as possible.

However, when displaying an outline map of the U.S. or a Lunar Lander with string or POKE graphics, I am faced with the task of assembling strings or computing the proper POKE locations. Whenever I am working on a display, I find myself shuffling several pieces of paper, a video display worksheet, a scratch pad and a sheet with POKE locations.

Finally, I let my TRS-80 do the work for me. After all, that is what computers are designed to do!

I call the following program Graphics Coder. It's a video display worksheet. While it still requires a hand listing, unless you have a printer, it speeds up the development of graphic displays.

Cursor and Pseudo Cursor

The program uses the → and ← cursor keys and the upward linefeed ↑ and downward linefeed ↓ to position the pseudo cursor. When the program runs, the pseudo cursor is initially located at the home position, 0,0. At the bottom of the screen, print location 960, the current print location and tab number of the pseudo cursor are displayed.

INKEY$ directs the cursor and edit functions. When the appropriate arrow key is pressed, the cursor moves one print position left or right, up or down.

When the cursor is in the location where you wish to place a graphic character, depress the space bar. The program then prompts the user to enter the appropriate graphic code. For instance, if you enter 191, the entire graphic block at that print location is turned on.

While I wrote the program to accept code-based TRS-80 graphics, you can enter and display any ASCII code. Both text and graphics can be assembled.

The ASCII codes are found in section C/2 of the *TRS-80 Level II User's Manual*. If you are not familiar with TRS-80 graphics codes, refer to the book *Introduction to TRS-80 Graphics* by Don Inman (dilithium Press, 1979).

Conversion

You will need to convert from hexadecimal to decimal. Begin-

ning with the first character, number from 129 to 191. An alternative source of information can be found in William L. Colsher's article *"Getting the Most out of Your TRS-80"* in the July, 1979 issue of *Microcomputing*. The characters are printed, but in a much smaller version.

Once the code is entered, the program clears the screen and displays all the code stored to that point. The cursor is also moved one position to the right.

The program has two editing features. Firstly, if you enter the wrong code or want to change the code in a location, return the cursor to that location, press the space bar and enter the new code. The program changes the code for that location.

Secondly, if you wish to delete a character and not replace it with another code, return the cursor to that position and press the D key. The program substitutes a space for that code (CHR$(32)().

After editing the display, reset it by hitting the R key. This function clears the video display, prints all the characters stored and places the cursor one position to the right of the last print location containing a character.

At any point during the program run, the print locations, graphic or ACSII codes and tab locations can be displayed in blocks of 14 by pressing the Q key. It is then a simple matter either to write down the information or print it out.

After listing the display data currently stored, the program asks the user if he wishes to continue. If the input is yes, the user can retain the stored code or begin a new display.

The program can be modified to include the line number, if it is necessary:

```
20 Y = 15360: A = 0 : H = 1
1010 IF A>63 THEN H = INT(A/64):
B = A – (64*H): H = H + 1
```

Add H to the print statements in lines 40, 140, 200, 210, 220, and 230. The lines should read: PRINT@960,A;B;H;:GOTO. ■

✓Reader Service index—see page 194

Keep your files safe with this simple utility.

Disk File Protection

Dan Keen
and
Dave Dischert
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Cape May Court House, NJ
08210

One of the problems with TRSDOS version 2.1 is the frequent overwrite on disks. Radio Shack has since released a new version, 2.2, and this problem appears to be solved.

But for those very critical times when you want to leave nothing to chance, structure your programs around this control routine and put your mind at ease.

Using the Program

The routine uses a sequential file to tell the computer where to put the random file information. The sequential file keeps track of where the last random file data is where new material will be put on disk. There is never any overwrite.

```
 0 CLEAR200
 5 REM * TEST PROGRAM FOR USING SEQUENTIAL AND RANDOM FILES
 10 ONERRORGOTO1000
 20 OPEN"I",2,"INDEX":INPUT#2,RX,SRX:CLOSE
 30 ONERRORGOTO0
 40 OPEN"R",1,"FILENAME":FORX=0TO4:FIELD1,X*50 AS PH$(X),50
    AS A$(X):NEXT
 50 IF(SRX=0)AND(RX=1)GOTO100
 60 IFSRX-1<0THENGET1,RX-1:B$=A$(4):GOTO80
 70 GET1,RX:B$=A$(SRX-1)
 80 PRINT"B$=";B$
 90 PRINT"LAST RECORD WAS #";RX-1:PRINT"LAST SUB REC WAS #";
    SRX
100 INPUT"ENTER NEW WORD";B$
110 LSET A$(SRX)=B$
120 SRX=SRX+1:IFSRX=5THENSRX=0:PUT1,RX:RX=RX+1:GOTO150
140 PUT1,RX
150 OPEN"O",2,"INDEX":PRINT#2,RX,SRX:CLOSE:END
1000 RX=1:SRX=0:OPEN"O",2,"INDEX":PRINT#2,RX,SRX:CLOSE:RUN
```

Program Listing.

First, let's define record and subrecord. A record is 256 bytes, one full buffer. A subrecord is a section of a record. Several subrecords make up a record. R percent is the variable used for the record number, and SR percent for the subrecord.

The number of subrecords per record is established in the fielding (line 40). Lines 60 and 120 must have proper values which match up with the number of subrecords.

In the control program, we have chosen five subrecords to fill up one record. Fielding is setup as usual, as described in the TRSDOS owners manual on page 7-72. Use PH$ as PHONEY$ to position the subrecord within the buffer. The manual calls it STARTHERE$.

The array in line 60, A$(4), holds the last subrecord data in the previous record. The number four would be changed if you use other than five subrecords. By the same token, IF SR% = 5 in line 120 would also need modification.

The first thing the computer tries to do is input data from a nonexistent file (line 20). The ONERROR routine sends execution to 1000 where the file is created. RUN terminates the error and it will not occur again. RESUME is not needed. Line 30 keeps the machine on the lookout for usual blunders.

An error would occur in line 60, if the program were allowed to get there. (Line 60 tries to get record number 0, which is not a legal record number.) But line 50 sees that this won't happen.

The last of the data entered are retrieved in either 60 or 70, depending on the values of the record and subrecords. The subrecord numbers and record number, if need be, are incremented in line 120. Information is then put in the proper random file. The new R percent and SR percent values are stored in line 150.

In Conclusion

It's easy to make errors when incorporating this routine into your programs. If trouble occurs, check the values in lines 40, 60 and 120.

The DISKDUMP/BAS utility provided on the TRSDOS disk is a powerful aid in debugging this type of program. With DISKDUMP you can see exactly what went on the disk, and determine if the problem lies in the writing or reading section of your program.■

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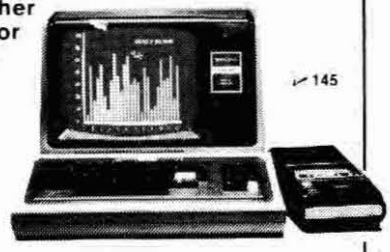

✓145

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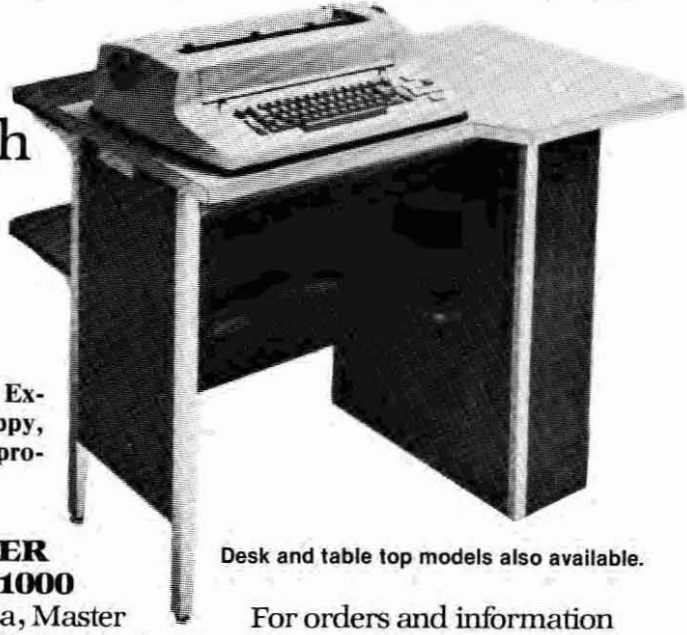

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✓Reader Service index—see page 194

See how your 80 sorts data, graphically.

Graphic Sort

C. A. de Zoysa
P.O. Box 170
Keyport, NJ 07735

Using a lot of paper, arranging and rearranging arrays and subscripted variables, I was helping a friend learn about computer sort methods. Through this maze of subscripted variables we managed to get an idea of how the computer carried out its process of sorting. It occurred to me to write a simple program which would graphically demonstrate the sorting process on the video display terminal.

The sort technique I have used is one that most beginners go through. Although it is not the most efficient method of sorting, it adapted itself very well to graphic display.

The BASIC Sort

The program was written for a TRS-80 Level II. The data statement is restricted to eight items, which eliminates the need for DIMensioning and permits the data to be displayed in single lines.

Only one subscripted variable is used. Other variables have been kept to a minimum.

The program should run on most microcomputers with little or no program modification provided the video display terminal can handle 64 characters per line.

The graphics display program listed (see Program Listing 1)

A —Array element
I —Dummy variable for keyboard input
L —Flag to check if switch takes place
J —Subscript—inner loop
N —1. Subscript during read
—2. Subscript—outer loop
T —Variable for temporary storage during switches
Q —1. Tab counter when printing headings
—2. Line counter during output
X —1. Array element indicator when printing headings
—2. Array subscript during output

Table 1. List of Variables.

```
10 FOR N = 1 TO 8
20 READ A(N)
30 NEXT N
40 DATA 254,-12,101,567,45,0.123,33,309
50 CLS : PRINT "ORIGINAL ORDER: "; : GOSUB 260
60 PRINT : PRINT : GOSUB 360
70 PRINT : Q = 0
80 FOR N = 1 TO 8
90 FOR J = 1 TO 7
100 IF A(J) < A(J+1) THEN 150
110 T = A(J)
120 A(J) = A(J+1)
130 A(J+1) = T
140 L = 1
150 GOSUB 250
160 PRINT
170 NEXT J
180 NEXT N
190 PRINT "END SORT"
200 PRINT : PRINT "SORTED ORDER: "; : GOSUB 260
210 PRINT : PRINT
220 INPUT "HIT ENTER TO REPEAT"; I
230 RESTORE : GOTO 10
240 END
250 PRINT TAB(1) N; TAB(5) J;
260 FOR X = 1 TO 8
270 PRINT TAB(13) A(X);;
280 NEXT X
290 IF L = 1 PRINT TAB(55) J; TAB(60) J+1; : L = 0
300 Q = Q + 1
310 IF Q > 8 THEN 330
320 RETURN
330 PRINT : INPUT "HIT ENTER TO CONTINUE"; I
340 CLS : GOSUB 360
350 Q = 0 : RETURN
360 REM PRINT HEADINGS
370 PRINT TAB(3)"LOOP"; TAB(29)"ARRAY"; TAB(55)"ELEMENT
    S"
380 PRINT "SUBSCRIPTS"; TAB(28)"ELEMENTS"; TAB(55)"SWIT
    CHED"
390 PRINT TAB(2)"N"; TAB(6)"J";
400 Q = 0
410 FOR X = 1 TO 8
420 PRINT TAB(Q+13) X;
430 Q = Q + 5
440 NEXT X
450 PRINT
460 RETURN
```

Program Listing 1.

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***DOUBLE DENSITY** refers to recording density in bits per inch (bpi). Typically single density means data can be recorded up to 2,938 bpi; double density means data can be recorded up to 5,876 bpi.

***DOUBLE-SIDED** refers to number of read/write heads. Single-sided is one head, read/write one side only; double-sided is dual heads allowing read/write operations on both sides of the diskette. A double sided drive appears as two separate drives to the controller.

***CAPACITY** unformated capacity is the total amount of storage space available on a diskette. Typically 125K bytes on a 40 track 5.25in. diskette. Formated capacity is the total USABLE storage space on a diskette. Typically 102K bytes on a 40 track 5.25in. diskette.

***ACCESS TIME** the time required for the head to move from one track to the next. Typically 5 to 40 milliseconds (ms).

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AEROCOMP	**YES**	**5ms.**	**YES**	**YES**	**250K bytes (both sides)**	**YES**	**YES**
RADIO SHACK*	NO	40ms.	YES	NO	109K bytes	NO	NO
PERCOM	YES	25ms.	YES	NO	250K bytes (both sides)	YES	NO
MPI	NO	5ms.	YES	YES	125K bytes	YES	NO
SHUGART	NO	40ms.	YES	NO	109K bytes	NO	NO
SIEMENS	NO	25ms.	YES	NO	125K bytes	YES	NO
TANDON	NO	5ms.	NO	NO	125K bytes	NO	NO
PERTEC	YES	25ms.	YES	NO	250K bytes (both sides)	NO	NO
BASF	NO	12ms.	YES	NO	125K bytes	NO	NO

Factual material from current manufacturer's data sheets is believed reliable but cannot be guaranteed, comparing Aerocomp Model 40-1 to similar models.

The TRS-80* expansion interface limits the track to track access time to 12ms. *Trademark of Tandy Radio Shack

AEROCOMP, INC. ✓387
Redbird Airport, Bldg. 8
P.O. Box 24829
Dallas, TX 75224

✓Reader Service index—see page 194

sorts a group of eight numbers in ascending order. Both decimal and negative numbers have been included in the data for a more vivid demonstration.

To sort in descending order, change the < sign in line 100 to >.

The program uses two nested FOR-NEXT loops. As the loops are executing, their subscripts, N for the outer loop and J for the inner loop, are displayed at the left of the screen. After each iteration, the array is displayed in the center of the screen.

If two elements are switched, their subscripts are displayed at the right, so you will know when a comparison has caused a change in the position of array elements. Hitting ENTER keeps the program executing.

Two Subroutines

The sorting process is carried out by lines 80 to 180. Two subroutines are used. One prints the headings and the other displays the array and subscripts after each iteration. Table 1 lists all the variables and their functions.

You may substitute your own data in line 40, but the number of items should be restricted to eight. Each item should be no longer than four places including signs and decimal points. PRINT statements should be entered exactly as listed for properly spaced output. Note that some PRINT statements have two semicolons at the end. These are necessary.

After you have studied the operation of the program, its efficiency may be improved by inserting the following program lines:

```
85 C = 0
135 C = 1
175 IF C = 0 THEN 190
```

These lines prevent further loop iterations after the desired sort. ■

✓Reader Service index—see page 194

I love my serial interface.

Pencil RS232 Driver

Dick Kinsey
5754 Thompson Rd.
DeWitt, NY 13214

The Electric Pencil by Michael Shrayer was intended to be used with either one of two printer interface options: the Radio Shack expansion interface with a parallel printer or the Small Systems Hardware TRS232 serial printer interface. Unfortunately, it does not support a conventional RS-232-C interface.

If this presents a problem, you can solve it in one of three ways: Buy the disk version of the Electric Pencil ($150), as it supports an RS-232-C interface and is also usable on a cassette-only system, buy a Small Systems Hardware TRS232 board ($50) to use in place of your RS-232-C interface; or, modify the cassette Pencil ($0). I chose the last approach.

Software Modification

The Electric Pencil loads into low memory and clears it from address 21224 to the top of your memory. Any I/O driver program previously loaded in high memory is thereby erased.

To protect the driver software required by an RS-232-C, I changed the Pencil program so that it fetches the memory size from reserved RAM and clears memory only to this point. It is written as a subroutine which is called from the two places in the program that do a clearing operation. The coding for this portion of the software change can be seen in Table 1.

All that remains is to connect the driver program you previously loaded into high memory. Table 2 gives the coding for this patch.

The patch is general, so you can specify any memory size you desire and locate your driver program anywhere in the now protected high memory area.

For anyone who recently increased memory to 32K, to POKE or PEEK an address above 32767, use desired address −65536 and not the formula given in the *Radio Shack Level II Reference Manual.*

BASIC Changes

If you don't have a monitor program that locates in high memory, you will have to make the Electric Pencil software changes described above using the POKE command. I have written two BASIC programs to accomplish this painlessly.

Running the first CLOAD relocates the pointers for BASIC source statements just above the area of memory that Electric Pencil occupies. PENCIL is then loaded under SYSTEM, and the

Address	Mnemonic	Comment
17270	CALL 21149	;the location of the new subroutine
17273	NOP	;a byte no longer used
20095	CALL 21149	
20098	NOP	
21149	PUSH BC	;save all necessary
21150	PUSH DE	;registers
21151	PUSH HL	;HL contains file space start address
21152	PUSH HL	;and (HL) = 0
21153	POP DE	;store HL in the DE register
21154	LD HL,(16561)	;fetch specified memory size and
21157	SBC HL,DE	;subtract to determine number of
21159	PUSH HL	;bytes available for file space
21160	POP BC	;store in BC register
21161	POP HL	;restore file space start address
21162	INC DE	;DE = HL + 1
21163	LDIR	;clear out file space
21165	POP DE	;restore the DE and
21166	POP BC	;BC registers
21167	RET	;return to caller

Table 1.

Address	Mnemonic	Comment
21136	PUSH BC	;save registers that
21137	PUSH HL	;will be used
21138	LD C,A	;transfer character to be printed
21139	LD HL,(16422)	;fetch the driver address from reserved RAM
21142	CALL 21148	;places program counter on stack to provide return address
21145	POP HL	;restore the HL and
21146	POP BC	;BC registers
21147	RET	;return to caller
21148	JP(HL)	;jumps to driver program

Table 2.

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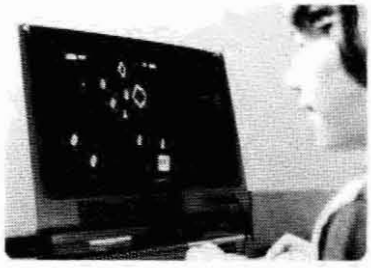

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break key is used to CLOAD the second program, the one that POKEs the software changes.

The modified Electric Pencil is then run, using SYSTEM and entering /17232 in response to the prompt (*?). In the course of clearing out the file space, it erases the now useless BASIC program. The instructions for this are displayed by the BASIC programs. ■

```
10 CLS
20 PRINT@385,"1. LOAD 'PENCIL' USING 'SYSTEM' – TAKES ABOUT 75
SECONDS"
30 PRINT@513,"2. HIT BREAK KEY AND 'CLOAD' THE SOFTWARE PATCH"
40 PRINT@900,""
50 POKE 16633,2:POKE 16634,84:POKE 16548,0:POKE 16549,84
60 POKE 21503,0:END
```

Program Listing 1.

```
10 FOR X = 21136 TO 21148
20 READ Y:POKE X,Y:NEXT
30 FOR X = 17270 TO 17273
40 READ Y:POKE X,Y:NEXT
50 FOR X = 20095 TO 20098
60 READ Y:POKE X,Y:NEXT
70 FOR X = 21149 TO 21167
80 READ Y:POKE X,Y:NEXT
90 CLS:PRINT@449,"3. ENTER /17232 UNDER 'SYSTEM'"
100 PRINT@900,"":END
110 DATA 197,229,79,42,38,64,205,156,82,225,193,201,233
120 DATA 205,157,82,0
130 DATA 205,157,82,0
140 DATA 197,213,229,229,209,42,177,64,237,82,229,193
150 DATA 225,19,237,176,209,193,201
```

Program Listing 2.

✓Reader Service index—see page 194

Use the first program on your tape to keep track of the tape.

Cassette File

James Tallman
3468 S.E. Roanoke
Hillsboro, OR 97123

If you want to store more than one program for your TRS-80 on a particular tape, a method of keeping track of the beginnings of each program is useful.

The CTR-41 tape recorder has a tape counter that can indicate where a program is saved on the cassette. To maintain a record of which program begins at what counter reading, simply jot down the tape count indication and program name.

However, if a written log is lost, you have no easy way of recovering the information. You can write a program to store the tape directory as the first file on any cassette. Such a program stores the information in DATA statements.

The program begins by clearing the screen and printing a heading (lines 110 and 130). For Level II machines an extra statement is required, because of an error in Radio Shack's ROMs. (See my note attached to the Program Listing.)

Statement 140 reads the program's name as A$ and three numbers, A, B and C. They are expected to be the tape counter's start of three copies of the program in A$. You can modify this if you want only one or two copies.

Any negative value read for A ends the program (line 150). I usually put a −1 value at the end of the program to indicate this.

The program then prints out A$ and the three starting counter locations of each of the three copies of the program. Control goes back to line 140 for another read and checks for a negative A. The program ends when either the negative value for A is read or the list of data is exhausted.

It's important to set the counter to zero at the start of the tape for the counts to be reliable. Also, I use the next-to-the-last line to indicate the next available place on the tape to save a subsequent program.■

```
100 REM CASSETTE FILE PROGRAM
110 CLS
*120 POKE 16553:255
130 PRINT" PROGRAMS ","COPY #1","COPY #2","COPY #3"
140 READ A$,A,B,C
150 IF A<0 END
160 PRINT A$,A,B,C:GOTO 140
500 DATA SLOWPOKE, 104, 109, 114
510 DATA BLACKJACK, 122, 180, 235
520 DATA CASSETTE TEST, 288, 297, 305
530 DATA NEXT AVAILABLE, 313, 0, 0
9999 DATA END, −1, 0, 0
```

This program works with both Level I and Level II BASIC.

*Required on Level II because of an error in Radio Shack ROMs. If this line is omitted, the program re-reads through an automatic RESTORE. (See Radio Shack's addendum to the *Level II BASIC Reference Manual*, item #1.)

Program Listing.

✓Reader Service index—see page 194

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How often have you returned from a long, successful business trip and dreaded facing that ugly beast, THE EXPENSE REPORT?

Before you left, you firmly resolved to note every expense in a little black book. It all worked fine for about two days. Now, you stare disgustedly at a pile of crumpled bills and scraps of paper, which you've dug out of various jacket pockets.

This program will take away that pain. No, it won't tell you how to cheat on that expense report! It will simply tell you how to play the game using established rules.

The jumble of figures you attempted to add could drive you up the proverbial wall. No matter what you try to do, the grand total refuses to equal the original cash advance for the trip.

However, when you supply your tale of woe to this program, your answer will be a clear expense layout, plausible and quickly done. (The program has hard-copy capability; you'll need a printer.) You'll be able to present a reasonable and credible expense sheet.

Gone are the desperate guessing games; now you can start your next business trip with an easy mind because you've got the Executive Expense Report Generator.

For the TRS-80 Level II 16K. **Order No. 0135R $9.95**

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The Energy Consumption program will record your utility bills for up to a five year period. All you have to do is supply data for the following six categories, which will be stored on a data tape:

1. GAS$$ – Dollars spent on natural gas.
2. CCF – Hundreds of cubic feet of natural gas used.
3. H20$$ – Dollars spent on water.
4. GAL – Gallons of water used.
5. PWR$$ – Dollars spent on electricity.
6. KWH – Kilowatt hours of electricity used.

These six monthly averages and unit costs will be calculated upon your request. The statistics section allows immediate retrieval of all information. You can compare data for a single month, or for multi-month periods in *any* combination.

The program is ideal for the following applications:

A. Comparing your costs versus the rising costs of energy.
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C. Analyzing the effectiveness of any conservation measures you may have undertaken.

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ENHANCED BASIC

Enhance the power of your TRS-80 Level II microcomputer with the Enhanced BASIC package. This package gives you many functions found in Disk BASIC plus other new features, without having to add a disk drive system.

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✓Reader Service index—see page 194

How to incorporate machine code into your BASIC programs.

Machine Code USR

Larry McDonald
4130 Ferrarra St.
Jacksonville, FL 32217

The major advantage that a machine language program has over a BASIC interpreter program is the speed of its execution. This proves very useful for long running programs or when producing high-speed graphics.

Program Listing 1 is a BASIC program that branches to a short machine language subroutine and uses this subroutine to paint the screen white. Control returns immediately to the BASIC program where we delay several seconds and then print a message.

Before you try Listing 1, try the two test programs below and time them for comparison.

Test 1 . . 10FORX = 0TO127:FORY = 0TO47: SET(X,Y):NEXTY:NEXTX
Test 2 . . 10FORX = 15360TO16384:POKE X, 191: NEXTX (191 in POKE is ASCII code for white graphics byte.)

Test 1 requires approximately 47 seconds from the time you hit the ENTER key until the word READY is displayed. Test 2 runs much faster and only requires about seven seconds to completely paint the screen.

Whiting Out the Screen

Now that you've made these comparisons, enter Listing 1. The first portion loads the machine language program (Example 1) and waits for the ENTER key to be depressed before actually executing the subroutine.

For comparison purposes, begin timing when you press ENTER and count until the screen is completely white. When you run this program, you should find that the screen is completely white before your finger has been lifted from the ENTER key (one second or less).

You can really appreciate the meaning of the term microsecond when you realize that this simple program performed over

```
 10 DATA 229,62,191,50,0,60,33,0,60
 20 DATA 17,1,60,1,255,3,237,176,225,201
 30 PRINT'Z-80 MACHINE LANGUAGE SUBROUTINE':PRINT
 40 PRINT'WHEN THE ENTER KEY IS PRESSED, THE PROGRAM WILL ENTER'
 50 PRINT'A MACHINE LANGUAGE PROGRAM VIA THE POKE COMMAND.':PRINT
 60 INPUT'PRESS ENTER TO POKE THE PROGRAM INTO MEMORY';A$:CLS
 65 FOR N=20346TO20364:READM:POKE N,M:NEXTN
 70 PRINT:PRINT'AT THIS POINT, A PROGRAM HAS BEEN LOADED'
 80 PRINT'THAT WILL CAUSE THE SCREEN TO BE PAINTED WHITE.'
 90 PRINT:PRINT'WE WILL USE THE USR(0) COMMAND TO BRANCH TO THIS'
100 PRINT'MACHINE LANGUAGE PROGRAM':PRINT
110 INPUT'PRESS THE ENTER KEY TO BRANCH TO THE SUBROUTINE';A$:CLS
120 POKE16526,122:POKE16527,79
130 X=USR(0)
140 REM - A DELAY LOOP TO KEEP THE SCREEN WHITE FOR SEVERAL SECONDS
150 FOR N=1TO1200:NEXTN:CLS
160 PRINT:PRINT'AT THIS POINT, WE HAVE RETURNED BACK TO THE'
170 PRINT'BASIC PROGRAM AND HAVE CONTINUED EXECUTING.'
180 PRINT:PRINT'END OF PROGRAM . . .'
190 END
```

Program 1. BASIC Program to White Screen.

```
  1 POKE 16553,255
  5 CLS
 10 DIM B$(16),C(16)
 20 DATA'0','1','2','3','4','5','6','7','8','9','A','B','C','D','E','F'
 30 DATA 0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15
 40 FOR N=1TO16:READB$(N):NEXTN
 50 FOR N=1TO16:READC(N):NEXTN
 70 PRINT'     HEXADECIMAL DUMP ROUTINE':PRINT
 80 PRINT'WRITTEN IN LEVEL II BASIC WITH Z-80 MACHINE LANGUAGE SRTN'
 90 PRINT:INPUT'ENTER STARTING DUMP ADDRESS IN HEXADECIMAL';A$
 99 REM  NEXT LINE SPLITS A$ INTO FOUR SEPARATE CHARACTERS
100 A1$=MID$(A$,1,1):A2$=MID$(A$,2,1):A3$=MID$(A$,3,1):A4$=MID$(A$,4,1)
101 REM  NEXT FIVE LINES CONVERT HEX CHARACTERS TO DECIMAL
105 N=0
110 SR$=A1$:GOSUB1000:A1=SR:N=0
120 SR$=A2$:GOSUB1000:A2=SR:N=0
130 SR$=A3$:GOSUB1000:A3=SR:N=0
140 SR$=A4$:GOSUB1000:A4=SR
150 REM  AT THIS POINT I HAVE CONVERTED ALL FOUR DIGITS AND AM READY
151 REM  TO MULTIPLY TO GET THE VALUES TO POKE TO THE SUBROUTINE.
152 REM  VARIABLE MS REPRESENTS THE MOST SIGNIFICANT BYTE, VARIABLE
153 REM  LS REPRESENTS THE LEAST SIGNIFICANT BYTE.
160 MS=(A1*16)+A2:LS=(A3*16)+A4
169 REM POKE DUMP LOC TO SUBROUTINE (MS TO 4F7D, LS TO 4F7C)
170 POKE 20349,MS:POKE 20348,LS
179 REM POKE START OF SUBROUTINE (4F7A) TO 16526+16527
180 POKE 16527,79:POKE 16526,122
185 CLS
189 REM  NOW WE BRANCH TO MACHINE LANGUAGE ROUTINE
190 X=USR(0)
199 REM  NOW WE HAVE RETURNED
200 PRINT@960,'';:INPUT'1=CONT.,2=NEW DUMP,3=END PROGRAM';Y
210 IF Y=1THEN190
220 IF Y=2THEN90
230 END
999 REM  THIS IS THE CONVERSION MATCH SRTN TO DERIVE POKE VALUES
1000 N=N+1
1010 IFN>16THENPRINT'ERROR..RE-ENTER VALUE':GOTO90
1020 IF SR$=B$(N)THEN 1030 ELSE 1000
1030 SR=C(N):RETURN
1040 END
```

Program 2. Hexadecimal Dump Program.

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✓31

```
------- START OF CONTROL ROUTINE -------
4F7A  E5              PUSH HL          .SAVE HL BEFORE WE CHANGE IT
4F7B  21 ## ##        LD HL,####H      .LD START ADD TO HL
4F7E  11 40 3C        LD DE, 3C40H     .LD VIDEO ADD TO DE
4F81  0E 08           LD C, 8          .LD 8 TO C FOR LINE COUNT
4F83  06 10     LOOP  LD B, 16         .LD 16 TO B FOR BYTE COUNT
4F85  CD AB 4F        CALL LOC1        .CALL SRTN TO PRINT BYTE LOC
4F88  7E        LOOP1 LD A, (HL)       .LD BYTE TO ACCUMULATOR
4F89  CD C6 4F        CALL CVERT2      .CALL 2 DIG. CONV. ROUTINE
4F8C  23              INC HL           .INCREMENT BYTE POINTER
4F8D  3E 20           LD A, 20H        .LD BLANK TO ACCUM.(SEPARATOR
4F8F  12              LD (DE), A       .LD ACCUM W/BLANK TO SCREEN
4F90  13              INC DE           .INCREMENT VIDEO POINTER
4F91  05              DEC B            .DECREMENT BYTE COUNTER
4F92  C2 88 4F        JNZ, LOOP1       .IF NOT 16 BYTES, JMP LOOP1
4F95  06 09           LD B, 09         .LD 9 TO B, TO SPACE TO NEXT
4F97  13        LOOP2 INC DE           .INCREMENT VIDEO 9 TIMES
4F98  05              DEC B            .DECREMENT COUNTER
4F99  C2 97 4F        JNZ, LOOP2       .B NOT 0, JUMP LOOP2
4F9C  0D              DEC C            .DECREMENT C (LINE COUNTER)
4F9D  C2 83 4F        JNZ, LOOP        .IF NOT 6 LINES, JMP LOOP
4FA0  22 7C 4F        LD (4F7C), HL    .SAVE POINTER LOC TO CONT.
4FA3  E1              POP HL           .RESTORE HL BEFORE RETURN
4FA4  C9              RET              .FINAL RETURN TO BASIC
4FA5  00 00 00        NOP              .FILLER BYTES IF NEEDED
4FA8  00 00 00        NOP              .FILLER BYTES IF NEEDED
----- END OF CONTROL ROUTINE ----- START OF LOCATION SRTN -----
4FAB  7C        LOC1  LD A, H          .LD H REG TO A REG
4FAC  CD C6 4F        CALL CVERT2      .CALL CONV.RTN TO DECODE BYTE
4FAF  7D              LD A, L          .LD L REG TO A REG
4FB0  CD C6 4F        CALL CVERT2      .CALL CONV.RTN TO DECODE BYTE
4FB3  3E 20           LD A, 20H        .THIS AND NEXT 6 LINES SIMPLY
4FB5  12              LD (DE), A       .LOAD BLANK TO ACCUM. AND
4FB6  13              INC DE           .THEN LOAD TO VIDEO - PURPOSE
4FB7  12              LD (DE), A       .IS TO LEAVE THREE SPACES
4FB8  13              INC DE           .
4FB9  12              LD (DE), A       .
4FBA  13              INC DE           .
4FBB  C9              RET              .RETURN FROM THIS SRTN
----- END OF LOCATION SRTN -----
4FBC  00 00 00 00     NOP              .
4FC0  00 00 00 00     NOP              .THESE 3 NOP'S JUST FILLERS
4FC4  00 00           NOP              .
----- START OF 2 DIGIT CONVERSION ROUTINE -----
4FC6  D9        CVERT2 EXX             .EXCHANGE REG. TO USE C'
4FC7  4F              LD C, A          .LD ACCUM. TO C TO SAVE
4FC8  D9              EXX              .EXCHANGE BACK TO NORMAL REG.
4FC9  CB 3F           SRL A            .THIS AND NEXT THREE LINES
4FCB  CB 3F           SRL A            .USED TO SHIFT MS BITS TO
4FCD  CB 3F           SRL A            .THE LS BITS AND ZERO OUT
4FCF  CB 3F           SRL A            .THE MS BITS(TO DECODE LEFT)
4FD1  CD E1 4F        CALL TST1        .CALL SRTN TO CONVRT TO ASCII
4FD4  12              LD (DE), A       .LD CONVRTED BYTE TO VIDEO
4FD5  13              INC DE           .INCREMENT VIDEO FOR NEXT
4FD6  D9              EXX              .EXCHANGE REG. TO RESTOR BYTE
4FD7  79              LD A, C          .LD BYTE BACK TO ACCUM.
4FD8  D9              EXX              .EXCHANGE BACK TO NORMAL REG.
4FD9  E6 0F           AND, 0FH         .AND TO MASK OFF MS BITS
4FDB  CD E1 4F        CALL TST1        .CALL SRTN TO CONVRT TO ASCII
4FDE  12              LD (DE), A       .LD CONVRTED BYTE TO VIDEO
4FDF  13              INC DE           .INCREMENT VIDEO FOR NEXT
4FE0  C9              RET              .RETURN FROM THIS SRTN
----- END OF 2 DIGIT CONVERSION ROUTINE ----- START OF ASCII SRTN -----
4FE1  C6 30     TST1  ADD A, 30H       .ADD TO CVERT TO ASCII
4FE3  FE 3A           CP 3AH           .CPARE TO SEE IF ALPHA
4FE5  FA EA 4F        JPM, TST2        .IF NUMERIC, JP TO RET (TST2)
4FE8  C6 07           ADD A, 07H       .ELSE, ADD 7 FOR ALPHA
4FEA  C9        TST2  RET              .RETURN FROM THIS SRTN
----- END OF ASCII SRTN -----
```

Program Listing 3. Hexadecimal Dump Routine.

```
4F7A   E5              PUSH HL        ;SAVE HL REG.
4F7B   3E BF           LD A, BFH      ;LD GRAPHICS BYTE TO A
4F7D   32 00 3C        LD (3C00),A    ;LD A TO 3C00
4F80   21 00 3C        LD HL, 3C00H   ;LD VIDEO ADD TO HL.
4F83   11 01 3C        LD DE, 3C01H   ;LD VIDEO+1 TO DE.
4F86   01 FF 3F        LD BC, 3FFH    ;LD 1023 TO BC.
4F89   ED B0           LDIR           ;BLOCK TRANSFER INSTR.
4F8B   E1              POP HL         ;RESTORE HL REG.
4F8C   C9              RET            ;RETURN TO BASIC PROG.
```

Example 1. Machine Language Subroutine.

a thousand operations in the time it took us to press and release the ENTER key.

Program Listing 2 is a hexadecimal dump program. The BASIC program obtains the desired starting address. This address is then converted to hexadecimal and inserted into the subroutine via the POKE command. The starting location of the machine language routine is then POKEd into memory locations 16526 and 16527.

At this point, I use a statement containing the USR(0) function (for instance, X = USR(0)) which causes control to

pass to the memory location loaded into bytes 16526 and 16527.

The machine language routine handles the actual conversion and display of the dump. This program displays eight lines of sixteen bytes per line (32 characters). It also displays the starting location for each line as the first four characters on the line.

The time required to convert and display each screen (eight lines by 16 bytes) is usually about one second. When the machine language subroutine is completed, control is returned to the BASIC program by means of an unconditional return (RET).

At this point, the BASIC pro-

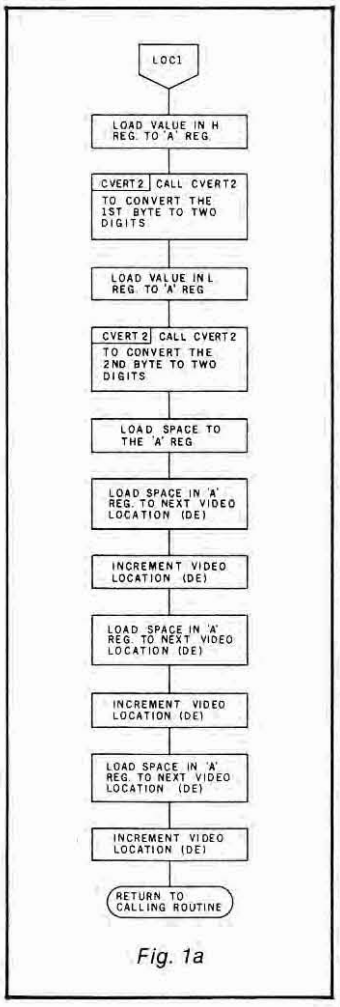

Fig. 1a

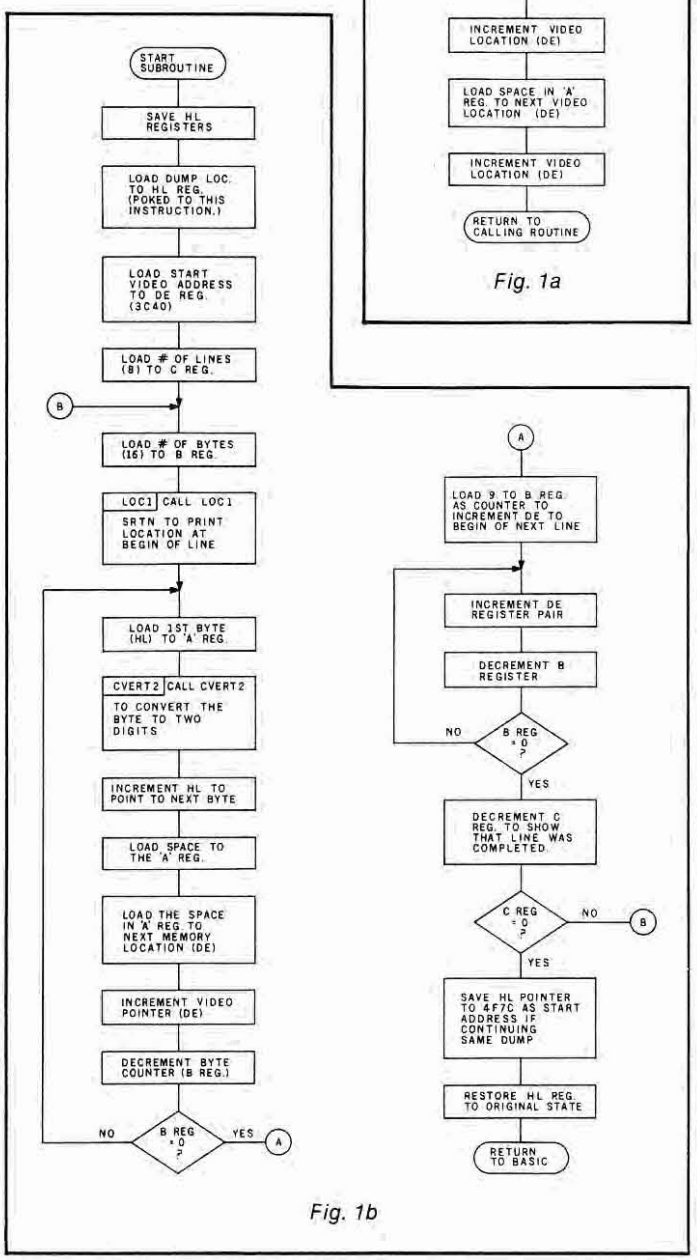

Fig. 1b

gram gives you three options. If you enter a one, the next consecutive eight lines will be displayed. If you enter a two, you are allowed to specify a new dump location. A three ends the program.

Program Listing 3 is the machine language subroutine. Although the format is similar to an assembler's output, it was manually entered.

When actually entering the data (via T-BUG), you use only the first two columns. The first column identifies the memory location, while the second column contains the actual hexadecimal values.

The program can be saved on tape with T-BUG (suggested name = HEXDMP), and the BASIC program can be saved immediately following it.

When you power up your Level II, answer the 'MEMORY?' statement with 20340. The subroutine loads via the system command, and then the main program loads and executes in the normal manner.

Comments have been added to Listing 3 to identify the various program functions.

Easier Loading

Since it is a short routine, it may be easier for you to load the machine language subroutine as part of the BASIC program, using the POKE statement. Adding the statements shown in Example 2 to Program Listing 2, eliminates a separate load of the subroutine.

```
32 DATA 229,33,122,79,17,64,60,14,8,6,16,205,171,79,126,205,198,79
33 DATA 35,62,32,18,19,5,194,136,79,6,9,19,5,194,151,79,13,194
34 DATA 131,79,34,124,79,225,201,0,0,0,0,0,0,124,205,198,79,125,205
35 DATA 198,79,62,32,18,19,18,19,18,19,201,0,0,0,0,0,0,0,0,0,217
36 DATA 79,217,203,63,203,63,203,63,203,63,205,225,79,18,19,217,121
37 DATA 217,230,15,205,225,79,18,19,201,198,48,254,58,250,234,79
38 DATA 198,7,201
```

Example 2. Additions to POKE Machine Language Subroutine.

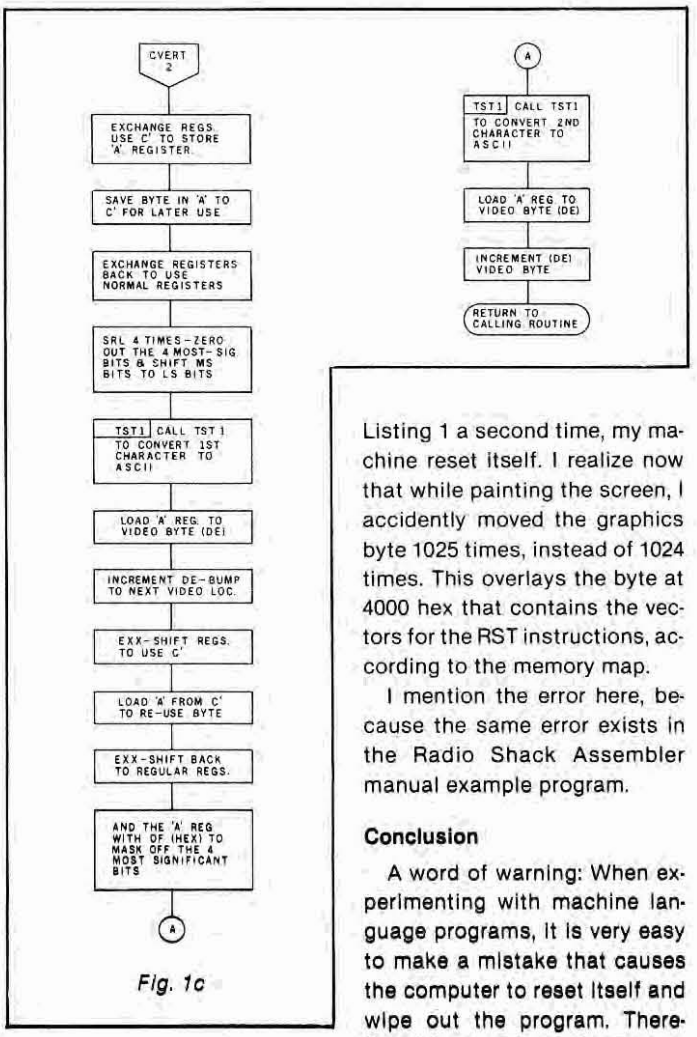

Fig. 1c

For those interested in delving into machine language programming, a flowchart of the subroutine logic is included as Fig. 1.

While experimenting with the USR(0) function, you might encounter one or two idiosyncrasies. The first is that you have to save the HL registers (PUSH HL) as the first part of the subroutine and then restore these registers (POP HL) before returning to the BASIC program. Failing to do this causes the program to dump the program location only, instead of dumping the location you specified. Apparently, the USR(0) function transfers the address from 16526 and 16527 to the HL registers.

The second idiosyncrasy is the result of a programming error of mine. You might make the same. Initially, if I ran Program Listing 1 a second time, my machine reset itself. I realize now that while painting the screen, I accidently moved the graphics byte 1025 times, instead of 1024 times. This overlays the byte at 4000 hex that contains the vectors for the RST instructions, according to the memory map.

I mention the error here, because the same error exists in the Radio Shack Assembler manual example program.

Conclusion

A word of warning: When experimenting with machine language programs, it is very easy to make a mistake that causes the computer to reset itself and wipe out the program. Therefore, it is a good practice to save the program before you attempt to run it. If you encounter any problem with these two sample programs, check carefully to see that you have the right numbers in the right places for the data statements, and that the POKE statements are as shown. ■

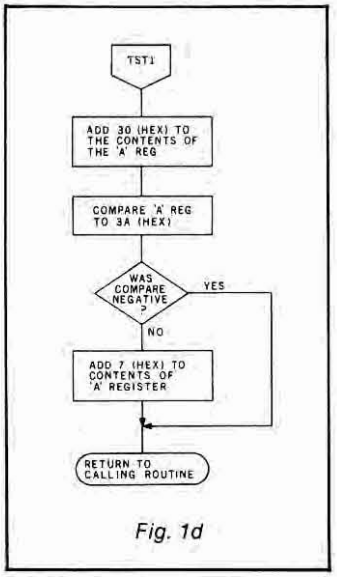

Fig. 1d

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✓Reader Service index—see page 194

For the computer neophyte, find out what a TRS-80 can do.

The TRS-80

Alexander MacLean
WA2SUT/NNN0ZVB
18 Indian Spring Trail
Denville NJ 07834

Only one small computer system is designed for home consumption, assuming little or no backgrcund in either computer programming or electronics—the Radio Shack TRS-80.

Once it is set up, which takes about 10-15 minutes the first time, you are ready to begin with the Level I manual which lives up to its reputation for being one of the best introductions to the computers and their language. Once you start playing with the computer you enter a mental state known as manic-keypressive. You won't want to stop until you get through the book as quickly as you can.

Flaws Along the Way

There are areas where I would fault the manual, especially since it's intended for a beginner.

While there are few obvious errors, I should have known there was going to be trouble when one of their examples referred to "Watts law."

Often you have to refer to the answer pages to solve a problem and find that their solution requires information you were not given.

Some problems, they don't even mention. There is an information storing line, called a data line, which they say can appear in any part of the program—beginning, middle, end or wherever. What they don't tell you is that data lines must be in the proper order among themselves or there will be trouble.

Imagine a list of quantities such as volts, ohms and amperes. The data for these catagories can appear at any point in the program, but the information must be in the order of the headings, thus the volts data must be before the ohms data which is before the amperes data.

Their graphics section in particular lacks explanation. You are shown examples of graphics procedures, but you are left to figure out exactly what is happening. You can imitate the manual, but you do not get a really firm grasp of what you are doing and why.

It will probably take you about one to two weeks work (at several hours per day) to go over all of the material in the instruction part of the manual.

The Next Plateau

That is where the next plateau begins. What can I do with the computer? That is where the Radio Shack manual, like others lets you down rather badly. There is an information gap between learning the various mechanical computer functions and developing working programs based upon your own information and needs.

There are a few sample programs in the back of the manual. Some are more than novelties, but even if studied they really only give you bits and pieces of information. Your learning depends on your ability to analyze.

There is an additional Level I BASIC instruction course available from Radio Shack for about $13, consisting of eight taped lessons to be played on your computer. Each lesson contains two to four parts.

One salesman told me that the lessons were meant for people who weren't going to learn the manual, another said they were supplemental information to the manual. I tried the course to see what it did. It took several hours to cover what in actuality was very little information.

For the material covered I think they could have done better with a small paperback costing a buck rather than a set of tapes costing much more.

You will get better with experience and there is no substitute for working with the computer. You'll start thinking in computer terms and find that you can build longer programs from your own information.

This still leaves unanswered the question of what you can actually do with your computer.

There is potential in the Level I 4K, but it has limitations. Much depends on how well you can take the individual language elements and combine them to do work.

While you can store data or do record keeping with it, it takes computer memory that you don't really have.

What the machine does best is manipulate numbers repetitively. Let's take a simple example, ohms law: $E = IR$. This elementary formula can solve many problems.

If we assume 10 volts and 10 ohms we can solve for current (I) by the use of $I = E/R$. For one value we can do it easily with a pocket calculator or even pencil and paper. In what Radio Shack calls the calculator mode, you can use your computer as a pocket calculator. But a TRS-80 is more expensive.

But suppose you wanted to know the current as you varied both the voltage and the resis-

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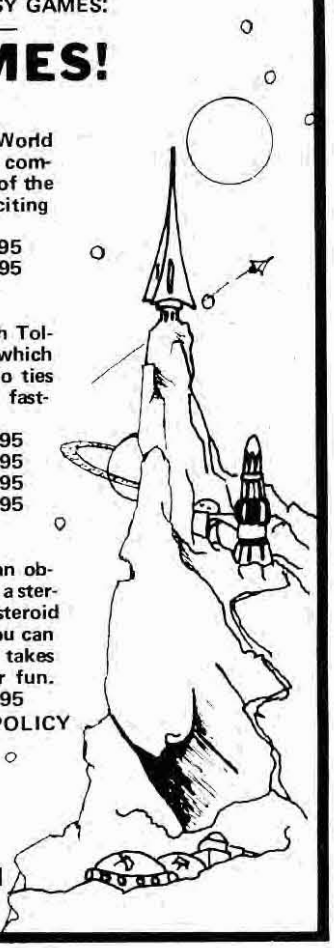

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- Thorough documentation. Each feature is explained in detail along with instructions for user modifications.

KEYEDIT will save you hours of effort in BASIC program development. So why waste another minute? Bring your keyboard to life today with **KEYEDIT!**

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✓Reader Service index—see page 194

tance, say 10 to 100 volts in ten volt steps with the resistance changing at each voltage level from 1 to 10 ohms in one ohm steps.

This takes 100 separate calculations. It would take some time to work out with the pocket calculator or using the computer in its calculator mode. But you could write a short program to solve it. The computer takes off on RUN and you have the answers in a few seconds.

Now suppose you wanted to know the power for each set of values. We have 100 values which means 100 more calculations for the power formula. This takes only a few extra lines added to the program. Now you have twice as much information.

Let's get real mean. Suppose you had a precision requirement and needed to know the values from 1 to 100 volts in 1 volt steps and 1 to 100 ohms in 1 ohm steps. The program would be just about the same length. Just a few numbers would change. But you would be talking about 10,000 calculations, plus another 10,000 for the power formula.

Try that on your pocket calculator or with pencil and paper. On a computer, it might take some time to run, but it would.

Three Salesmen

Now let's look at another operation. Let's assume we have three salesmen, as in Table 1. Smith, Jones and Rogers each earn so much in sales, spend so much to make it and have a total earnings and percentage figure.

We would like the computer to list names and figures and then do calculations based upon the data. Here is where we run into computer problems.

The basic computer will not give you a list of names and figures like that. However, the computer can take the earnings and costs and figure the net earnings and the percentage earned.

Notice that these figures appear across the line. In that form the computer will do these calculations on each person.

Now look at the bottom figures. These are the overall totals for the earnings and expenses. This requires the computer to figure from top to bottom. But a Level I cannot read or manipulate the data in that form.

There are programs that will perform some of the calculations but they require high level programming skills. All the data has to be typed into the program in the correct form and only limited answers are available.

This does not mean that the computer can't be used for some form of data processing, but you will have to break the job up into smaller sections.

Even prepared 4K programs are limited in scope. An inventory program I saw, allowed only 100 items with cost and inventory.

	GROSS	COST	NET	PERCENTAGE
Smith	10,000	2,500	7,500	75%
Jones	10,000	3,000	7,000	70%
Rogers	9,000	500	8,500	94.44%
	29,000	6,000	23,000	79.31%

Table 1. While the computer figures across the lines, Level I cannot add columns or handle the names in any convenient manner.

A Learning Tool

By now it should be clear that what you really do with the Radio Shack TRS-80 is learn with it. It is an effective introduction to the computer. You will have to work at finding your own path into the computing world beyond, but help is out there: clubs; stores; magazines; night schools. Good luck! ■

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With NEWDOS you also get DIRCHECK, which tests and lists disk directories, DISASSEM, which is a disassembler, EDTASM, which allows you to use your Radio Shack Editor-Assembler on disk with disk I/O Level I in Level II allowing you to use or create Level I programs and save or retrieve them from disk. Using LVIDSKSL, LMOFFSET helps save and load machine language tapes from disk even if in same memory as DOS. Finally, SUPERZAP, which allows you to display, print and modify memory or disks. Comes with over 30 pages of documentation and presumes ownership of TRSDOS 2.1 and the Radio Shack Editor-Assembler.

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CP/M is a file-oriented disk operating system that provides a common set of utilities for program development and operation. There are six built in commands plus utilities called in from disk. CP/M will run on a TRS-80 with as little as 16k of memory and one disk drive. Comes complete with six manuals. CP/M is a registered trade mark of Digital Research.

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✓ Reader Service Index—see page 194

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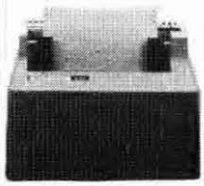

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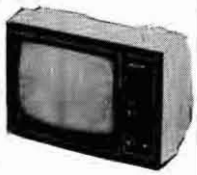

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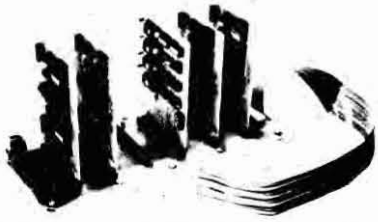

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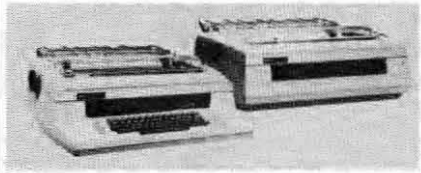

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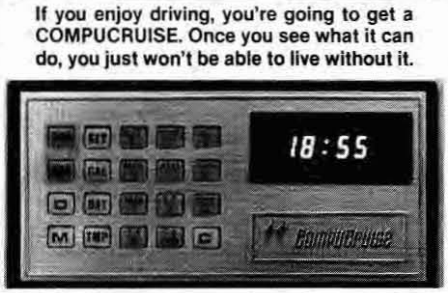

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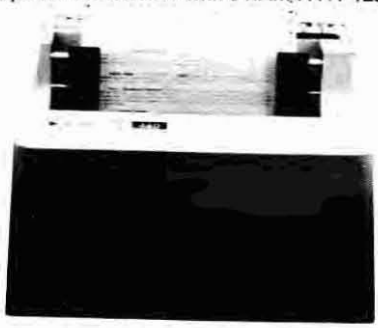

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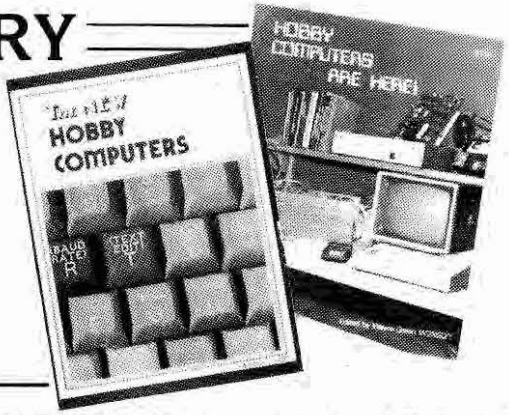

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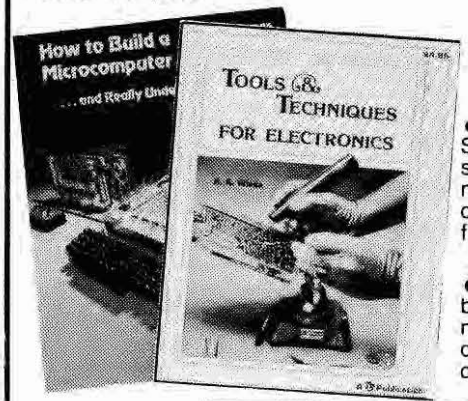

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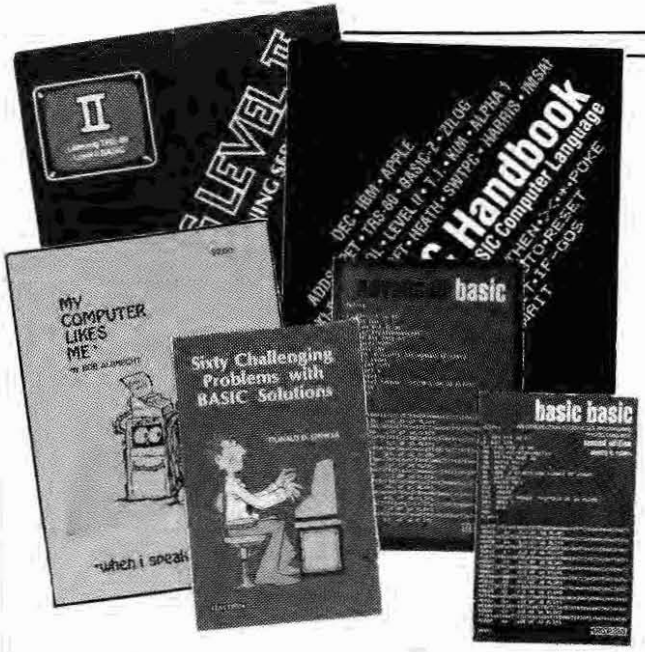

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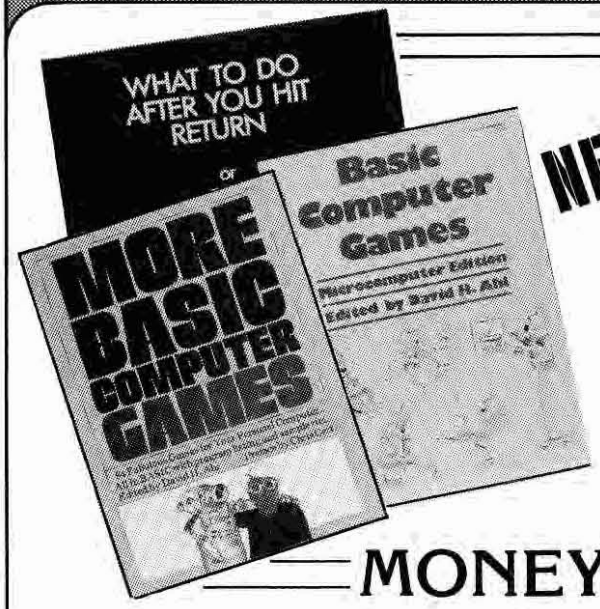

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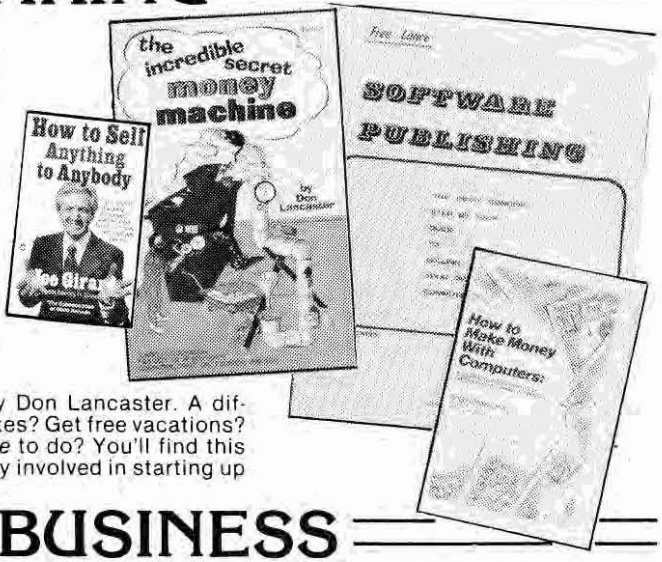

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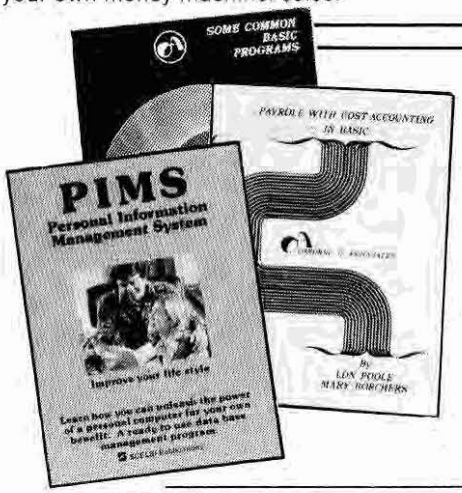

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