July 1980 $2

THE MAGAZINE FOR TRS-80* USERS

80 microcomputing™

ADVENTURE

Scott Adams

One programmer's success. Pg. 48.

EDUCATION

Eighth Grade Programmers

The most popular course in this Florida grade school. Pg. 44.

TUTORIAL

The BASIC Switchyard

Switching tracks by computer.
How the 80 chooses its priorities. Pg. 52.

Plus:

Software Reviews, Hardware Reviews, Book Reviews.
More than 30 articles and columns.
Full Contents on Pg. 5

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80 Microcomputing 7/80 #7

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™.

Add the Electric Crayon™ to your system and your keyboard becomes a palette, the tv screen your medium.

You dab and stroke using one-key commands to create dazzling full-color drawings, eye-catching charts and diagrams.

Or you run any of innumerable programs. **Your own BASIC language programs** that generate dynamic pyrotechnic images, laugh-provoking animations.

From a combined alphanumerics-semigraphics mode to a high resolution 256- by 192-element full graphics mode, the microprocessor-controlled Electric Crayon™ is capable of generating **10 distinctly different display modes.**

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

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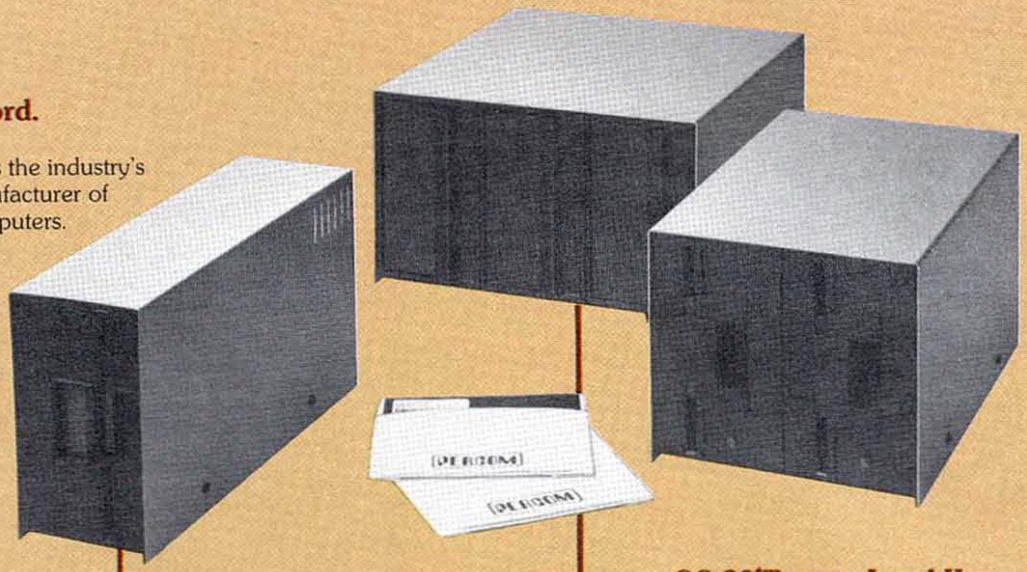
Get into computer color graphics the easy, low-cost way with a Percom Electric Crayon™. Available at Percom dealers nationwide. Call toll-free, 1-800-527-1592, for the address of your nearest dealer, or to order direct if there is no Percom dealer in your area.

TRS-80* Computer Compatible . . .

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[tm] drives and over two-and-one-fourth times as much on TFD-200[tm] drives.

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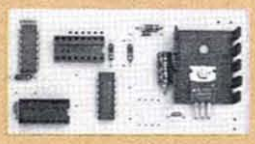
Available in 1-, 2- and 3-drive configurations, Percom drives for the TRS-80* computer start as low as $399.

The gift of speech



Called Speak-2-Me-2[tm], 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).

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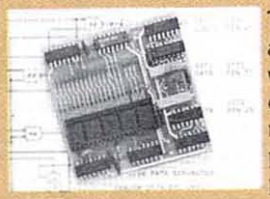
the Separator:[tm] End "CRC error. Track locked out!"



This plug-in adapter virtually eliminates data read errors, a problem that plagues TRS-80* computer systems. The SEPARATOR[tm], 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.

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All are helpful programming examples.

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NEW! OS-80[tm] Machine Language SAVE / LOAD Utility. Only $14.95 on minidiskette w/instructions.

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MEMORY EXPANSION FOR TRS-80*

All you have to remember is to plug it in

Memory expansion. It's a field packed with intriguing theories. For instance, it has been suggested that the memory areas of the human brain are transferable from one body to another, like transplanted kidneys. In man or machine, a larger memory is always a welcome acquisition.

If you are interested in expanding your TRS-80 memory without shelling out dollars for a full blown expansion interface, we have just the solution.

Introducing the MT-32. Our new, brilliantly designed Printer/Memory expansion module for the TRS-80. This unit will add 16K or 32K of dynamic RAM to your basic 16K machine. The module also contains circuitry to drive Microtek's MT-80P dot matrix printer, or any other Centronics-compatible printer.

No hardware modification to your TRS-80 is required. Just plug into your bus connector and you are ready to go.

All Microtek products are covered by a one year warranty.

Four configurations are available:

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MEMORY TRANSPLANT

July 1980 Issue #7

80 microcomputing T.M. DATA

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★NEW★ MTC AIDS-III* ★NEW★

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

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- Up to 20 USER-DEFINED FIELDS of either numeric- or character-type.
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- Full feature EDITING when adding or changing records:
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  - 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 is user-defined, features user-specified fields and print/display formats, conditional record selection, updating of fields within records, sorting 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. Formatting a report or defining a custom label, less than 30 seconds. Sorting 200 records takes less than 5 seconds. Add "subsystems" for additional capabilities.

MTC AIDS-II $49.95
For Model II $79.95

AIDS

CALCULATION SUBSYSTEM (CALCS)

Use for report generation involving basic manipulation of numeric data, such as quantity & cost computations, balances carried forward and columnar totals. Expands capabilities with respect to inventory, accounting and other numeric-based information systems.

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NEWDOS/80

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mTc-SHIRTS. $5.95

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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

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Custom Cable only $19.95

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

MAKES EVERY BYTE COUNT

IN YOUR TRS-80® MODEL I OR MODEL II DISK SYSTEM

PROGRAMMING TOOLS

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Any 5, $79.80
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For Model II $29.95
Includes MTC QUE Card!

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DIVERGE $19.95
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Compares two BASIC program files, showing the differences between them. Identifies & lists lines which have been inserted, deleted, & replaced. Use for version control.

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Reorganize programs for adding program code, faster execution, readability. Much more than simple renumbering. Rearrange groups of statements within a program - automatically updates references to line numbers. Use with SUPERSEDE and MINGLE for maximum effect.

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A "must have" for the professional programmer or the serious amateur. Probably one of the greatest time-savers available. Write programs in shorthand - change variable names - generate program documentation - use with REBUILD and MINGLE to build new programs from old ones.

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includes REF, RENUM, SUPERZAP, EDITOR/ASSEM., DISASSEM., DIRCHECK, and more! This is the original NEWDOS with all of Apparat's utility programs, plus any 2 MTC PROGRAMMING TOOLS (for Model I), of your choice. Includes exclusive MTC QUE (Quick User Education) card.

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✓Reader Service—see page 178

80 REMARKS

by Wayne Green

". . . There was a TRZ sign and a little microcomputer called the Video Genie."

The Personal Micro Computer, just announced by Recordec and to be sold via mail order in the U.S. Compare it to the Video Genie.

While the giant companies (and perhaps even the post office) are hassling over who should run an electronic mail (EM) system (see my REMARKS in the June 80), I'm hoping that the microcomputer industry can pull an end run and get a system up and running which will become the standard.

Assuming that we are going to be using the telephone system for communications, we have to work within the restrictions of the poorer telephone circuits. This is why 300 baud is being used at present.

What is a baud? It's the number of bits of information per second you send over a line. Thus if your system is running at 110 baud and you are using the ASCII standard of 11 bits per character, you are sending 10 characters per second. That's 600 characters per minute. And, at six characters per word (the accepted average), you are chucking it out at 100 words per minute. Most of us can read at anywhere from 300 words per minute to 1200, so 110 baud is pokey. At 1200 baud our messages would go over the lines at speed-reading pace.

Industry Input

In talking this EM idea over with a number of people in the industry some good ideas have emerged. Probably the best of all ideas came from Bill Schroder of Galactic Software who pointed out that roughly 80 percent of the content of business letters boils down to around 200 words. These could be set up in a ROM dictionary and expressed with one byte of information. If we then set up another 32,000 words in a larger ROM dictionary, these could be looked up via two bytes. Any words not fitting into the ROM dictionaries could be spelled out one character at a time.

Further, we might set up specialty dictionaries for specific business groups, limited perhaps to 1000 words, and that would save more transmission time.

The time saved by compressing data would enable transmissions at an effective rate of well over 6,000 words per minute . . . about one hundred per second!

Firms wishing to make their communications confidential might have special ROMs made with their own dictionary or they could use the regular ROMs and just flip some of the bits before transmitting their messages. Decrypting messages made up of letters isn't too difficult, but decoding them when each character represents a word gets very, very complicated.

One thing we don't need is a dozen different EM systems. We need one and only one. Toward this end I shall be trying to get the major firms of the field together for agreements on technical standards and protocols. We must be able to send and receive a message on any system, not just a TRS-80 or an Apple.

You may be sure *80* will be most interested in further ideas and technical articles on accomplishing the above, on proposed standards, etc.

Chasing the TRZ-80

Almost a year ago the Instant Software rep for South Africa mentioned that while Tandy was doing poorly down there with their TRS-80, a Hong Kong-built system called the TRZ-80 was doing very well in sales. He ordered more TRS-80 software since it ran just fine on the TRZ.

The next hint on the system was an ad by Dick Smith Electronics of Australia for their Dick Smith System 80, which looked like it must be the same TRZ-80. It had a keyboard, a built-in cassette recorder, output for a TV set, an expansion unit for the S-100 bus and a level II compatible BASIC, so it could run all Tandy software.

While visiting Asian electronic shows last Fall, I asked around Japan, Taiwan, Korea and even Hong Kong, trying to find some trace of the TRZ-80 folk. No dice. No one knew much about it.

While visiting the Tandy booth at the Hanover (Germany) Fair in April this year I asked if they had heard anything about the TRZ-80 and they said yes, there was one in the very next booth. Sure enough, there was a TRZ sign and a little microcomputer called the Video Genie. I asked a lot of questions and got the address of the European sales office in Amstelveen, not far from Amsterdam in Holland.

A few days later, while on our way from Brussels to Rotterdam, I drove up to Amstelveen and found the Video Genie offices. I asked more questions and took pictures of the unit. They gave me the name of the American importer, but said that not much had happened with him.

Flash now to NCC in Anaheim three weeks later. The Video Genie is on display, now called the Personal Micro Computer, Inc. and being distributed by Recordec, which has also picked

Continue to page 32

This is the ad for the Dick Smith System 80 which appears in the latest Dick Smith catalog (Australia). The ad makes much of the compatibility of the system with both the TRS-80 software and the S-100 bus. Many people feel that this is what Tandy should have done in the first place.

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LABEL: Prints labels from MAILFILE.

CONVERT: Make MAILFILE from RS mail list.

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

80 INPUT

"Disabling the break function is . . . usually done by paranoid programmers who believe this is how to protect their code from theft."

Processor Praised

Writing letters to editors is not something I usually do, but your May issue has prompted me to make an exception. I refer specifically to the "BASIC Word Processor" by Delmer Hinrichs.

For some time now I have been saving my pennies with the hope of obtaining an Electric Pencil. Then, in April when I stopped at your office to say how much I like this magazine, you told me about Radio Shack's new Scripsit. So . . . I diverted the intent of my piggybank, and dropped in some more coins. Then . . . along came the May issue, and WOW! This BASIC program does everything I expect I'll ever need. It has more than paid for my subscription. Now . . . again I've diverted the intent of my piggybank toward a decent printer. (Hopefully I can find a used Selectric somewhere.)

Admittedly, the INKEY$ input is slow, but I don't anticipate doing so much that it will really bother me. There is one modification that I have made, though, that really seems important. In line 1740, after the first colon, I inserted an INPUT statement to call a halt to printing between pages. Otherwise, using sheet paper on my Line Printer II would have been impossible. I also intend to make a few other minor modifications to suit my own use, but basically I think it's a great program.

Rev. Richard W. Beebe
Fryeburg, ME

For the Defense

I can't stand it any more!! This is the first time I have written a letter to the editor of any major publication; the letter you published from Ernest Kirschner in the May issue of *80 Microcomputing* has finally driven me to speak up in defense of Radio Shack. In particular, Mr. Kirschner's comments on Radio Shack's policy regarding repairs to machines which have been modified by the user, expose his ignorance about the complexity of any computer system.

I have seven years experience working on complex digital minicomputer circuit boards, both in production testing and customer service repairs. Every circuit board has its own set of schematics; these schematics are like a road map to the technician. When a customer makes unauthorized modifications to a board, cutting etches, running extra wires, or adding components, it makes the technician's job extremely difficult because his road map is no longer valid. This is like sending someone out to deliver a package to an address in Los Angeles, but only providing a map of San Diego. The most dreaded and most difficult board for a customer service technician is that one with customer mods on it and a tag with the single word "BAD" written on it.

As for Mr. Kirschner's assertion that companies like DEC, IBM and HP will service modified equipment at the same rates as unmodified equipment, I find this hard to believe. I expect that as a minimum, all customer mods would be ripped out of the board (and not be replaced). This is the policy at many companies; if the technician cannot figure out a customer mod in a reasonable length of time, and has not been provided with the necessary technical information to repair the modified board, he is justified in removing the mods and restoring the circuits to their original condition, and/or charging higher rates to make up for the extra time involved in repairs. Anyone considering making modifications to his computer equipment should keep these points in mind. What looks like a good idea now could turn into a real bucket of worms later!

Dave Stambaugh
Fountain Valley, CA

Relocate Break

It continues to amaze us that hardware manufacturers persist in placing keys which should not be used in the normal course of business right on the keyboard, where they can easily be hit by mistake. Specifically, on the TRS-80 Model II, the break key (which should never be used by an operator when running a debugged program) is sitting right next to the backspace key, which will normally be a frequently used key. As a result, the break key is frequently hit by mistake, and otherwise foolproof application code often goes down the tubes.

Disabling the break function is not the answer, although it is easily done. This is usually done by paranoid programmers who believe this is how to protect their code from theft. Two problems: 1) When a true program problem occurs, it becomes that much harder to solve. 2) If I wanted to steal a program (which I don't) disabling the break key wouldn't slow me down by more than a minute or two.

The real answer is simply to move the break key out of the operator's way, so it won't be hit by mistake. This really should have been done on the drawing board (as a hardware modification), but since it wasn't, it can be addressed through software. We have developed a series of patches, reproduced below, for Model II TRSDOS and BASIC which simply define a different keystroke for the break function, one which is a little inconvenient to use, and therefore not ever used unintentionally. We selected CTRL-6 as the keystroke to use, as no TRSDOS or BASIC operations use this code.

Your readers should refer to the Model II manual, pages 3-28 through 3-31 for details on how to install the following patches:

```
PATCH IODVRS/SYS A=00AC,F=03,C=7E
PATCH IODVRS/SYS A=03A6,F=03,C=7E
PATCH IODVRS/SYS A=03B6,F=03,C=7E
PATCH BASIC A=57AD,F=03,C=7E
PATCH BASIC A=58E8,F=03,C=7E
PATCH BASIC A=5F09,F=03,C=7E
PATCH BASIC A=5FFF,F=03,C=7E
PATCH BASIC A=64AD,F=03,C=7E
```

After installation of the patches, the system should be re-booted to load the revised code into memory.

Robert Snapp
Cincinnati, OH

Disk Formatter

TRS-80 users with disk systems can use "LPRINT Formatter" (February *80*) by changing the 17129 in line 50010 to 26810. Further, the combining of this utility program with any other BASIC program can easily be done with the merge operation generally available in the disk operating system as long as there is no line number overlap.

Edw. M. McCormick
Gorden Grove, CA

Memory Size

The utility program "Screenprint Video" (May *80 Microcomputing*) contained some useful and informative ideas. What caught my eye was the idea of setting Memory Size from your machine-language program, avoiding some of the repetitive bother of SYSTEM mode. Unfortunately the method described applied only to DOS, leaving us Level II users forgotten.

Tracing through the power-up sequence in

ROM, I discovered a couple of ways to get this done:

```
21 xxx    LD   HL,MSIZE
C3 EF00 JP   00EF
```

This does the trick, writing also the Level II logo and jumping to the BASIC entry point of 1A19. It also NEWs any BASIC program in memory.
Alternatively:

```
21 xxxx   LD     HL,MSIZE
22 B140   LD     (40B1),HL   ;top of memory pointer
11 CEFE   LD     DE;FFCEH    ;calculate displacement
19        ADD    HL,DE       ;for variables pointer
22 A040   LD     (40A0),HL   ;save it
CD 721B   CALL   1B72        ;set all ptrs & return
```

Will redefine memory ceiling without damage to BASIC listings.

Use T-BUG to place these bytes just before Radio Shack's line renumberer to make it a valuable utility:

```
7C35  21 4B 7C 22 B1 40 23 22 8F 41 21 19 7B
7C42  22 A0 40 CD 72 1B C3 19 1A
```

Save the modified version with the Punch command #P 7C35 7FFF 7C35 RENAME. You now own a SYSTEM format tape which may be loaded at any time during program development, sets its own Memory Size and is called by typing 'NAME'.

From BASIC type SYSTEM *? /0 (again NEWing your program) or try MSIZE=xxxxx:MSB=INT(MSIZE/256):LSB=MSIZE-MSB*256:POKE 16561,LSB:POKE 16562,MSB:CLEAR:RESTORE
To avoid this loss.

Dan Rollins
Azusa, CA

Supplies to England

Could I please use the letters page of your excellent magazine to thank Cybermate and REMsoft, Inc. for replying to my letters about goods advertised in your early issues. I was pleased to find both companies would supply goods to England.

S.J. Turner
London, England

SCRIPSIT Re-visited

First, I want to compliment you and the rest of the staff for the very best publication produced for owners of TRS-80 machines. I have got more value out of one issue of this magazine than out of all my copies of the overrated and much too expensive H&E Computronics newsletter.

I was, however, disappointed in your long-awaited and once postponed comparative review of SCRIPSIT and Electric Pencil. I have both systems. But long before I got SCRIPSIT, I was looking for a definitive review, which no one has yet done. I find that strange. In any other field that I know of, people who are sure of their product send advance copies or models to the press.

Your review was wishy-washy. You overlooked some of the defects of both SCRIPSIT and Pencil and did not emphasize strongly enough some of the shortcomings. Nor did you note available remedies.

1. SCRIPSIT will not run properly with lots of printers, namely Selectric types. It drops the second line feed after carriage return which means that you must hit enter three times to double space and the paragraph format command is useless. The computer, however, counts three lines while the printer types two. So your 66-line page ends in the middle of the sheet. This problem makes all formatting commands meaningless except left and right margin. By setting page length at 75 and text length at 70, you can manage, but you must then go to page by page printing. This is nonsense if you are doing long manuscripts whose format does not change from line 1 to END.

2. Radio Shack's response to the above problem is three sheets of machine language. Thanks a lot. I have neither the time nor the inclination to get deeply involved in BASIC programming, let alone machine language. Further plaints to Ft. Worth brought silence. A plea for help to the locals brought: "Tough. You got all the help you're going to get. You should have bought a Radio Shack printer." Since Radio Shack had this code ready to send immediately, it is a problem they well know and that many of your readers must have. You should address it in your magazine. After all, if you can't use the formatting commands, SCRIPSIT isn't very useful, even if it's cheaper than Pencil.

3. Adding the AUTO command to SCRIPSIT, as I also have done, does not preclude you from entering DOS. You just hold down the enter key, which overrides the AUTO command. I also have AUTO in Pencil, but it is set to bring up the Directory first. If you don't hit DIR before Pencil, you can drop into DOS when you hit break, which can be annoying, if not disastrous.

4. The need to drop into DOS when in SCRIPSIT in order to read the directory is not merely an irritation, it is a fatal defect. Going to DOS wipes out everything you had in SCRIPSIT and also requires you to completely re-initialize the program when you come back to it. Further, you have to write down your directory entry since it is not displayed when you want to load it into SCRIPSIT. This one major fault alone is enough to put SCRIPSIT on my back shelf.

5. The SCRIPSIT formatting commands, useful as they may eventually be with the right printer, certainly can drive you batty. It is convenient to be able to save them for specific types of letters and other documents. But they also take up memory. And SCRIPSIT already uses far more memory than does Pencil. A text that easily fits into memory with Pencil will not fit by a couple of K into SCRIPSIT.

6. SCRIPSIT's other commands seem to me much more cumbersome than Pencil's. Consider deletion or movement of a block. Pencil: control-up arrow before and after, set cursor where you want it, control-H, control-U. Zap.

SCRIPSIT: set cursor before, control-block-letter key; set cursor after, control-block-end key. To delete, move cursor to first block marker, type control-delete-D. To move, place cursor where you want to go, control-insert-block-letter then control-delete-D. That's a lot of work. If you get confused, you can spend a long time figuring out what you did wrong. Most of the other commands are equally complicated. The search and replace function, for example, requires three key strokes before you type the string, then takes what seems forever to find it. The cursor lands right on the string, which is an advantage of sorts over Pencil. But Pencil needs only two strokes (control V), which, strangely, seems much less than three, and instantly finds the string, or not.

7. Pencil is not without defects. There are two that are particularly annoying, and I have seldom seen them addressed or even mentioned. If you type fast, as I do, Pencil will drop characters at the beginning of the line as the cursor tries to catch up with flying fingers. I typically lose two or three characters at the beginning of every line when I'm zipping along.

Further, for some reason, Pencil has a sort of keybounce of its own, though it's not really that. If you don't get your finger off the key fast enough, it will repeat. So not only do I end up with truncated words at the beginning of the line, I have extra letters in the middle of it. (I should say that I have used Pennington's fix to speed up the cursor in my Pencil, which aggravates the problem, particularly when you are a two-finger typist.)

SCRIPSIT's one great advantage: it will handle keyboard input as fast as you can generate it. Any typing errors are yours, not the program's.

I therefore find it best to generate the first draft in SCRIPSIT (provided it will fit in my 48K memory), transfer it to Pencil, do the heavy editing, format and print it. It resides in my permanent disk file then as a Pencil file. This saves time another way too. Even though I am working in SCRIPSIT, I only have to hit enter twice to get double-space copy and a proper line count because Pencil converts and reads the control character correctly.

I disagree with your conclusion. Pencil is the winner and still champion mainly because of its ease of use. SCRIPSIT has lots of useful bells and whistles if you have a use for them. But for simple straight-forward stuff, it's too cumbersome. Its one advantage is speed and accuracy of input. And, oh yes, hyphenation.

Peter J. Brennan
New York, NY

80 BEEF

I wonder if your readers realize what a need there is for agricultural programs. Farming has become so complicated, that farmers are searching for help in accounting and recordkeeping. The TRS-80 is affordable and versatile enough for most farmers' needs.

The only groups I know of, currently producing agricultural programs for the TRS-80 are Oklahoma State University, which has about 11 programs related to recordkeeping, beef and dairy rations, income-expense projections, machine costs, etc., and Northwest Missouri State University, which has only a few programs.

Farmers living in the Old West Region of North Dakota, Montana, Nebraska, South Dakota and Wyoming are lucky to be able to hook up to AGNET. The computer is located in Lincoln, Nebraska. The only cost to the farmer is the cost of a dummy terminal and video screen in his home and the long distance call to a location in his state. If he uses the county agent's terminal, the computer's use is free.

AGNET has over 100 excellent agricultural programs. However the individual farmer is not able to store his own figures and records on this computer. AGNET is developing an accounting system, but some farmers may balk at keeping their income and expense records on a government computer.

Most of the cattle breed associations have some kind of computer to analyze its cow herds. However the farmer must fill the records in by hand, mail them to the association and wait weeks for the results.

I can see the need for a program to record dairy cow production and analyze the efficiency of each cow, and one to make income and expense projections to use when a trip to the banker becomes necessary.

If anyone knows of other agricultural programs made for the TRS-80, I would be interested in hearing from them.

Farm magazines have many articles on using computers in agriculture, but most of them admit that the problem is finding farm-related software. Come on you programmers. Fill this need.

Nancy Hansen
Oakes, N.D. 58474

Linkage Failure

I am running an Anadex DP-8000 printer and am having a few problems with it. Every now and then—when I'm not looking—the ribbon catches on the perforation as it feeds past. I use the instruction "LPRINTCHR$(12)" to seek top-of-form, but sometimes, especially on long runs, the printer loses its top-of-form. This is aggravating.

Now for the major malfunction: The linkage which joins the paper advance solenoid with its associated spring suffered catastrophic failure due to metal fatigue. I have jury rigged it while awaiting parts, and I am rewarded with only occasional spurious radiation of springs and linkages.

I would like input from other Anadex DP-8000 users who might help me solve my loss of top-of-form. Also, I'd like to know if there have been other mechanical failures so that I might stock up on spare parts.

Arthur T. Mullin, Jr.
Rt. 3, Box C-9
Beaumont, TX

Campus Connection

Help! Someone must have done this before! I would like to connect my TRS-80 to the main campus computer. The main computer is a new IBM 4331 which runs on 370 software. I have been assured that using a phone modem presents no hardware problem but that a software problem does exist. What is needed, I am told, is an assembly language software program on the 4331 which makes use of the BTAM macros. If anyone has written such a program and would be willing to share it, I would be most appreciative.

David E. Anderson, Ph.D.
Department of Psychology
Allegheny College
Meadville, PA 16335

Data File Transfer

I was wondering if you could provide me with, or direct me to some sources of information. I have a 48K Level II TRS-80, printer and two disk drives and would like to be able to transfer data files between a Digital PDP 11/70 and my TRS-80. The 11/70 has existing modems but as of yet I have not purchased any such equipment for my TRS-80. I have several questions:

1. Is such an interface possible, and if so, what sort of hardware would I need to obtain?
2. If I had all the hardware, what kind of communications software would be suited to this application?
3. If this interface is not possible, could I obtain a tape drive that is compatible with the 11/70, so that I could transfer data files from my TRS-80 to the larger machine? Where could I find such a drive? Are there any companies that would rent such equipment?

Ed Maurer
1340 East Fairgrove Ave.
West Covina, CA 91792

On Software Piracy

I agree with your editorial on software piracy 100 percent and for my part have not and will never accept a free copy of a pirated computer program.

I am currently in my third year of law school and know just how severe the penalty for breach of copyright can be, and, eventually, the right case will go before the courts such that a severe and harsh penalty will be established for stealing others' software.

John M. Delaney Jr.
Wood River, IL

Home Improvement

After eagerly awaiting the arrival of the May issue, I tore into it as soon as it arrived. Two articles caught my attention immediately. The first was "Home Brew Memory" by Richard Ragucci.

While he was using static memory he also said the circuitry he described would work for dynamic RAM, ie. the circuitry 4116's.

Before any one attempts building an external memory card using the 4116's, let me caution them on one item. The −5 volt power supply **must be brought up first** and removed last. There are several ways of doing this, one way would be using SCR's to apply the other voltages by enabling the SCR's once the −5 volts has been established. If this is not done, the 4116's will be destroyed.

I learned this lesson the hard way. To the tune of $80. After smoking the ICs I read the fine print and found this out.

The second article that caught my eye was "Free Format Search" by Henry G. Riekers. His algorithm for finding a string within a string is a very good one, however there are two major programming problems with his routine, and one problem that most programmers have. The biggest problem that faces a user of a program is its documentation. While Mr. Reikers program is only 13 lines long there is not one REM statement.

I am an electronic engineer, and work with

large scale computerized simulators, both hardware and software. Regardless of the language, be it Fortran, BASIC, Machine, CMS-2-Y, etc. a programmer should precede every section with some remarks as to what the routine does in general. Then each subsection and subroutine should also state what its function is.

Finally, a comment on every line telling what that line's reason for existence is, doesn't hurt. All this goes to help the user who didn't write the program. In any language the author may come back to modify his program in six weeks to six months, and not know what he did or why. These comments will help refresh his memory.

The two programming technical errors are a horse of a different color. The first error occurs in line 60. If he finds a match, he transfers control outside of his loop without cleaning up the loop. If he really wants to transfer control outside of the loop, he should have set the loop counter (N) to a value greater than the upper limit (70). This automatically causes the program to fall outside of the loop.

By not clearing the loop counter, he has left some information on the machine language stack that tells the interpreter what and where to go. If he then executes the subroutine enough times in a program, the stack grows down and eventually crashes with his program, an unhealthy result.

Since he needs to know whether he found a match and transfered control outside the loop or if there was no match, and control fell outside the loop, I suggest he use a flag. This is a variable set in line 60 if there was a match. Then, before each successive entry to the loop the flag is cleared. The modified coding reads:

```
48  FLAG = 0 :REM SUBSTRING FOUND FLAG -0 =
NO
50  FOR N = 1 TO 70 : REM LOOP CTR FOR MAJOR
STRING
55  REM  TEST FOR SUBSTRING IN MAJOR STRING
60  IF A$ = MID$(W$,N,X) THEN 64 ELSE 70
62  REM  SUBSTRING FOUND ! SET FLAG & EXIT
LOOP
64  F:AG =1 : N = 71
70  NEXT N
75  REM   TEST FLAG TO SEE IF SUBSTRING WAS
FOUND
80  IF FLAG = 1 THEN 100 ELSE 40
100  PRINT W$
```

The second error is not so grave. Line 80 checks the value of N, his loop counter, to see if it is greater than the upper limit. In his program this is a needless test, since if the counter were not greater than the limit, the program control would not have fallen outside of the loop. However, some type of test would be required here if he had used the flags as I did above.

John T. Blair
Norfolk, VA

Improved INKEY$

In the article, "INKEY$" by Gary Himler (April '80) the problem of multiple-digit entries is discussed. It is possible to make entries of any number of digits using INKEY$ and without resorting to ENTER.

```
10 A$ = INKEY$:IF A$ = ""THEN 10 ELSE 20
20 B$ = INKEY$:IF B$ = ""THEN 20 ELSE 30
30 C$ = INKEY$:IF C$ = ""THEN 30 ELSE 40
40 D$ = A$ + B$ + C$:A = VAL(D$):PRINT A
```

The computer assigns the value of the first digit to A$, the second to B$ and so on. Because they are string values they can be concatenated as in line 40. Entries of 1,2 and 3 read 123 and the VAL(D$) statement assigns that value to A. I hope *80 Microcomputing* is a huge success.

Robert T. Martinott
Chemical Week
New York, NY

RS Reconsider?

Radio Shack
A Division of Tandy Corporation
P.O. Box 2625, Fort Worth, Texas 76101

Attn: Mr. Lewis Kornfeld
President

Dear Mr. Kornfeld:

This letter was prompted by Jim Perry's note (May, 1980) in *80 Microcomputing*. Jim mentions that Radio Shack has cancelled their advertising contract with *80* because credit was not given to TRSDOS 2.3 in a recent article which printed extracts from H. C. Pennington's book, *TRS-80 Disk & Other Mysteries.*

If so, might that decision be reconsidered?

We think that *80 Microcomputing* is the best general source of information available for the TRS-80. Pennington's book has been the most helpful and informative documentation we have seen for the TRS-80 disk system user.

Based on our experience (we have an early model and have encountered every damned problem the machine is subject to), Mr. Pennington was kind to Radio Shack with the comments in his book.

In spite of the problems and countless wasted hours we have experienced, we are strong supporters of the TRS-80 and have "sold" several systems for you. The machine is quite sound. The biggest failing has been the weird refusal of TRS to acknowledge problems or accept criticism of any kind.

Instead of pulling the plug on *80* and your strongest supporters, why not develop a good working relationship? It would be a pity if Radio Shack's sensitive attitude persists because Tandy will be among the eventual losers.

Jim Donndelinger
Libertyville, IL

cc: *80 Microcomputing*

Derogatory Remarks

Obviously, neither TRS-80 users, *80 Microcomputing* readers, Tandy nor *80 Microcomputing* publishers are well served by the just announced rift between Tandy and *80 Microcomputing*. (May, 1980). But it is understandable that the statements made by Pennington about Tandy and others like "Tandy didn't spend $5 for lower case chips" would annoy Tandy. *80 Microcomputing* should not continue to publish such derogatory statements.

Somehow, Tandy should take an active constructive part in *80 Microcomputing* magazine. They should be given the opportunity to critique statements made by the *80 Microcomputing* freelance staff. This staff should be informed that outright derogatory statements against Tandy will be deleted from their manuscripts.

TRS-users who do not wish to upgrade their systems welcome a magazine that gives very useful suggestions on how to use them. The articles on cheap hardware and software alternatives to expensive peripherals allows users to make intelligent decisions about upgrading their systems. It seems to me that active participation by Tandy in some way will only benefit all concerned.

Peter Feitis
Santa Barbara, CA

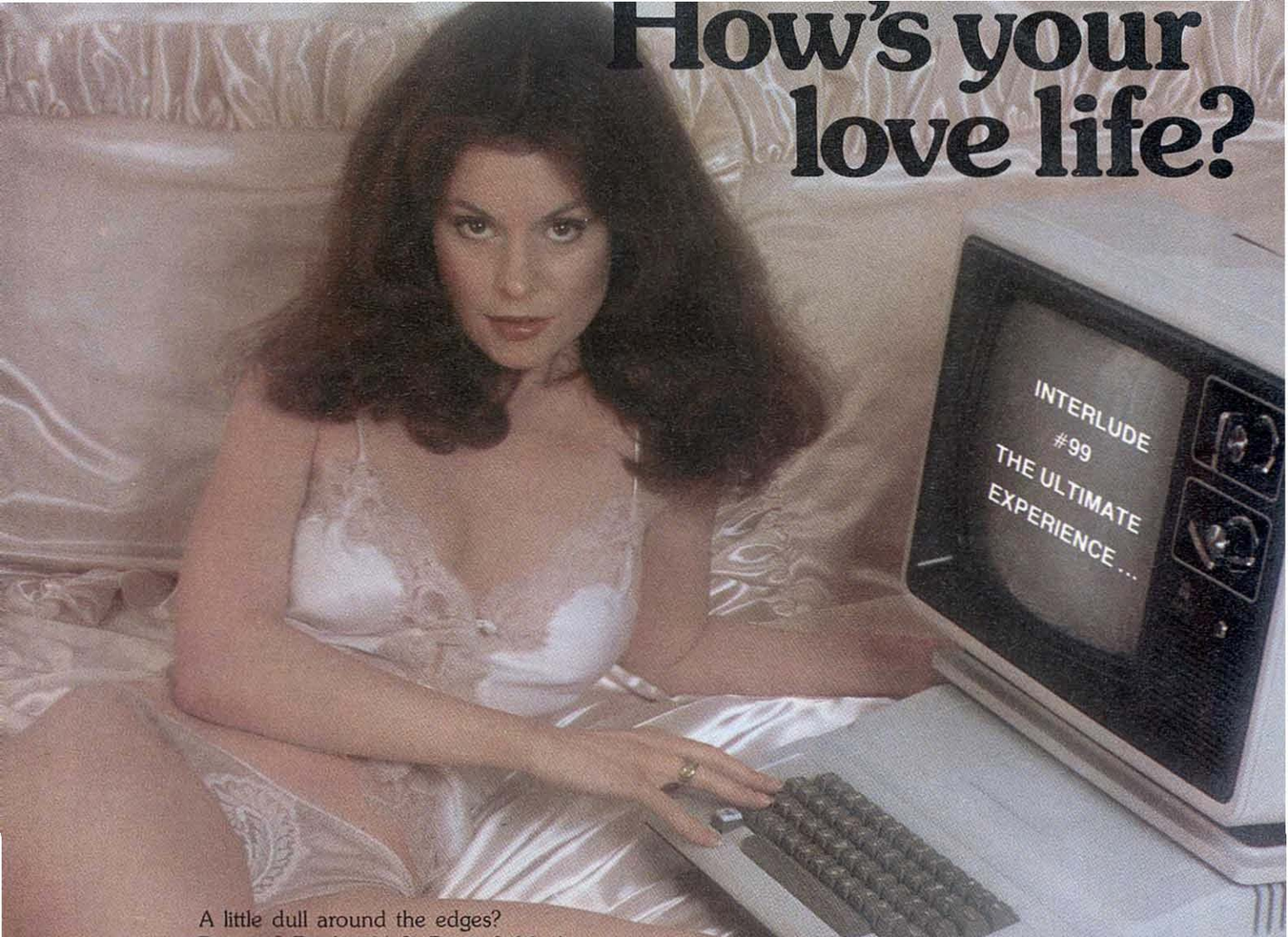
Fleeting Pain

My sincere congratulations on "EDIT 80" in the May issue. I am sure that any pain caused by losing advertising from Radio Shack will be fleeting. The real interesting hardware and software for the TRS-80 comes from many sources and I take a sort of perverse pride that my machine has only the bare minimum from Radio Shack.

As soon as my expansion board from LNW is populated and the first MPI B-51 installed, I'll have to buy Pennington's book. If the rest of the book is up to the excellence of the introduction you quoted, it must truly be worth the rather large price it commands.

Irv Hamlin
Sevierville, TN

How's your love life?



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80 REVIEWS

"If you're presently looking for a mailing list processor, this represents the current state of the art."

Introduction to T-BUG
Don and Kurt Inman
dilithium Press, 1979
Forest Grove, OR
120 pp., Softbound
$6.95

by James H. Sheats

Since the Radio Shack TRS-80 has a great deal of appeal for users with no prior exposure to machine language coding the new user has a vast need for tutorial material on this subject. Radio Shack's own documentation of both their Editor/Assembler Program and the T-BUG Z-80 Monitor and Debugging Aid is very inadequate.

Introduction to T-BUG goes a long way toward satisfying this need. Its excellent text helps greatly in understanding T-BUG, because the authors presume little prior exposure to Z-80 machine language.

Each T-BUG command is explained and illustrated with short programs in machine language, tables and sketches. In addition, the book explains in much greater detail than Radio Shack's literature the use of certain ROM subroutines.

Graphics Display

The book includes a section on graphics display in machine language. A later chapter expands this topic into a machine language game program. This same chapter includes a discussion of flag bits. It is one of the most lucid explanations of this topic that the reviewer can recall.

The final chapter covers debugging. Errors are deliberately left in the already introduced game program, so that the reader can examine the debugging process as the authors demonstrate and explain the technique of finding and correcting errors.

This book provides the novice with a "go ahead" text full of useful tricks, enabling him to begin a more detailed study of machine language programming, as well as have a little fun. It is not a complete text on Z-80 machine language programming and is not intended to be. With this limitation in mind, the reviewer recommends the book. ■

Supermap
Fuller Software
Grand Prairie, TX
40 pages
$18.95

by Paul Wiener

Supermap is a detailed memory map of the TRS-80 showing what functions are performed by different areas in memory, especially ROM. As the listing of Radio Shack's ROM is copyrighted, *Supermap* doesn't contain a printout of the ROM code but it describes the purpose of the code in various locations.

The user will have to provide his or her own disassembled listing of ROM to make the best use of the book.

Secrets Revealed

Supermap is nearly 40 pages long and documents about a thousand memory locations. Most of these are in ROM, but RAM addresses used by the system to store the stack, stack pointer, variable names and values and other information are also indicated.

The book reveals many interesting secrets. For example, *Supermap* taught me that when you default on the 'MEMSIZE?' question, the TRS-80 performs a crude memory test of each memory location in ascending order. When a failure occurs, the system assumes that the top of physical memory has been found and saves that address as a pointer to the top of memory.

I also learned that to obtain a new random seed, the TRS-80 loads a value from the Z-80 refresh register.

In addition to a wealth of such information, *Supermap* examines the BASIC tape format, the SYSTEM tape format and the editor/assembler, an alphabetized table of entry points for Level II commands and the RAM storage format for BASIC programs.

This information is invaluable to anyone who wants to program a TRS-80 in machine language. It's also useful to the BASIC programmer who wants to find out what some PEEK or POKE in a published program does.

In the software lab where I work, hardly a day passes without more than one request from my fellow workers to use *Supermap*—despite the fact that most of the software involved is in BASIC.

Price Break

According to a note that Fuller Software included with *Supermap*, the next edition will contain additional material—including a table format summary of the most useful subroutines. The volume of sales has been great enough so that the second edition will sell for $8.95 instead of the current price of $18.95. ■

Special Delivery
by Dan L. Thornsberry and Steve Watson
Software Etc.
Carrollton, TX
$125

by Jake Commander

Special Delivery, a three-program disk-based package, manipulates mailing list files. And manipulate it does! If you're presently looking for a professional mailing list processor, this represents the current state of the art.

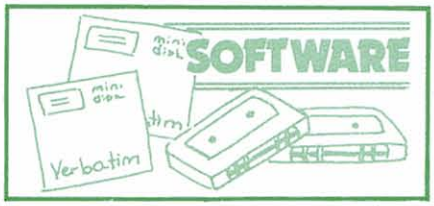
As well as the three programs, three files are supplied that allow a newcomer to experiment before lurching headlong into his own lists. This is a thoughtful idea, because the documentation—well written though is is—has so much to say regarding the use of the programs that it becomes too much to digest.

A quick scan of the manual, followed by a session at the keyboard is the best way to familiarize yourself with the package and get a feel for its speed. All three programs are written in machine code and leave any equivalent BASIC program miles behind.

File Conversion

For those of you who have the BASIC mailing list program from Radio Shack (TM., bow, scrape, face East, etc.), but want to change to Special Delivery, fear not—your current mailing files can be quickly and painlessly converted by CONVERT. Like all file conversion programs, it's only likely to be used once per file to hasten your arrival into the world of serious mail list word processing.

If you detect a feeling of enthusiasm, you're right. If this package had reached the market a year ago, it could have become the Electric



```
 MAILFORM -V 1.4- COPYRIGHT 1979 BY SPECIAL DELIVERY-WATSON
NAME    ____________________________      F - PAGE FORWARD
COMPANY ____________________________      B - PAGE BACK
ADDRESS ____________________________      G - GET RECORD
CITY    ____________________              P - PUT RECORD
STATE   __              D - DELETE CHAR   K - DELETE RECORD
ZIP     _____           I - INSERT CHAR   S - DEFINE SEARCH
DATA 1  ______________                    C - CONT. SEARCH
DATA 2  ______________                    T - SORT RECORDS
                                          R - READ FILE
RECORD # ___  LAST 000  MAX 316           W - WRITE FILE
FILESPEC ___________________________      X - EXTRACT FILE
                                                E - EXIT
```

Fig. 1.

Pencil of mailing lists—and still may do so.

MAILFORM: This is the main part of the whole package. With this program you can create and edit mail list files flexibly. First, it checks to see if you have a lowercase video chip enabled. If not, then everything typed will be taken as uppercase regardless of whether or not you use shifted characters. (This is one of the few things I would like to have seen done differently. It would have been useful for users without lowercase video, but with a lowercase printer to be able to enter lowercase even though it was actually displayed as uppercase.)

When MAILFORM runs, it displays a form on the screen (Fig. 1), which makes it clear which field goes where, and how many characters it allows.

The keyboard routine, which is the heart of any word processor, has been well thought out. A flashing cursor lets you know exactly where you are. Though the form display on the screen indicates the remaining characters in any field, if you're paying more attention to the keyboard than the screen, an optional beeper can be wired up to the cassette remote jack. All sorts of error situations are signalled using this method, and though I didn't hook up a beeper, my relay clicked patiently whenever I tried to do something amiss.

MAILFORM lets you enter data in any field as befits your needs. Later, the whole form is entered as a single record to memory. Then, enter your next record. (Here I wish a single key was able to clear the previous record from the display. You can do this by pressing ENTER to each line in turn.)

No Keyboard Modification

All control functions are carried out using shift/down-arrow as the control key, so absolutely no modifications are required to the keyboard.

This requirement of putting a record to memory is very important as the whole concept of MAILFORM is to do all of its work in memory, rather than using time-consuming disk I/O. This allows extremely fast searches and sorts. The manual glibly tells you the sort will take less than 12 seconds—and I believe it.

When you have completed what you consider to be a file, that's when you sensibly decide to save it to disk. If you want, you can re-sort it using another key and save it to a different file.

Now, we have more good news regarding disk I/O. While outputting, you can: save to a new file, rewrite an old file or append to an existing file. While inputting, you can: concatenate files, extract particular records or, if memory becomes full, refill memory from that particular point in the file. This eliminates excessively large files.

Also, if you should accidentally (?) hit the reset button after typing in 315 records, all is not lost. Just type MAILFORM*. The appended asterisk will see to it that memory is not initialized and your 315 records are safe.

This by no means covers all the functions of MAILFORM, but a mention should be made of the very fast search facility. The search does not differentiate between upper and lowercase, so Smith will be found, whether it's written SMITH or Smith or smiTH.

MAILRITE: This program creates personalized letters, labels and envelopes by using an address file created with the MAILFORM program. The program takes a file written by a word processor and replaces pre-defined flags in that file with fields from your address file. An example illustrates how this works.

Bagweed, I Presume

Say your address file starts with the name Bagweed,Spratley. If your letter file starts with Dear Mr. <L, then your printout will say "Dear Mr. Bagweed" <L is the flag for "replace with last name."

If your letter starts Dear <F, then "Dear Spratley" will be printed, as <F is the flag for "replace with first name." Any field from a MAILFORM address file can be inserted anywhere in a letter or label as often as required.

The letter file need not be an actual letter, it can be a file containing only flags such as <L or <F, in which case a printout is obtained containing only fields from the address file. The whole process repeats itself for each record in the address file with an option to pause between each record to adjust the printer, if necessary.

The printout will also pause if you press the space bar or use a special pause flag embedded in the letter text. In fact, eight print control flags exist.

<U	- Toggle underscore on or off
<B	- Toggle boldface on or off
<Ixxx	- Change left margin to xxx
<Jxxx	- Change right margin to xxx
<-	- Homograph hyphen
<H	- Cause printing to pause
<R	- Print three-digit record number
<Dxxx	- Print CHR$(xxx)

These flags allow powerful print control from WITHIN the text itself. Underscore and boldface only apply to printers that recognize separate carriage return and linefeed.

One Miscalculation

Unfortunately, during one of the print pause options, I pressed BREAK. As a result, my computer suffered a spectacular crash, overwrote a disk track and is only just recovering. I couldn't recover the memory file.

Admittedly, I should not have pressed BREAK to abort the printout; I should have pressed ENTER, but be wary.

At a price of $125.00 this package is not cheap. But then, good software doesn't come for pennies. Any businessman using mail lists (and that doesn't leave out many!) would be well advised to use this package. You'd be hard put to find a better one. ■

Bootstrap
Practical Applications
San Carlos, CA
$15.95

by James Ranney

The advertisement for this program sounded so fantastic that I had to try it. It didn't disappoint me. Bootstrap creates a machine language program. BOOT CMD, on the DOS disk, that loads and runs your BASIC programs. It sets the files and memory size automatically by pushing the reset button.

The program arrived on a cassette with a short but adequate instruction sheet. Although the instructions don't say so, Bootstrap can only be used on 32K or 48K machines. I had considerable difficulty loading the cassette, I resorted to using a volume setting about one quarter lower than normal.

There were four dumps on the cassette. The first two were identical, intended for TRSDOS 2.2 or 2.3. The last two dumps, also identical, were intended for NEWDOS. BOOT CMD loads at AB00H 43786 decimal, so if you have any other programs in this area, they will interfere with one another.

Automatically LOAD

My first project was to set up a disk that would automatically load my lowercase software and my text editor. I copied my lowercase program, which I named LOCASE/TRS and the text editor, which I named TEXT80, onto the disk, then loaded and ran Bootstrap.

After the credits to Practical Applications,

the program opened a file and showed DOS READY on the screen along with a @ in the upper right corner warning you that you are not really in the DOS mode. I entered the following responses:

```
DOS READY
VERIFY (enter)
DOS READY
LOAD LOCASE/TRS (enter)
DOS READY
BASIC (enter)
HOW MANY FILES?__(enter)
MEMORY SIZE?65280
BASIC
SYSTEM (enter)
BASIC
/65280 (enter)
BASIC
CONT (enter)
BASIC
RUN"TEXT80:0" (enter)
BASIC
__(enter)
BASIC
__(enter)
```

The enter key must be used twice in a row to exit Bootstrap. At this point Bootstrap creates the BOOT/CMD program, clears the screen and prints out a FINISHED message. By using CMD"S to get into DOS, you type AUTO BOOT (enter) and your task is finished.

Now, by inserting my disk and pushing the reset button, I can automatically load the DOS, the VERIFY command, the machine language program LOCASE/TRS and BASIC. Bootstrap, furthermore, sets the files size to 3, protects high memory at 65280, goes into the system mode, runs the machine language program at 65280, goes to the CONT command and loads and runs TEXT80.

I did have to use the CONT command after running the machine language program, because an OUT OF MEMORY error appeared and TEXT80 wouldn't load. By using the CONT command I get a CAN'T CONTINUE error message, but the routine does continue. It loads and runs TEXT80.

You can load and run as many machine language programs as you want, but you can only run one BASIC program. All further commands will be ignored. Bootstrap can also be used to merge two or more programs and run them without interruption.

If you intend to format more than one disk with this DOS, when you answer the HIT 'ENTER' TO CONTINUE prompt, BOOT/CMD will go through its full cycle before you can use CMD"S to return to DOS. Format and backup work by answering all the prompts, but go into an endless loop when you answer the same prompt.

If you have the BASIC prompts on the screen and you use CMD"S, your routine will go to DOS, but you will still show BASIC on the screen. You can use BASIC * to go back to BASIC without having to reset the files and memory size prompts.

The instructions suggest you use the DIR command to list the disk directory, but if you are using more than one drive, the directory for the first drive flashes on and off the screen so fast that you won't be able to read it. The answer is to use the FREE command which lists the disk name, formatting date and password for all drives in use.

Continuous Loop

You can fall into some traps playing around with Bootstrap, such as setting up BOOT/CMD so that it executes a continuous loop. If you can't get out with the break key, shut off the computer and remove the disk. Turn the computer on again, insert another DOS disk and load it with the reset button. You can then re-insert the original disk and use KILL BOOT/CMD to cancel the endless loop.

The instructions say you can use as many commands as you like, up to 255 bytes in the prompt file. I sucessfully set up one test disk with 31 commands, all of which executed perfectly. ■

Radex-10
IJG Computer Services Division
Upland, CA
$99

by Dave Orozco

Having searched long and hard for a way to justify the ownership and maintenance of a microcomputer in my own home, I was relieved to learn that my wife had been appointed to the board of directors for our town's youth soccer league. Here, at last, was a chance to prove the worth of my little TRS-80, and possibly to assure it's survival! With the courage of the ignorant, I quickly volunteered to do any recordkeeping that the club might need.

I found myself keeping track of data for 400 players, their coaches, team mothers and officials.

A quick visit to my local supplier produced a copy of I.J.G.'s Radex-10(Random Access Data Executive). A brief look at the thorough documentation raised my hopes.

Random Access Files

Written in BASIC, Radex-10 creates random access files and maintains them without taxing the user's technical knowledge. The program can generate reports with parameters that you create. Thirty-one searches are made per report, with each variable and its relationship to the others infinitely selectable.

Any number of fields can be output to the report, printed in any order, and the same fields can be used more than once. The fields can be formatted either vertically or horizontally. Mailing labels are automatically printed using the first five fields, currently employing a four-across pattern. This is too wide for my Heathkit H-14 printer, but a modification is forthcoming to allow free form label printing. Page numbering, dating and titling are automatic.

Hardware requirements for Radex-10 include 32K RAM and two disk drives. The six control programs are stored in BASIC on Disk Drive Zero, along with your favorite DOS.

All files are stored on Disk Drive One, requiring only a formatted diskette with no tracks locked out. When this diskette fills up, a prompt is sent to the user, telling him to insert another and continue. This disk-spanning method enables up to 10,199 records of 255 bytes each to be stored and accessed.

All of the prompting in the program is very easy to understand and use. The instructions mercifully avoid the use of abbreviations. Sometimes it even tells you why it is doing a particular thing, which is quite a departure from the "push the X button now" syndrome.

To begin, the package asks you to choose a function from its menu: 1) create data base, 2) file maintenance, 3) create reports, 4) run reports, 5) print file parameters and 6) end program. Subfunctions are selected by display choices as well.

File maintenance is the heart of the system, and allows all additions and deletions to your record lists. When you create a report, it stays on file for future use. All you need do when using it, is provide a new set of parameters to suit your current needs. The reports may be arranged with vertical or horizontal layouts; and the information can be arranged in any order that you wish. The file parameters can also be displayed or printed, as you desire.

Capabilities

Versatility seems to be the key word with Radex-10. If you are using a 35 track drive and a record length of 119 bytes, you can get 638 records on one diskette.

Slated modifications to the Radex-10 package will allow you to change fields after parameters have been established and data has been filed, to link data files together, to index and to use the Electric Pencil.

Its documentation is simple, well written, and very easy to understand. It starts with a brief discussion of the program, and includes six pages of definitions, which I found more enlightening than Radio Shack's TRSDOS manual. There is also a section on file structure and data bases in general. and even a list of suggested reading.

All the prompts are fully illustrated and explained. The manual is a real treat for those who are not too technically-minded.

A word or two should be said for the people at International Jewel Guild, the marketers of Radex-10. At the outset of this adventure, I managed to make some rather simplistic mistakes, which were not obvious to me at the time. A quick call to the experts, and the problem was corrected to my satisfaction.

Conclusion

Though, admittedly, not cheap, it takes a powerful program such as this to utilize the potential of a home computer system.

I'm still not sure if my microcomputer has justified itself, but I think that with the help Radex-10, it has taken a quantum leap toward social respectability! ■

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THIS CARD EXPIRES JULY 18, 1980

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TRS-80 Model II
Tandy Corporation
Ft. Worth, TX

by Charles M. Kolb
and Gene McManus

Five months ago, we made a big decision to commit nearly $10,000 to Radio Shack's Model II. Based on our experiences with the TRS-80 Model I, we were looking forward to the Model II's increased data and processing speed.

Now that the equipment is here, our excitement has diminished.

We are a small communications and software firm. To us, the microcomputer is a tool. Like other office equipment, it must contribute to our productivity or it is a bad investment. So far, we haven't decided on which side of the ledger the Model II belongs.

"The parallel port option works fine, if you can find a compatible plug."

Hardware

Radio Shack's equipment is compact, reasonably attractive and holds no surprises. a good value, no doubt. Its keyboard works comfortably and the special function and cursor control keys, now that we know how to activate them, are most useful.

The video is clear, with very little fall-off in sharpness at the edges of the screen. The video reverse function clarifies operator prompts, but the characters are not as solid as we'd like. One tends to avoid long strings of reversed lowercase text.

The TRS-80's built-in 8-inch disk drive is easy enough to use and after several hundred hours of operation, it remains reliable.

On the rear panel, there is no provision to screw-connect the DB25 serial port plugs, they tend to pull out. Likewise, the a.c. receptacle is not sturdy enough to avoid disconnects. Duct tape solves the problem by eliminating any strain on the cables.

The parallel port connector works fine—if you can find a compatible plug. Radio Shack supplies only finished cables to connect to their own peripherals. If you own something else, you're on your own.

The expansion unit with its three additional disk drives is less successful. We are experiencing I/O problems and don't know if they originate in the hardware or software. In any case, reliable I/O between tracks 45 and 76 is impossible. Below 45, things work fine, now that we have the DOS 1.2.

After steadfastly denying there was any hardware fault in the disk controller,. Radio Shack now has a free hardware modification, which seems to have corrected the I/O reliability problems between the bus and the expansion drive.

There are no lights to indicate an active drive. In fact, the expansion drives differ entirely from the main drive. This tends to be confusing to busy operators.

With the early Model I days in mind, we are generally pleased with the amount of information in the Model II manual. It's only a temporary release, but from some of the proofs of new material we've seen, the completed manual will be comprehensive. Scanty indexing does need improvement, however.

DOS 1.2

By the time this is in print, all Model II owners should have the revised DOS, so we won't rant and rave over the preliminary version. Suffice to say that Radio Shack is aware of its problems and corrected most of them. Highlights of the DOS library commands include:

AGAIN: Repeats the last DOS command. Saves repeating long command specifications, if for some reason the command fails to function.

AUTO: Allows multiple initialization functions when used in combination with the BUILD and DO functions. Using these, it is possible to start the clock, initialize both serial ports and the parallel port, establish FORMS parameters and complete the sequence with a running BASIC program. This is extremely valuable when non-computer-oriented personnel operate the system.

DEBUG: Allows creation, testing, uploading and manipulation of machine-language programs.

DIR: Directory supports a print parameter (PRT) that saves a lot of effort when printed disk directories are needed.

ERROR: When a DOS error is encountered, only the error code is displayed. The operator must enter the error code to discover what it is.

FREE: Displays a map of granule allocation. Used in combination with the DIR command, the operator has a clear picture of how the disk is organized.

FORMS: Initializes either serial or parallel printers for page size, lines per page, characters per line and a special control code required by some printers.

LIST: Allows listing to screen or hardcopy printing of a disk file from a single record to an entire program in both ASCII and/or hex.

PATCH: Allows changing the contents of both machine language and data files. Patch provides a convenient means of software modification.

PURGE: Limited and careful use of this command is advised and one should always backup first. It allows quick scanning and optional deletion of all files on a disk.

SETCOM: Initializes RS232 baud rate, word length, parity status and number of stop bits. It allows baud rates from 100 to 4800.

TERMINAL: A menu-driven terminal program that makes the Model II an interactive terminal, transmits from RAM of programs and data, allows auto sign-on and other useful functions.

XFERSYS: This command, designed to upgrade existing DOS 1.1 disks to 1.2 on single-drive systems, has problems which are, as yet, uncorrected.

DOS 1.2 is destined to become a very good operating system, but still has some unexplained mysteries. For instance, a tested BASIC program will suddenly lock up. Or one byte of one program line will suddenly be transformed and that can cause a loss of data. The only way out is to RESET.

BASIC on the Model II

The Model II uses an extended Microsoft BASIC. Unlike Model I, THEN must be added to statements. In addition, the statement LPRINT without an argument does not reliably send a carriage return and a line feed to the port.

When listing a program or data to the screen, some lines are repeated. On the other hand, the last line of a very long string is often missed.

Random I/O seems to be sorted out now. Except for the disk problem mentioned earlier, I/O is reliable and pleasingly rapid.

Some of the different Model II BASIC commands are:

INSTR: Returns the position of a string within an existing string. This function speeds up string searches in edit routines.

RENUM: No longer adds trailing blanks to line numbers of less than five digits.

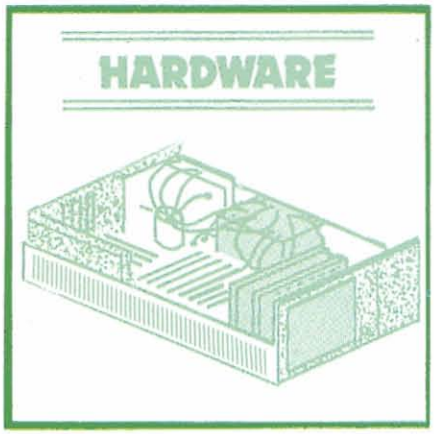
SWAP: Exchanges the values of two variables and has proven very useful in sort routines.

SYSTEM"DOS COMMAND": Allows most DOS commands to be used in BASIC programs. SYSTEM without an argument returns control to DOS, losing your BASIC program.

Beyond these, Model II runs much like Model I DOS BASIC.

Conclusion

As a small business trying to increase it efficiency, the Model II is simply not sufficient. There are just too many mysterious problems that nobody can answer. Store and repair center personnel are earnest, but they seem ill-prepared for the business market and its demands. ■



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.

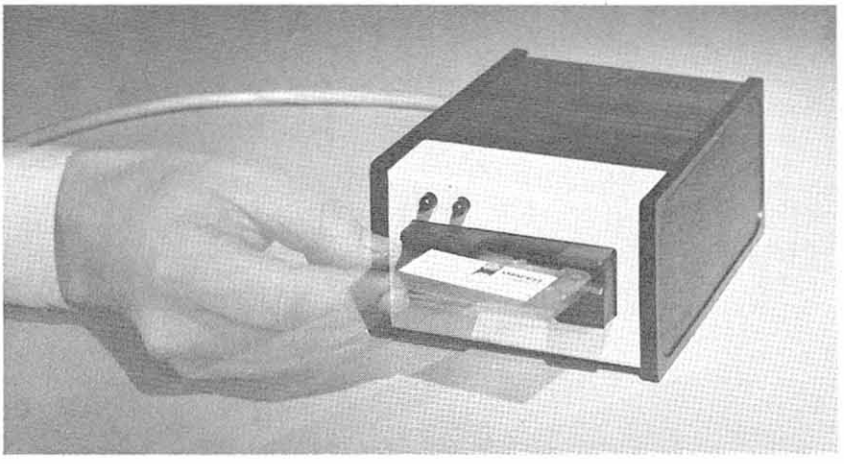
The software in every ESF adds a parity bit to every byte saved on tape, and a checksum to the end of every file. These are checked both after recording data and upon replay, any detected error is indicated by a message on the video display. This system of automatic error checking gives confidence in 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

THE ASSEMBLY LINE

by William Barden, Jr.

"A table in assembly language programs usually refers to a collection of data organized in one contiguous block."

I'll be discussing table look-ups and cassette tape calls this month. Next month I'll continue the discussion of high-speed graphics, using some of the table look-up techniques discussed here. (I know, I know, but promises are made to be broken.)

Many assembly language programs use tables, rather than BASIC DATA statements. It's important to know the various ways in which data in the tables can be accessed, or retrieved. There are a number of different approaches and presented below is a potpourri of them for your amazement and amusement.

I'll also discuss a cassette driver using Level II ROM subroutines that can be used to read or write cassette tape files.

How to Win at the Tables

A table in assembly language programs usually refers to a collection of data organized in one contiguous block. Contiguous simply means that the block of data occupies consecutive memory locations. The first byte of data might be at location 8000H (32768 decimal) in RAM, the second byte at location 8001H, the third at 8002H, and so forth. This arrangement is similar to the BASIC DATA statement, where one piece of data follows another, however, the data are probably not contiguous in memory, but distributed in BASIC statement lines.

Of course, as many tables can exist in memory as we want, each one occupying its block of contiguous memory locations. How large can a table be? A single table might occupy all of RAM, or may be only one or two bytes.

As a matter of fact, tables may be "fixed-length" or "variable-length." A fixed-length table is a fixed number of bytes in memory, while a variable-length table may change its length "dynamically," as a program is running.

An example of a fixed-length table is a table of 90 bytes, each byte of which holds the sine value of 0 to 89 degrees, as shown in Fig. 1.

```
00100           ORG     8000H           ;START OF TABLE, PROGRAM
00110 TABLE     EQU     $               ;USING EQU HERE IS OPTIONAL
00120           DEFM    'CALOSANGELES   '
00130           DEFM    'CABAKERSFIELD  '
00140           DEFM    'ILCHICAGO      '
00150           DEFM    'ILMOLINE       '
00160           DEFM    'TXFORT WORTH   '
00170           DEFM    'TXDALLAS       '
00180           DEFM    'TXBIG SPRING   '
```

Listing 1.

```
8060 54         00180           DEFM    'TXBIG SPRING
8061 58
8062 42
8063 49
8064 47
8065 20
8066 53
8067 50
8068 52
8069 49
806A 4E
806B 47
806C 20
806D 20
806E 20
806F 20
8070 210080     00190 SCANF     LD      HL,TABLE        ;START OF TABLE
8073 111000     00200           LD      DE,16           ;# OF BYTES PER ENTRY
8076 0607       00210           LD      B,7             ;# OF ENTRIES
8078            00220 SLOOP     EQU     $               ;PUT PROCESSING HERE
                00230 ;
                00240 ;
                00250 ;
8078 19         00260           ADD     HL,DE           ;FIND NEXT ENTRY
8079 10FD       00270           DJNZ    SLOOP           ;GO IF NOT LAST ENTRY
0000            00280           END
00000 TOTAL ERRORS

SCANF   8070
SLOOP   8078
TABLE   8000
```

Listing 2.

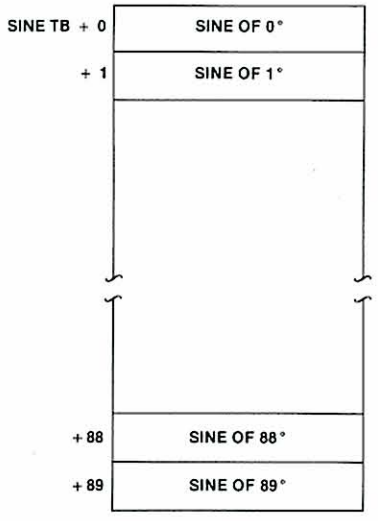


Fig. 1.

The Variable-length Table

An example of a variable-length table is a table of test scores of n number of bytes, each byte holding the score (from 0 to 100) of the First Annual TRS-80 BASIC Test at Big Spring, Texas. In this case, the number of test scores, n, must be held somewhere. It might be held in the first byte of the table, or in variable NENTTS (the number of entries in the table of test scores).

Of course, the size of the variable-length table is not infinite. There must be some limit to the number of entries, so that enough contiguous memory is allocated to hold the maximum number of entries. If the table will be huge, it's a common practice to put it at the end of the assembly language program and let it build upwards in memory. This can be done by defining the table with an EQUate as in:

```
        LD      (HL),A  ;STORE A REGISTER
        JP      ATTEN   ;JUMP TO ATTENTION
TABLE   EQU     $       ;DEFINE HUGE TABLE
        END     FORUS   ;END STATEMENT
```

Now the table can expand upwards until it runs into the stack area. Because we don't want this to happen, the program must continually

```
1FA0 54         00180           DEFM    'TXBIG SPRING    '
1FA1 58
1FA2 42
1FA3 49
1FA4 47
1FA5 20
1FA6 53
1FA7 50
1FA8 52
1FA9 49
1FAA 4E
1FAB 47
1FAC 20
1FAD 20
1FAE 20
1FAF 20
1FB0 21A01F     00190 SCANF   LD      HL,TABLE+6*16   ;START OF TABLE
1FB3 111000     00200         LD      DE,16           ;# OF BYTES PER ENTRY
1FB6 0607       00210         LD      B,7             ;# OF ENTRIES
1FB8            00220 SLOOP   EQU     $               ;PUT PROCESSING HERE
                00230 ;
                00240 ;
                00250 ;
1FB8 B7         00255         OR      A               ;RESET CARRY
1FB9 ED52       00260         SBC     HL,DE           ;FIND NEXT ENTRY
1FBB 10FB       00270         DJNZ    SLOOP           ;GO IF NOT LAST ENTRY
0000            00280         END
00000 TOTAL ERRORS

SCANF   1FB0
SLOOP   1FB8
TABLE   1F40
```

Listing 3.

```
8060 54         00180           DEFM    'TXBIG SPRING    '
8061 58
8062 42
8063 49
8064 47
8065 20
8066 53
8067 50
8068 52
8069 49
806A 4E
806B 47
806C 20
806D 20
806E 20
806F 20
8070 210080     00190 SCANF   LD      HL,TABLE        ;START OF TABLE
8073 111000     00200         LD      DE,16           ;# OF BYTES PER ENTRY
8076 017080     00210         LD      BC,TABLE+7*16   ; (LAST ADDR+ONE ENTRY)
8079            00220 SLOOP   EQU     $               ;PUT PROCESSING HERE
                00230 ;
                00240 ;
                00250 ;
8079 19         00260         ADD     HL,DE           ;FIND NEXT ENTRY
807A E5         00265         PUSH    HL              ;SAVE NEXT ENTRY ADDRESS
807B B7         00268         OR      A               ;RESET CARRY
807C ED42       00270         SBC     HL,BC           ;TEST FOR END
807E E1         00275         POP     HL              ;RESTORE NEXT ADDRESS
807F C27980     00280         JP      NZ,SLOOP        ;GO IF NOT DONE
                00285 ; DONE HERE
0000            00290         END
00000 TOTAL ERRORS

SCANF   8070
SLOOP   8079
TABLE   8000
```

Listing 4.

check the size of the table to see that it doesn't reach the limiting number of entries, or the maximum boundary.

If the size of a variable-length table is smaller, then the table may simply be imbedded in the assembly language program itself, with enough space allocated to handle the maximum number of entries. This could be done with an EQUate, or (more commonly) with a DEFS, a DEFine Storage.

```
TABLE1  EQU   $         ;DEFINE TABLE OF
                        ;100 BYTES
NEXT1   EQU   $+100     ;RESERVE 100 BYTES
        LD    A,(HL)    ;WE JUMPED HERE
                        ;FROM SOMEWHERE ELSE
        .
        .
        .
TABLE2  DEFS  100       ;DEFINE TABLE OF
                        100 BYTES
NEXT2   LD    A,(DE)    ;WE JUMPED HERE FROM
                        SOMEWHERE ELSE
```

There's no reason that table entries in either fixed or variable-length tables couldn't be any size. For example, each entry in a given table might have to be two bytes in size to hold addresses in memory, or the entries might have to be four bytes in size to hold values up to 4,294,967,295. Although we could make the entries variable length, it's probably more common to leave the entries a fixed length of a certain number of bytes, even though the number of entries in the table will be variable.

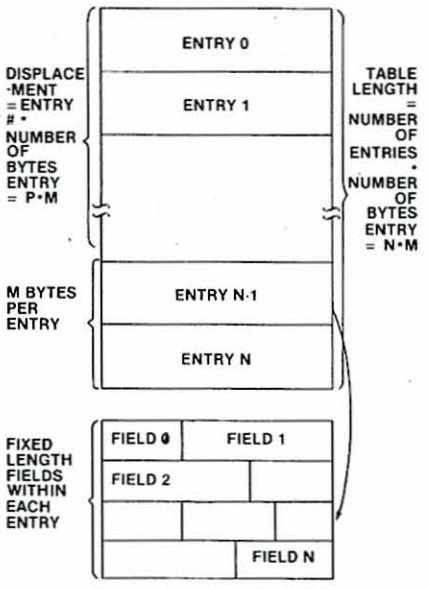


Fig. 2.

Also, there's no reason to limit each entry to a single item of data. Within each entry, there might be several "fields" of data. For example, a mail list table containing the names, addresses, and other descriptors of all TRS-80 users who have never duplicated copyrighted programs, might be a fixed-length table with only 10 entries!

Each entry is further subdivided into a last name, first name, street address, city, state, zip, and miscellaneous field. Each field is also fixed-length; the length for each field is defined as the maximum number of bytes necessary to represent the data. The zip code field is probably five bytes, while the last name field might be 20 bytes.

What do we have up to this point? We have a table of a certain number of entries, let's say "n," with each entry a fixed length of "m" number of bytes, and each entry possibly subdivided further into fixed-length fields. Each is a specific number of bytes. The parameters of this general table are shown in Fig. 2. The size of the table is the number of entries times the number of bytes per entry, n•m, while the "displacement" of any entry from the beginning of the table is given by p•m, where p is the number of the entry, starting from 0, and counting up through 1,2,3, and so forth.

Accessing Data in Tables

Now that we've defined what typical tables look like in assembly language, let's find out how to access the data within them. We won't talk about sorting (arranging the data within the tables) or searching (finding a key piece of data within the table), but just how to scan

```
8060 54        00180          DEFM    'TXBIG SPRING
8061 58
8062 42
8063 49
8064 47
8065 20
8066 53
8067 50
8068 52
8069 49
806A 4E
806B 47
806C 20
806D 20
806E 20
806F 20
8070 FF        00185          DEFB    0FF             ;-1 FOR TERMINATOR
8071 210080    00190 SCANF    LD      HL,TABLE        ;START OF TABLE
8074 111000    00200          LD      DE,16           ;# OF BYTES PER ENTRY
8077           00220 SLOOP    EQU     $
8077 7E        00230          LD      A,(HL)          ;GET ENTRY
8078 FEFF      00240          CP      0FFH            ;TEST FOR TERMINATOR
807A 2803      00250          JR      Z,DONE          ;GO IF TERMINATOR
               00260 ;
               00270 ; PUT PROCESSING HERE
               00280 ;
807C 19        00282          ADD     HL,DE           ;FIND NEXT ENTRY
807D 18F8      00290          JR      SLOOP           ;GO FOR NEXT ENTRY
807F           00300 DONE     EQU     $               ;MORE CODE HERE
0000           00310          END
00000 TOTAL ERRORS

DONE    807F
SCANF   8071
SLOOP   8077
TABLE   8000
```

Listing 5.

```
8000           00100          ORG     8000H           ;CHANGE FOR YOUR SYSTEM
               00110 ;*************************************************
               00120 ;* SUBROUTINE TO READ OR WRITE CASSETTE RECORD    *
               00130 ;*************************************************
               00140 ;
8000 CD1202    00150 CASTPE   CALL    212H            ;TURN ON CASSETTE
8003 CB41      00160          BIT     0,C             ;TEST READ OR WRITE
8005 200E      00170          JR      NZ,CWRTE        ;GO IF WRITE
               00180 ; READ HERE
8007 CD9602    00190          CALL    296H            ;READ LEADER AND SYNC BYTE
800A CD3502    00200 RLOOP    CALL    235H            ;READ ONE BYTE
800D 77        00210          LD      (HL),A          ;STORE BYTE
800E 23        00220          INC     HL              ;BUMP POINTER
800F 10F9      00230          DJNZ    RLOOP           ;GO IF MORE TO READ
8011 CDF801    00240 RLOOP1   CALL    1F8H            ;TURN OFF CASSETTE
8014 C9        00250          RET                     ;RETURN
               00260 ; WRITE HERE
8015 C5        00270 CWRTE    PUSH    BC              ;SAVE BYTE COUNT
8016 CD8702    00280          CALL    287H            ;WRITE LEADER AND SYNC BYTE
8019 C1        00290          POP     BC              ;RESTORE BYTE COUNT
801A 7E        00300 WLOOP    LD      A,(HL)          ;GET BYTE TO WRITE
801B CD6402    00310          CALL    264H            ;WRITE ONE BYTE
801E 23        00320          INC     HL              ;BUMP BUFFER POINTER
801F 10F9      00330          DJNZ    WLOOP           ;GO IF MORE TO WRITE
8021 18EE      00340          JR      RLOOP1          ;GO TO TERMINATE
0000           00350          END
00000 TOTAL ERRORS

CASTPE  8000
CWRTE   8015
RLOOP   800A
RLOOP1  8011
WLOOP   801A
```

Listing 6.

through a table from beginning to end.

You can scan the table, forward and backward. Assume that we have a typical table in RAM referenced by the name TABLE and made up of a fixed number of seven entries. Each entry is 16 bytes long; the first two bytes are a two-byte state name in ASCII format, while the next 14 bytes are a city name in ASCII format, with trailing blanks. The table is defined during assembly, but could have been filled dynamically. The table before assembly is shown in Listing 1.

We may want to scan through the table forwards, looking for a state or city name as we do. In this case we need to start with the location of TABLE, and end with the last entry.

Each time we want to move to the next entry, we need to increment a pointer by 16, the number of bytes per entry. Listing 2 shows how this can be done for the table above. HL is set up as a pointer to TABLE. HL is incremented by the bytes of each entry, adding the 16 in DE to HL for each new entry. The numberof entries is put into the B register initially; in a variable-length table the number of entries could be taken from the NENT variable, the current number of entries.

To scan the same table backwards, the HL pointer is set up to the address of the last entry in the table, and HL is adjusted by subtracting the size of each entry from HL. This procedure is shown in Listing 3. HL is initially set to TABLE + 6*16, which corresponds to the address of the last entry (Let the assembler perform those odious computations for you!). DE is set to 16, the number of bytes per entry as before, and B holds the number of entries. Remember that in subtracting, the carry flag must first be set to 0, as the subtraction is a "subtract carry."

The index registers, IX or IY, could be used in place of the HL pointer to facilitate access of the fields in each entry, as in:

```
LD      A,(IX+2)    ;GET FIRST BYTE OF
                    ;CITY NAME IN ENTRY
```

The scheme above works fine, as long as the number of entries is less than or equal to 256 (Zero is used in B for 256 entries). If the number of entries in the table is greater than 256, though, we can no longer use the DJNZ instruction to decrement an entry count in B. We could use the BC register pair to hold the entry count, and decrement BC. However, to test for zero in this case, we would have to load A with B and OR in C, as DEC BC does not set the zero flag!

An alternative approach is to work directly with the pointer addresses, and test for the last address. This is shown in Listing 4 for the scan forward case.

Here, HL is loaded with the start of TABLE, as before. DE is loaded with the number of bytes per entry, as before. BC is loaded with the address of the last entry in the table plus one entry, TABLE + 7*16.

In scanning through the table, HL is incremented by adding DE. Afterward, the current address is saved in the stack, and BC is subtracted from HL. If the result is zero, the Z flag is set, and the scan is over.

Note that the current address is restored to HL by "popping" the stack before the JP test of the Z flag; popping the stack to a register pair never affects the flags (except for POP AF). This same scheme can be used in scanning through the table backwards.

Assembly language programmers are noted for avoiding work whenever possible. As a true test of your abilities in this pursuit, can the reader find a cleaner way to scan the tables, one that involves fewer instructions?

Several alternatives are possible. One way might be to take advantage of the CPI or CPD instructions. These instructions automatically increment (CPI) or decrement (CPD) a pointer in HL by one, decrement a count in BC by one, and compare a key in the A register. They will also set the Z flag, if the key compares to the contents of the location pointed to by HL, and reset the P/V flag if the count in BC is decremented down to zero.

The kicker here is that the pointer is adjusted only by one, and not by the number of bytes per entry. However, it is a simple matter to perform an add (or subtract) from DE to further adjust the pointer by the number of bytes-1 in something similar to:

Continue to page 28

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80 APPLICATIONS

by Dennis Kitsz

"Whenever we LIST, we are asking Level II BASIC to take a program and translate it for our eyes."

Graphics: fun to have, frustrating to set up. If you would like a better way, then SEESPOT! is for you. At a cost of a mere hundred bytes, you can have full graphics controlled directly from the TRS-80 keyboard.

Two keys, the up and down arrows, when shifted have no effect when used in normal BASIC. SEESPOT! redefines these shifted arrows as control keys to create all 64 graphics characters. Before turning to the program itself, let's have a look at those graphics characters. Run Example 1.

```
110 FOR X=128 TO 191
120 PRINT CHR$(X) "-----";
130 NEXT X
```

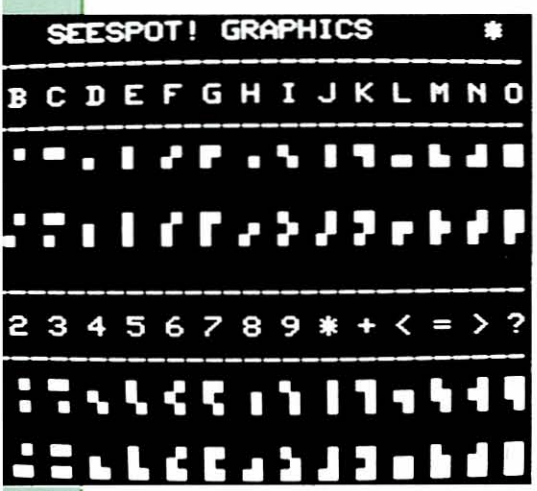
Example 1

```
205 CLS
210 FOR X=0 TO 127
220 FOR Y=0 TO 2
230 SET (X,Y)
240 NEXT Y,X
250 GOTO 250
```

Example 2

```
305 CLS
310 FOR X=15360 TO 15423
320 POKE X,191
330 NEXT X
340 GOTO 340
```

Example 3



Different Methods

Now let's take a look at several ways of displaying those graphics in a BASIC program, from the slow and unwieldy to the fast and flexible. For a group of identical graphics, there are three common ways. (See Examples 2, 3 and 4.)

For groups of different graphics characters, programming starts to get just a little unpleasant. Have a look at Examples 5, 6 and 7.

Altogether, we have here five different ways of producing graphics: Examples 2 and 5 use the versatile, but extremely slow, SET and RESET commands. Example 3 POKEs a group of characters into a specific place on the screen; Example 4 prints out a "string of strings."

Example 6 is a fast method of printing a string; it concatenates individual character strings to create one long series of graphics. It is flexible, too, but as you can see from the length of line 610 in this example, it takes a large amount of memory to define all the individual character strings necessary to create the graphic patterns; just CHR$(176), for example, uses nine letters to describe a single pattern.

```
405 CLS
410 CLEAR 64
420 PRINT STRING$ (64,191)
430 GOTO
```

Example 4

```
505 CLS
510 SET(0,0):SET(0,1):SET(0,2)
520 SET(1,0):SET(1,2):SET(2,0)
530 SET(3,1):SET(3,2):SET(4,2)
540 SET(5,2):SET(6,0):SET(6,1)
550 GOTO 550
```

Example 5

```
605 CLS
610 A$=CHR$(183)+CHR$(169)+CHR$(176)+
    CHR$(133)
620 PRINT A$
630 GOTO 630
```

Example 6

```
705 CLS
710 A$="XXXX"
720 B=VARPTR (A$)
730 C=PEEK(B+1)+256*(PEEK(B+2))
740 POKE C,183:POKE C+1,169
750 POKE C+2,176:POKE C+3,133
760 PRINT A$
770 GOTO 770
```

Example 7

Many of you have used these four methods of creating screen graphics. But now, let's take a look at another way, shown in Example 7. If you haven't actually run this program, give it a try now. See that a pattern is produced that is identical to those in the previous two examples. This is no surprise. But now LIST line 710.

```
A$="AUTONAMEDEFCMD"
```

What is this? How did it get there? In fact, this is the subject of another month's Applications, but let's take a brief look at what has happened to the original line 710,

```
A$="XXXX"
```

Four Distinct Commands

Notice, first, that there are four distinct command words buried inside this new line 710: AUTO, NAME, DEF and CMD. At this point there are as many words as there once were X's in this string; does that solve the mystery? In part. Line 730 uses a little-known BASIC command, VARPTR (VARiable PoinTeR), which tells us some important things about variables and strings.

If you were writing BASIC, how would you find a variable in a program? You might have the language do one of two things: hunt through the program until it finds a variable, or refer to a table telling it where that variable is to be found.

Using the first method, who knows how long it will take to find a value located at the end of a program! So Level II BASIC saves information about each variable, and we can find that same information by using VARPTR. Simple? Well, maybe not quite, but PRINT VARPTR (A$) returns with the place in memory that stores the length of A$. The next two consecutive memory locations tell us where A$ itself is stashed.

Look at line 730, which converts two decimal bytes into the full decimal address of A$. Since we now know where A$ is, line 740 can take the four graphics characters we have used in the other examples, and POKE them in A$. The four X's disappear, and the graphics characters take their place when we PRINT A$.

But what about the strange changes in the program listing?

Whenever we LIST, we are asking Level II

BASIC to take a program and translate it for our eyes. From the computer's point of view (does it have one?), there's no use in storing PRINT as P-R-I-N-T; we humans are the only ones who need to read that.

Instead, the TRS-80 stores PRINT as the one-byte value of 179—which happens to be the same value as one of the 64 graphics characters! So when it sees our values of 183, 169, 176, and 133, the LIST routine says, "Aha, yes, a computer command . . . I will find it for this funny human and display instead a pretty word to read."

The result, in line 710, is AUTONAMEDEFCMD. We'll cover this ground in the future; if you want to experiment, try to edit line 710 and see what happens. For now, let's get back to SEESPOT!.

Look at Listing 1, an assembler version of the graphics program. I have to admit some ambivalence about including a completely annotated listing in this column, but some readers have requested that I expand my blocks of hex code for purposes of illustration—so this is an experiment. I look forward to your comments.

SEESPOT! Uses Muscle

In brief, SEESPOT! muscles its way into the normal keyboard scanning process of the TRS-80, but is careful not to destroy any other utilities that may be patched into the same place. If you are a program author, I strongly urge you to consider this technique, because it's especially frustrating for most of us, as average users, to receive a machine language program which effectively cancels out any other programs we are trying to use.

Once it's going, SEESPOT! checks to see if the computer is in command mode during a keyboard scan (recall that shift/up arrow is the escape from the edit mode). If that checks out, it continuously looks at the keyboard until it spots the simultaneous depression of shift and either of the two vertical arrow keys.

If these three conditions are met, it can shift into its own, independent keyboard scan. It loops until it finds any other key depressed, or until the shift/arrow combination is lifted. It identifies the key pressed with address/data conversion routines, and creates a graphics character by tweaking the high bit of the byte. When it's all done, it returns a graphics character to the video display.

SEESPOT! may be entered using a monitor like T-BUG or an editor/assembler. It is easily relocated by changing the origin address in line 100, and takes care of its own housekeeping.

A BASIC listing is also provided. This is set to address 31729, which means you must respond to MEMORY SIZE? with that number. I have taken care to place SEESPOT! low enough that it should not conflict with most other utilities that you may be using. It, too, can be relocated, but you'll have to calculate its location and USR(0) entry points.

Graphics on the Screen

How is SEESPOT! used? Load your SYSTEM tape in place, or run the BASIC version. The BASIC program (Listing 2) may be deleted after it is run. A READY is returned to you,

```
00010          ;       ******************************
00020          ;       *      S E E S P O T !       *
00030          ;       *                            *
00040          ;       *  KEYBOARD GRAPHICS PATCH   *
00050          ;       *                            *
00060          ;       *   DENNIS BATHORY KITSZ     *
00070          ;       *  ROXBURY, VERMONT 05669    *
00080          ;       ******************************
00090          ORG     7C00H           ; CHANGE TO RELOCATE
00100          ;       ******************************
00110          ;       *     SELF-PATCH BLOCK       *
00120          ;       ******************************
00130 START    LD      HL,(4016H)      ; KEYBOARD PATCH POINT
00140          LD      (JUMPER),HL     ; RETURN POINT SETUP
00150          LD      HL,ENTRY        ; GET ENTRY POINT READY
00160          LD      (4016H),HL      ; ENTRY POINT TO PATCH
00170          JP      06CCH           ; RETURN TO BASIC
00180          ;       ******************************
00190          ;       *  COMMAND MODE CHECK BLOCK  *
00200          ;       ******************************
00210          EX      (SP),HL         ; GET RETURN ADDRESS
00220          LD      A,L             ; GET LSB INTO A
00230          CP      5BH             ; CHECK LSB OF 1D5BH
00240          JR      NZ,NOTRDY       ; OUT IF NOT
00250          LD      A,H             ; GET MSB INTO A
00260          CP      1DH             ; CHECK MSB OF 1D5BH
00270 NOTRDY   EX      (SP),HL         ; RETURN STACK ANYWAY
00280          JR      NZ,AWAY         ; BEGONE IF NOT 1D5BH
00290          ;       ******************************
00300          ;       *    ARROW VERIFY BLOCK      *
00310          ;       ******************************
00320 ENTRY    LD      BC,3840H        ; KEYBOARD ROW ADDRESS
00330          LD      A,(BC)          ; GET KEYBOARD DATA
00340          AND     18H             ; CHECK IF UP/DN ARROW
00350          JR      Z,AWAY          ; BEGONE IF NOT
00360          ;       ******************************
00370          ;       *    SHIFT VERIFY BLOCK      *
00380          ;       ******************************
00390          RLC     C               ; GET SHIFT KEY ADDRESS
00400          LD      A,(BC)          ; GET SHIFT KEY DATA
00410          CP      01              ; SEE IF SHIFT PRESSED
00420          JR      NZ,AWAY         ; BEGONE IF NOT
00430          ;       ******************************
00440          ;       *   KEYBOARD EXAMINE BLOCK   *
00450          ;       ******************************
00460          LD      HL,4036H        ; GET KEYBOARD BUFFER
00470          RLC     C               ; GET FIRST KEYBOARD ROW
00480          LD      D,0             ; SET DATA COUNTER
00490 AGAIN    LD      A,(BC)          ; CHECK KEYBOARD DATA
00500          LD      E,A             ; SAVE DATA TO FREE A
00510          AND     E               ; CHECK TO SEE IF ZERO
00520          JR      NZ,FOUND        ; GO IF KEY DEPRESSED
00530          LD      (HL),A          ; CLEAR KEY ROW BUFFER
00540          INC     D               ; INCREMENT DATA COUNT
00550          INC     L               ; INCREMENT BUFFER ADD.
00560          RLC     C               ; GET NEXT KEYBOARD ROW
00570          LD      A,C             ; PUT ROW COUNTER IN A
00580          SUB     40H             ; SUB. FINAL ROW VALUE
00590          JR      NZ,AGAIN        ; GO BACK IF VALID ROW
00600          JR      ENTRY           ; TRY AGAIN IF LAST ROW
00610 FOUND    AND     (HL)            ; CHECK IF SAME KEY
00620          JR      NZ,ENTRY        ; TRY AGAIN IF SAME KEY
00630          LD      (HL),E          ; SAVE VALUE IN BUFFER
00640          ;       ******************************
00650          ;       *      DEBOUNCE BLOCK        *
00660          ;       ******************************
00670          PUSH    BC              ; SAVE BC VALUES
00680          LD      BC,200H         ; LOAD DELAY VALUE
00690          CALL    0060H           ; CALL DELAY SUBROUTINE
00700          POP     BC              ; RESTORE BC VALUES
00710          LD      A,(BC)          ; AGAIN CHECK KEYBOARD
00720          AND     E               ; AND WITH VALUE SAVED
00730          JR      Z,ENTRY         ; RELOOP IF A BOUNCE
00740          ;       ******************************
00750          ;       *KEY ADDRESS CONVERSION BLOCK*
00760          ;       ******************************
00770          LD      A,D             ; GET DATA COUNTER BACK
00780          RLCA                    ; MOVE IT OVER
00790          RLCA                    ; MOVE IT OVER
```

Continue to next page

Continued from page 28

```
00800           RLCA                    ; AND ONE MORE TIME
00810           LD      D,A             ; SAVE PLAYTIME VALUE
00820           ;       ******************************
00830           ;       * KEY DATA CONVERSION BLOCK  *
00840           ;       ******************************
00850           LD      C,1             ; SET UP SECOND COUNTER
00860 NOTYET    LD      A,C             ; VALUE READY FOR PLAY
00870           AND     E               ; CHECK IF A MATCH
00880           JR      NZ,GOTIT        ; YEA, GO IF A MATCH
00890           INC     D               ; INCRMT. SHIFTED DATA
00900           RLC     C               ; READY NEXT MATCH TEST
00910           JR      NOTYET          ; GO BACK AND TRY AGAIN
00920           ;       ******************************
00930           ;       *  GRAPHICS CREATION BLOCK   *
00940           ;       ******************************
00950 GOTIT     LD      A,(3840H)       ; GET ARROW ROW AGAIN
00960           CP      10H             ; SEE IF DOWN ARROW
00970           JR      Z,NOBIT         ; GET GOING IF IT IS
00980           LD      A,90H           ; UP ARROW SHIFT VALUE
00990           JR      THERE           ; SKITTER PAST MATH
01000 NOBIT     LD      A,80H           ; DOWN ARROW SHIFT
01010 THERE     ADD     A,D             ; CREATE FULL GRAPHICS
01020           ;       ******************************
01030           ;       *    JUMP / RETURN BLOCK     *
01040           ;       ******************************
01050           RET                     ; BACK AND DISPLAY IT
01060 AWAY      DEFB    0C3H            ; DEFINES JUMP COMMAND
01070 JUMPER    DEFB    0E3H            ; DEFINES NORMAL LSB
01080           DEFB    003H            ; DEFINES NORMAL MSB
01090           END     START           ; DEFINE ENTRY ADDRESS
01100           ;       ******************************
```

Listing 1.

```
5     POKE 16553,255
10    FOR X = 31744 TO 31859 : READ A : POKE X,A : NEXT X
20    POKE 16526,0 : POKE 16527,124 : M% = USR(0)
30    DATA 42,22,64,34,114,124,33,27,124,34,22,64,195,204,6,227
40    DATA 125,254,91,32,3,124,254,29,227,32,86,1,64,56,10,230
50    DATA 24,40,78,203,1,10,254,1,32,71,33,54,64,203,1,22
60    DATA 0,10,95,163,32,12,119,20,44,203,1,121,214,64,32,241
70    DATA 24,217,166,32,214,115,197,1,0,2,205,96,0,193,10,163
80    DATA 40,201,122,7,7,7,87,14,1,121,163,32,5,20,203,1
90    DATA 24,247,58,64,56,254,16,40,4,62,144,24,2,62,128,130
100   DATA 201,195,227,3
```

Listing 2.

and the TRS-80 operates normally. Now depress the shift, followed by the down arrow. Type some letters . . . aha! Indeed, graphics on the screen! Try shift plus up arrow, and type. You've got similar results, but different characters are produced. Photo 1 shows the letter/number combinations and the respective graphics patterns.

Now, let's create a simple graphics string, in the program. Start a line: 10 A$ = " and use SEESPOT! to type graphics characters in place. Close the quote marks, make line 20 PRINT A$, and RUN. There you are.

Now LIST the program—again, the graphics characters are turned into BASIC command words in the listing. Since the TRS-80 only has 256 different bytes with which to create everything—commands, mathematics, letters, graphics, data to tape, etc.—this shows one of the great economies of computer "innards." Our human languages are rich with letters, numbers, symbols, punctuation, musical notation and electronic characters. The TRS-80 has but 256 choices out of which to build its entire computer vocabulary. With that economy come such curiosities as the "translation" of graphics into command words.

Remember, though, that translation also says "caution"—you may not edit a line containing such a graphics string! Even if you type EDIT 10, ENTER and ENTER again, the string has been completely redefined as you see it printed in the list. Try it and see.

Here's a final suggestion for insanely addicted BASIC programmers: It is possible to use SEESPOT! to write your BASIC command directly into the program, much like Web Associates' TSHORT program. With the two-level shift/arrow method, *every BASIC command* is available to you.

The hitch is this: they'll look like graphics until you LIST the program! Game? (Heh heh). Next month: Curiosities, Glitches, and Secrets.

I would appreciate hearing the experiences of readers who try using SEESPOT!. Address letters to my home address, Roxbury, Vermont 05669. ■

THE ASSEMBLY LINE

From page 24

```
        LD      HL,TABLE    ;LOAD TABLE START
        LD      BC,7        ;LOAD NUMBER OF
                            ;ENTRIES IN TABLE
        LD      DE,15       ;ENTRY SIZE-1
        LD      A,(KEY)     ;SEARCH KEY
LOOP    CPI                 ;SCAN TABLE FOR KEY
        JR      Z,FOUND     ;GO IF FOUND
        ADD     HL,DE       ;POINT TO NEXT
                            ;ENTRY
        JP      PE,LOOP     ;GO IF BC NOT ZERO
```

In the above code, the ADD HL,DE does not affect the P/V flag, which is used to test for an entry count in BC of zero. Also, only the first byte of each entry is tested by the CPI and scanning for a certain state name requires further processing.

Is there a cleaner way, you lazy coders? A common technique is to use a terminator for the table. (No, this is not a hit man from Fort Worth who seeks out TRS-80 compatible equipment suppliers.) This is a unique value that never appears in the table entries themselves. A commonly used value is −1. When a table is set up in this fashion, the next entry after the last entry in the table is set to the terminator value, and each comparison first looks for the terminator before testing the table entry.

This scheme is shown in Listing 5, which initializes the table with a terminator of −1. In a variable-length table it is convenient to fill the entire table first plus one entry with the terminator before dynamic entries; that way a terminator always exists.

How to Use (Expletive Deleted) Tape

Level II ROM, as many of you know, contains a number of interesting stand-alone subroutines. For those of you still using cassette, we'll offer the following subroutine, which reads or writes a cassette record (Listing 6). The calling parameters must be set up in the following registers:

(HL) = Buffer area for read or write
(B) = # of bytes for read or write (0 = 256)
(A) = 0 for cassette drive 1 or 1 for cassette drive 2
(C) = 0 for read or 1 for write

After first starting the cassette and writing 255 bytes of zeros and a sync byte, the subroutine, writes a cassette record of one to 256 bytes. The sync byte synchronizes the timing Level II cassette read routine to the start of the data on the tape. Data to be written on the tape must be in the buffer before the call is made to write.

It is good practice to checksum the data in the buffer by adding all bytes together. This is then written out as the first byte of data; a subsequent read then compares the cassette checksum with a checksum of the data that has been read to verify it.

When using TRSDOS, it is a good idea to disable interrupts by a DI instruction before CALLing this routine. The DI turns off the real-time clock interrupt to prevent inaccuracy by the cassette software timing loop. ■

✓Reader Service—see page 178

CAPTAIN 80

by Bob Liddil

"The Cat became well known for his convention antics, strutting about in Tabby ears and a striped tail."

Here's Captain Eighty, in his Woodfern and Boldword investigative reproter disguise, checking back into the office after an exhaustive look into the sad demise of the Cheshire Cat Software Company.

The Cheshire Cat began almost at the same time as the software industry. One talented programmer began the company by marketing his own creations.

Grew with the Industry

As the fledgling industry grew, so did The Cheshire Cat Software Company, The Cat, became well known for his convention antics, strutting about in Tabby ears and a striped tail, much to the amusement of his followers and rivals alike. He had style and personality, was beloved and trusted by both his customers and his peers.

As time wore on the Cat's advertisements appeared on a grand scale in all the computer magazines. His software line was a cross section from major producers coast to coast. During these early days the Cat's reputation was well deserved. He cared personally for his company and a few mistakes got past him. More importantly, Cheshire Cat made money.

Meanwhile, he acquired production or distribution rights to everything that looked good. He was a consistant winner.

Then it went sour, but where? The culprit seems to have been the omnipresent big bucks business software market. A brilliant west coast CP/M author made a great package available to Cheshire Cat, Inc.—so the story goes—and the potential Kilobuck return required a multi-kilobuck investment. Translating the business package to BASIC and debugging it was a time-consuming, money-draining project that dragged on for months.

Authors Unpaid

Meanwhile, the software companies and authors of programs that made up Cheshire Cat's dependable line went largely unpaid—a situation which might have been tolerable, if it hadn't been for the bouncing checks.

Salesmen, hired to boost the Cat's sagging sales, left almost as soon as they arrived. In despair, programmers and other Cheshire staff departed, as even their paychecks were returned to them unpaid. Quality control spiraled downward to the point where cassette labels and documentation consisted of little more than faded gray photocopies of better times. Tapes that had been very carefully produced in the past, crashed with increasing predictability, leaving dealers and customers frustrated and furious.

Cheshire Cat, Inc., if not the Cat himself, had become an industry joke and an industry paranoia in one stroke. The rumors began to fly. Cheshire was bankrupt, went one story. They were bootlegging everybody's software went another.

For those companies with bad Cheshire Cat checks to deal with, anger was mixed with a touch of sympathy for an old friend somehow gone wrong.

The Captain Takes Some Advice

A lovely and sensitive lady, one that this Captain respects, asked me recently, upon hearing about Cheshire's breakdown, "Why kick the guy, when he's down? Give him a break."

She's right of course. The Cheshire Cat's not a bad sort.

Kick him! No, there's no vendetta here, only the public's right to know the facts.

And the fact is, as of this writing, the Cheshire Cat is on the comeback trail. His business program is debugged, his inhouse programs are still competitive, and though he lost some programs, others are in production. But the talk of bootlegging and shady practices will no doubt persist for a long time.

If there is a lesson in all this, it would seem to be directed toward software producers and would be programmers. There is a tendency to place pedestals under those who are prominent in any field. When elevated to lofty heights even small mistakes can balloon into disasters.

Marketing computer software is a business, a sometimes cruel and demanding business that can swallow up the ill-informed and the unaware. It is not enough to be a good programmer. You must also be a salesman and crack Private Eye.

The Cheshire Cat Software Company has now disappeared from magazine pages. They sell only in-house software, and, though I feel, the Cat will eventually pay everyone who has a claim against him, his business will never be the same. It's sad. He was my friend and I liked him. ■

80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

The major asset of most businesses is inventory. Purchasing inventory is probably the largest single use of cash, regardless of the nature of the product bought and sold.

The speed of its turnover has a major effect on the cash position of the business. A sales slowdown reduces the amount of cash that is available, and faster sales will liberate cash to pay increased expenses that can be expected during these inflationary times.

This is where a computerized inventory management system can be very valuable. By knowing your inventory and its sales history, a businessman can reduce inventory and the subsequent cash outlay by liquidating slow moving stock while increasing his gross by concentrating on those items which move best.

IMS by Radio Shack

Recently Radio Shack introduced an Inventory Management System for the Model II, catalog #26-4502, that represents a significant improvement over the ICS available for the Model I.

It requires a 64K Model II system with one disk drive, and a line printer capable of printing 132 characters per line (such as the Line Printer I, or III). IMS stores 3,000 stock items, and features a rapid review of current inventory status.

The program takes full advantage of the screen capabilities of the Model II. Extensive editing and maintenance options are available with screen formatting, which makes these controls easy to use. The system offers comprehensive ordering and receiving including multiple orders of the same item. It has a rapid and easy-to-use sale-posting-routine. Sales transaction, inventory and ABC code analysis reports are printed.

The system also has provisions for a 200 name vendor file, and a complete vendor listing. To aid in maintaining the inventory, the

Continue to page 32

TRS-80* OWNERS:

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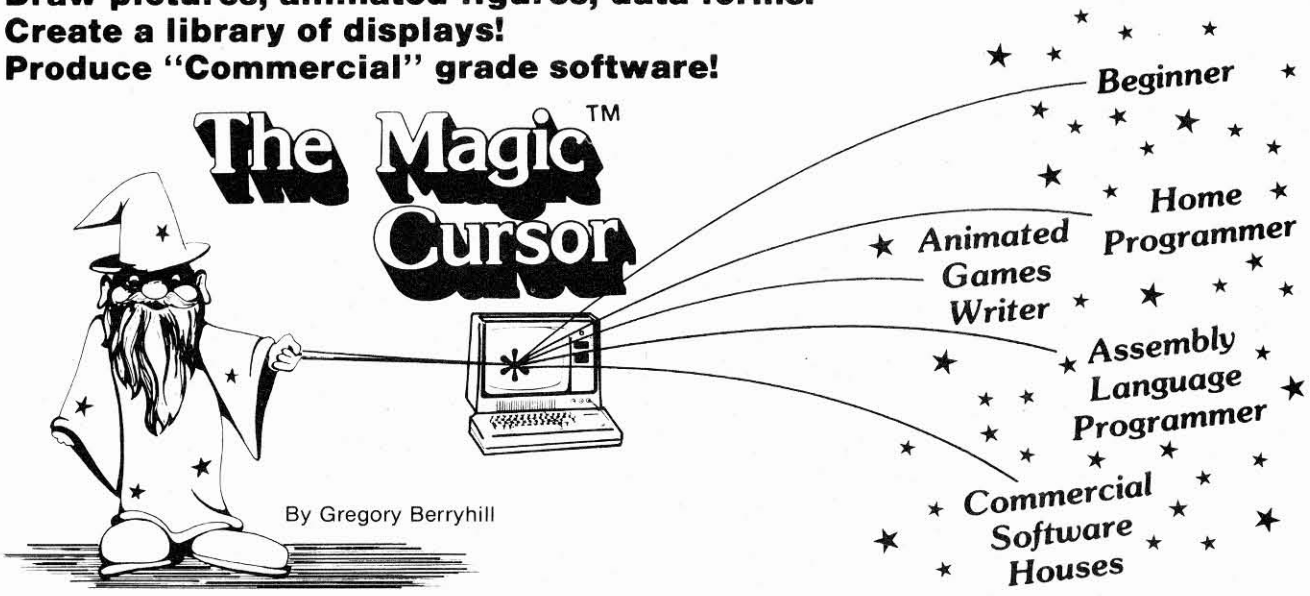

The **Magic Cursor** is a Revolutionary Family of Products which provides a dramatic new method of reproducing drawings and displays that you create on your screen. It makes both simple displays and complex interactive data input forms. It stores a "BASIC PROGRAM" on disk (or tape) ready for you to execute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

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

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By Ty Halderman

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80 ACCOUNTANT

From page 30

system generates physical inventory worksheets and automatic file up-dates.

IMS represents automation of a concept of inventory management that is used by many large corporations. Basically, it ranks sales according to volume. The top 20 percent of items sold in terms of sale dollars are classified as category A, the next 30 percent as B, the next 20 percent as C, the next 20 percent as D and the bottom 10 percent as E.

During the first year, the system requires that you enter an estimate of sales by item as its base. Consequently, if your estimate is off the system reports will be off.

After one year actual sales figures will be used and the reports will be more useful.

The ability to stratify sales by volume is an excellent tool when a stable stock is maintained. If you generally stock the same items, this system will allow you to concentrate your dollars in items which will generate the highest sales volume. Items with the lowest demand will become apparent in the E category very quickly.

Unfortunately, this system does not work well if there is an uneven demand for your product. In these cases another type of inventory control is required. Such IMS features as the inventory location, the profit earned on sales, and other activity reports are still useful.

Changing Price

From an accounting point of view, IMS offers a significant improvement over the ICS system on the Model I. The effects of changing price in the master file are spelled out in the manual. When merchandise is received, the screen displays the current price on file and allows you to change it.

However, the manual cautions you that you have just changed a unit price, and thereafter, all reports will use the new price. If you change the price each time a new item is received, the inventory cost on the IMS system will approximate Last In First Out inventory valuation. However, this system is clearly not intended to be used for accounting inventory valuation.

Perpetual cost and perpetual selling price is calculated based on sales and receiving data. Take warning—the perpetual selling price may not be the actual selling price. IMS does not accommodate selling prices other than the standard price on the master file.

When sales are entered, only the unit sales are entered. IMS prices those sales for you. If the actual sales price is different, it will be necessary to alter the master file price before recording the sale. Only if this is done will the IMS sales figures balance to the sales journal.

Another problem can occur during sales entry. Sales are entered by batch and these can be edited prior to posting. In batch entry control, totals should be used to guarantee the accuracy of the entry process. But there is no edit to insure the stock number entered is valid and the sales entry subroutine does not generate any control totals.

In the event of a data entry error, the update or posting run must be made before the error is identified. If there is no match between the stock number entered and the inventory master file, an error message is indicated on the transaction register, and the entry is ignored. If a greater quantity is entered than is present on the master file, then the entry is also ignored.

If sales transactions are not posted promptly, data entry errors can remain undetected for some time. If you delay the entry of receiving paperwork, obviously, your sales figures will be inaccurate.

Despite problems, the Inventory Management System represents a major stride forward for Radio Shack. With the proper controls installed, it can prove an effective inventory management guide for the small businessman. I hope Radio Shack will follow-up with an IMS designed for a fashion or seasonal business that will utilize some of the super features of this program. ■

80 REMARKS

From page 8

up Exidy and the Sorcerer. Personal Micro Computer, Inc., is the new name of Microsette Co. The plans are to sell the PMC by mail. Obviously, it will take some time to build a dealer and service network, though a start, via the Exidy sales, has been made.

IBM Emerges . . . Slightly

The first approach of IBM to the microcomputer market was to back off and wait. And, too, there were some worries among the top brass about the effect of government regulation should they take over the micro market as they had the larger computer markets. This earlier dominance was bringing enough heat.

Not much happened until Tandy (Radio Shack), a firm with a good marketing plan, got into the field. Tandy's first year of production was sold out in a couple of weeks and they have been playing "catch up" ever since.

Tandy down-played their success, not wanting IBM and other big firms to know what was happening. They issued very modest statements on production. But the corporate balance sheet told the story for anyone used to reading those things. Despite a disaster in CB and a serious downturn in hi-fi sales, Tandy reported record sales that had to be coming from somewhere. IBM began to move.

Every now and then rumors in the trade press reported that IBM was entering the microcomputer market. Word leaked out that they would be showing their personal computer system at an upcoming show, but somehow the expected system never materialized.

I flew to Germany in mid-April and drove to Hanover, in the North Central part of the country. Here they hold a week-long fair every year where nearly every product made or sold in Germany is on display. There are 23 buildings on the fair grounds, and the attendance is usually well over 500,000 people. Many of the firms exhibiting have permanent exhibits and pay $75,000 or more a year for them—all for that one week show every April.

I had my first good look at the new IBM Personal Computer. Full color. I took some pictures just to prove that there was such a beast. I'll try to get more data on the unit for you.

The IBM looks first rate. The color is good and it has its own monitor. But will IBM muff it?

The recent articles about Texas Instruments, for example, and the TI-99/4 seem unanimous in dismissing them as a serious contender in the micro computer market. *Fortune Magazine* has run several articles on the subject and I don't know of anyone in the industry who disagrees with the evaluation made by *Fortune*. Texas Instruments is proof that even the biggest of them can make horrendous mistakes. ■

From that hint at Hanover, I traced the TRZ to an office in Amstelveen, Netherlands. It was now being called the Video Genie System, definitely a Hong Kong type of name. No matter, it looked like it might have great possibilities in the right hands.

After looking for over half-a-year, I finally found the mythical Hong Kong TRZ-80! Here it was at an industrial fair in Hanover, Germany.

Fine Tools For Skilled Programmers

Three Utility Packages For Your TRS-80*

Disk Editor

Disk Editor is a powerful machine-language utility program that will allow you total access to ANY byte of information in ANY sector in ANY track of your diskettes. It is a fast, simple, and efficient method of modifying files, whether BASIC program, system programs, or just data. All commands are readily accessible, with no need to refer to a command table.

With Disk Editor you can examine, alter, add, and delete information with ease. Information can be retrieved from the disk by supplying track and sector information, or by giving the filespec. You can even search the disk for a specific string of characters (up to 8 characters long).

If you need hardcopy, use the LINEPRINT command to send a copy of the video display to your lineprinter.

You can transfer command from Disk Editor to Radio Shack's DEBUG and back, allowing dynamic debugging of disk I/O procedures.

Disk Editor is compatible with TRS-DOS 2.1, 2.2, and 2.3, as well as with Apparat's NEWDOS. It is even capable of reading disks made by Percom's Micro-DOS.

There are two versions of Disk Editor; one is for a 35 track DOS, and the other is for a 40 track DOS. Both are included in this package.

This package requires the following minimum system:

1. A TRS-80 Level II with 16K RAM.
2. An Expansion Interface.
3. A single Disk Drive.
4. Any compatible Disk Operating System. (Disk Editor is not compatible with VTOS 3.0.)

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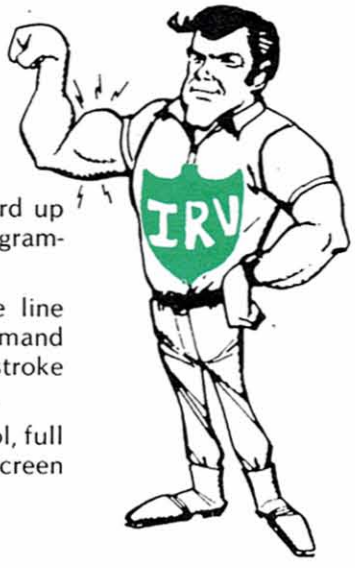

Input shorthand: programmable keyboard up to 255 characters per key plus a pre-programmed command set.

Relocate lines by simply changing the line number. Merge lines and relocate command blocks in the listing with simple one keystroke routine plus the Level II EDIT command.

Video screen editor has full cursor control, full power over anything that appears on the screen including line listings and graphics.

On cassette (DOS compatible).

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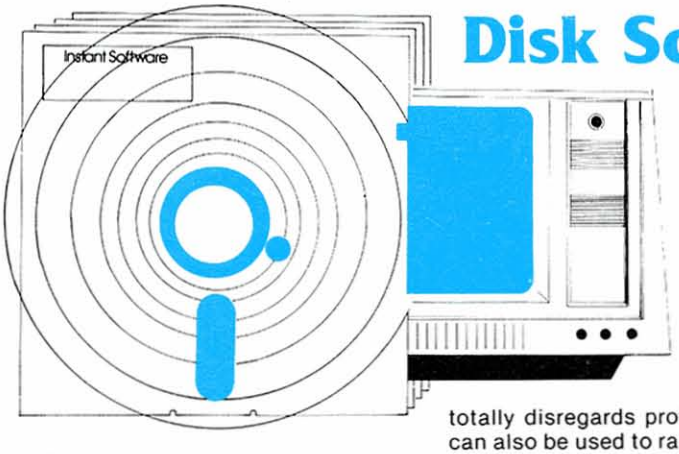
Disk Scope



- **Fileloc**
- **CDisk**
- **Password**

Need to check out a disk? Perhaps you want to see how the files are stored, or you forgot your password. No problem! You've got Disk Scope.

If you know the name of the file, the **Fileloc** program will show you what tracks and sectors on the disk contain that file, as well as how much memory the file takes when loaded into RAM. This works for both program and data files. **Fileloc** then allows you to print the information, restart the program or exit to BASIC. The information obtained allows you to use the **Cdisk**program effectively.

Cdisk is a powerful little BASIC utility and test program. It will allow you to view any track and sector on your disks in ASCII, Hex and screen POKEs. It totally disregards protection codes. It can also be used to randomly check all 350 sectors of your disk for read errors.

You don't know the whole file name if you haven't got the password, so the **Password** program has been included in the Disk Scope package. This machine-language utility not only gives you a password for files, but for whole disks as well.

Whether you're a novice or a pro, if you use a disk system, you need Disk Scope.

This package requires the following minimum system:

1. A TRS-80 Level II with 16K RAM.
2. An Expansion Interface.
3. A single disk-drive.
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Night Flight

May, 1941—The dreaded Nazi battleship, the Bismarck, has broken out of the North Sea and is now somewhere in the North Atlantic. Your mission is to make a nighttime photo reconnaissance flight over the Bismarck. These photos will help the Admiralty determine the extent of damage done to the Bismarck in a previous battle and whether the British fleet has a chance to sink the German pocket battleship.

The Night Flight program lets you take-off, fly, and land a propeller driven aircraft. You can practice approaches and landings with a full on-screen display of the landing field. Or, you can go on a mission, follow the radar vectors to your target, and get your photo (hopefully returning safely to your airbase without being shot down).

This program simulates the flight characteristics of a real aircraft with pilot input for all flight maneuvers. During the flight, you are supplied with a real-time stream of flight information, navigational aids, glide-slope markers, and landing field information. The instructions with this program can practically teach you to fly.

Somewhere out on the cold, gray North Atlantic, the Bismarck tries to elude her persuers. Your photos are vital. Launch yourself into the night sky with the Night Flight package.

Order No.0117R. $9.95

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Flight Path

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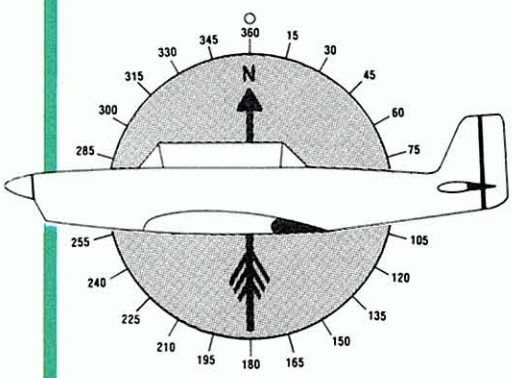

The Flight Path package will let you experience all facets of modern day aviation.

Mountain Pilot transforms you into a daring bush pilot as you fly badly needed supplies to a remote gold mining camp. You'll have to cross a hazardous mountain range, while struggling with headwinds, tricky navigation and rapidly diminishing fuel.

Watch your airspeed, altitude and rate-of-climb or you could stall-out and crash. If you deliver your supplies, you can't relax; you must return over those mountains with a heavy cargo of gold bullion.

O'Hare is a control tower simulation where you become an Air Traffic Controller. The lives of hundreds of people become your responsibility as you guide aircraft through your control sector to a safe landing.

You'll have to deal with different aircraft requirements, wind change warnings and potential midair collisions. But no matter what happens, you must bring in twenty aircraft safely on your tour of duty.

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Order No.0171R. $9.95.

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).

For a free catalog listing over 200 programs write: Instant Software Catalog Dept.,Peterborough,N.H. 03458.

*A trademark of Tandy Corporation

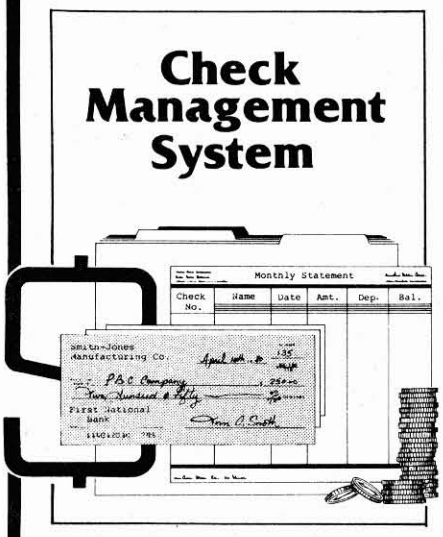
Instant Software™

Prices subject to change without notice.

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

Instant Software™ New Releases

FOR THE PRUDENT BUSINESSPERSON



CHECK MANAGEMENT SYSTEM

The Check Management System was created to provide you, the small business owner or individual, with a system for writing checks and maintaining records.

This program allows you to make check entries, edit or correct the entries, print the checks, and search and display check records by check number, code, date, description, or amount.

You'll be able to maintain a complete record of all your checks on disk for fast, easy access. You can record all your checks as you write them, have them automatically printed on fan-folded, pin/tractor feed check forms, and locate any specific check within one minute.

The program will do all the arithmetic for you, maintain a constant running balance, and, if you make a mistake, allow you to correct your records without having to go through all the checks.

A Code command and Search routine allows you to print a list of all checks written for specific expenses. This is a great aid when tax time comes around.

The program can print check reports with your name or your business's name and account number at the top of each report.

This package requires the following minimum system:

1. A TRS-80 with 16K of memory.
2. An Expansion Interface with 16K of memory.
3. Two minidisk drives.
4. Any compatible Disk Operating System.
5. A pin/tractor-feed line printer.

Order No. 0147RD (disk-based version) $39.95.

THE ONE-D MAILING LIST

Here is a one-disk mailing list system, with fast storage and retrieval for names and addresses. You have up to 17 categories of selection. Disk versatility allows you to add, delete, or change the numerous details stored in the system.

MAILING LIST FEATURES

- Automatically sorts names (alphabetically and by ZIP code).
- Rapid access to any name on file.
- Easy error correction and recovery.
- Prints selective name listings.
- Revise or up-date listings at any time.
- Up to 2500 names on-line (with 4 drives).
- Up to 17 mailing list categories.
- Prints a list of all names on file.
- Prints mailing labels.

The ONE-D MAILING LIST package is designed to be used with the following minimum system:

1. A TRS-80 Level II Microcomputer with 16K memory
2. An Expansion Interface with up to 32K RAM
3. A single disk-drive (with option for up to three additional disk-drives for extra storage space)
4. A line printer
5. Any compatible DOS for the TRS-80

Order No. 0123RD $24.95

FOR THE INTELLECTUAL CHALLENGE

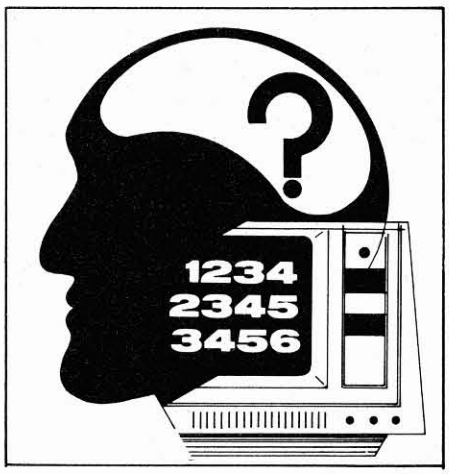
MIND WARP

Are you a problem solver? Do you enjoy narrowing down possibilities until you've reached a solution? Then the Mind Warp package is what you've been lusting for!

This two-part package includes:

- **Mind Twist**—A mastermind-type game but with a "twist." Try to guess the computer's secret digit sequence. The computer will score your guesses.
- **Mind Bender**—A multi-level game where you must ferret out the computer's secret code. You have a choice of deciphering a three, four, or five digit code.

It's no enigma, the Mind Warp package is for puzzle lovers everywhere. For the TRS-80 Level II 16K. **Order No. 0118R $9.95.**



I Q TEST

Ever wonder what your I Q is? Well here is the chance to find out, in the privacy of your own home, and have fun doing it. With the I Q Test program, your TRS-80 will administer and score an intelligence test in a mere 30 minutes.

For variety, there are three equivalent tests, each consisting of 35 questions. These questions are designed to test your knowledge and problem solving abilities.

There are not too many of us who can justifiably claim to be a genius, but here is a chance for you to find out! For the TRS-80 Level II 16K. **Order No. 0157R $9.95.**

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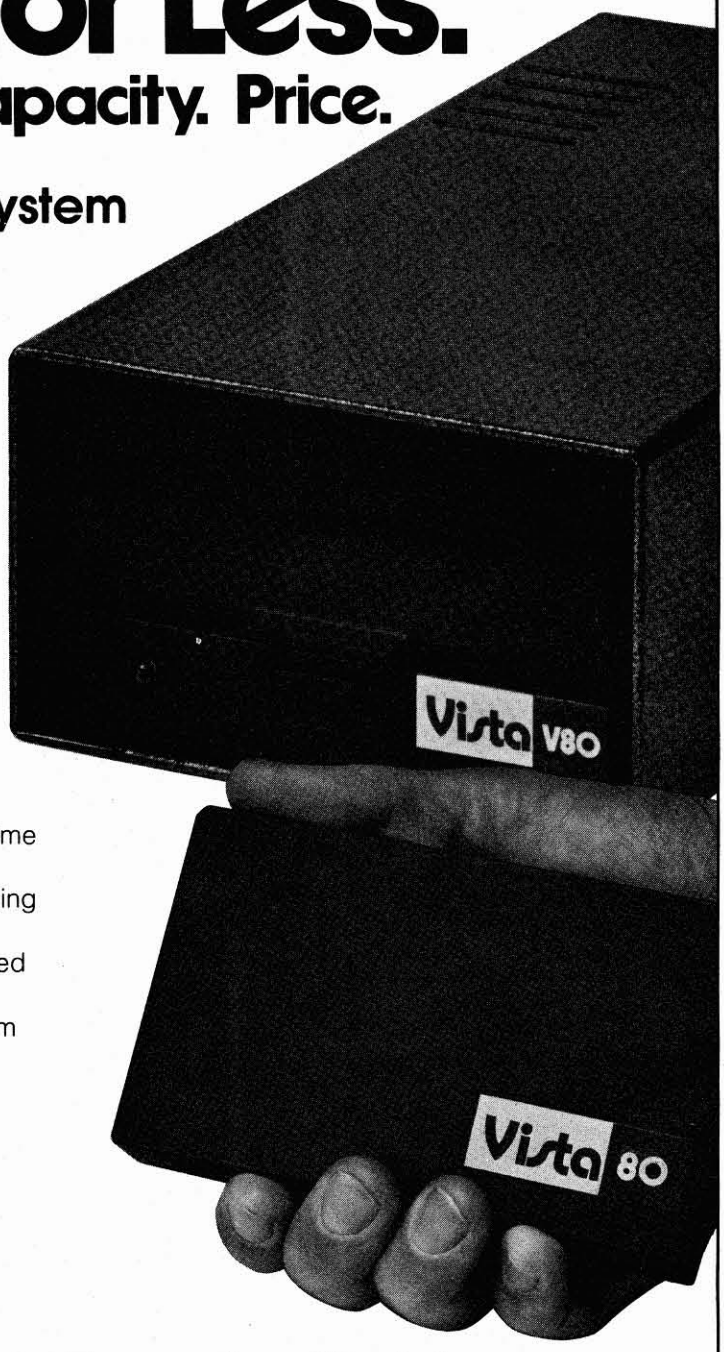
✓2

✓Reader Service—see page 178

More for Less.

Speed. Capacity. Price.



The Vista V-80 mini disk system is 8 times faster than the TRS-80, 23% more storage capacity, and costs only $395.

Compare our performance to Radio Shack's TRS-80*. Then match our price with theirs. Then decide which one is for you.

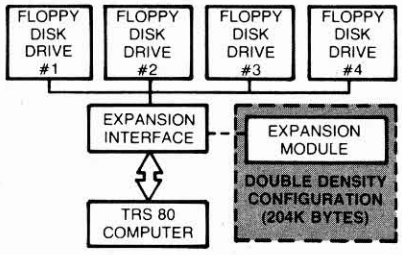
Features

- Vista offers 102K bytes to Radio Shack's 89K. That's 13K more bytes per drive for Vista.
- The V-80 operates at 12ms versus 40ms for TRS-80. Our drive can operate at 5ms, but only 50% of TRS-80 will operate at that speed; therefore, Vista has purposely set the access time at 12ms.
- Totally compatible with all available disk operating systems.
- Upgraded system. Increased storage and speed patch supplied at no charge by Vista.
- Drives are interchangeable for any location from Drive 0—thru Drive 3.
- Immediate Delivery.
- **120 Day Warranty**

Prices:
Single Drive System $395
Two Drive System $770
Four Drive System $1450

*TRS-80 is a registered trademark of Radio Shack, a Tandy Company

TYPICAL CONFIGURATION



Single Density Configuration (102K Bytes)

Vista Expansion Module

The expansion Module provides a double density modification to your current Radio Shack interface that allows you to format diskettes in either single or double density. In double density format, your Vista Drive increases your storage capacity up to 204K bytes on a single 40-track drive.

To insure the highest performance possible, without compromise, we recommend that you use Vista disk drives in conjunction with our Expansion Module.* For a demonstration on your system call **TOLL-FREE 800-854-8017**

Price $239.00 (includes all hardware and software)

**Vista cannot guarantee Radio Shack drives to operate 100% in double density.*

Vista

The Vista Computer Company 1401 Borchard Street • Santa Ana, California 92705 • 714/953-0523

Bigger Is Better.

Expandable storage. Greater Versatility.

The Vista Model II* Disk Expansion System provides one, two or three drives, and adds up to 1.5 million bytes of storage.

You say you want more disk storage, more programming versatility . . . at a reasonable price. Say no more. Our Vista Model II Disk Expansion System may be just the answer for you. Choose from 1, 2 or 3 drives, already mounted. Each additional disk drive will add about 1.5 million bytes of on-line storage to your system. Buy only what you need now. As your needs grow, you can continue to expand your capacity by adding another drive. It's that simple.

But the best part we've saved for last. The price. It's cheaper than Radio Shack, yet our Model II will do everything Radio Shack's expansion system can do. The only difference is our Model II will keep on working long after most others have stopped. That's why we are justifiably proud of our product's high reliability. And our **120-day warranty**. Actually, it's not hard to stand behind a product — that works — if you know what we mean.

*Model II is a registered trademark of Radio Shack, a Tandy Corporation.

COMPARE OUR INTRODUCTORY LOW PRICES

1-drive Expansion System	$1,000	3-drive Expansion System	$2,100
2-drive Expansion System	$1,550	Additional Drives Only	$ 525

NO WAITING • IMMEDIATE DELIVERY.

NAME _____
ADDRESS _____
CITY _____ STATE ___ ZIP _____
TELEPHONE ( ) _____
OPTIONAL
COMPANY AFFILIATION _____
TITLE _____
INTENDED APPLICATION _____

PLEASE ☑ ONE:
☐ CHECK OR MONEY ORDER ☐ CREDIT CARD ☐ C.O.D.
PLEASE CHARGE MY CREDIT CARD: _____
☐ MASTER CHARGE ☐ BANK AMERICARD VISA
CARD NO. _____
EXPIRATION DATE _____
PRINT EXACT NAME OF CARD HOLDER _____
SIGNATURE _____

Item	Quantity	Price

Subtotal _____
Calif. Res. add 6% sales tax _____
Per-Unit Shipping and Handling _____
($5.00 UPS - $7.50 UPS Blue) _____
Total _____

Vista

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✓Reader Service —see page 178

80 NEWS

by Nancy Robertson

"The TRS-80 co-stars helping the world famous Good Guy in his fight against Evil."

Centronics Price Hikes

Centronics Data Computer Corp., Hudson, NH recently raised prices on most of their printers, parts and services.

Centronics printers which are compatible with the TRS-80 are the 730 and 737 models. Prices of these models were increased by six percent, bringing the suggested retail price of the 730 to $795 and the 737 to $995.

Parts for the 730 and 737 models were raised eight percent in price. Service, other than carry-in, was raised 10 percent. Carry-in service rates have not changed. ■

Mailgrams Can be Transmitted by TRS-80s

The TRS-80 Level II can now be used to send Mailgram messages. Mailgrams are an existing service offered jointly by Western Union Electronic Mail, Inc. (MUEMI) and the U.S. Post Office. Initiated electronically, the hard copy is delivered anywhere in the 50 states with the next business day's mail.

The advantages of Mailgrams have been considered to be their speed, compared to regular mail delivery, and their cost, compared to telegram rates.

Tandy Corp. has developed a Mailgram package and negotiated with WUEMI to arrange access to Mailgram services for TRS-80 users via a toll free telephone connection. Message storage of text, mailing lists, etc., is also available.

Accounts must be established with WUEMI if you wish to use the service. Rate sheets and service agreements for accounts are included with Radio Shack's Mailgram package. Account customers will have lower rates than the general public.

If the WUEMI account is not approved, the Radio Shack package may be returned for a full refund. The request must be made within 60 days of the purchase.

The minimum system required for the Mailgram package and service is a 16K Level II with an expansion interface, RS-232-C serial interface board and Telephone Interface II. ■

NJ Personal Computer Show and Fleamarket 80

The New Jersey Personal Computer Show and Fleamarket will be held Saturday and Sunday, Sept. 27 and 28, at the Holiday Inn (North) Convention Center, Newark International Airport.

The show is designed with residents of New Jersey, Connecticut and New York state in mind. It is being promoted as a show for hobbyists and small businesses.

Besides the traditional indoor sales area, there will be an outdoor fleamarket.

Indoor or fleamarket exhibition/sales space may be reserved on a first come first serve basis. Indoor booth space costs $180, including table, chairs and electric current. Fleamarket space cost $7 per day.

Contact Kengore Corp., 9 James Ave., Kendall Park, NJ 08824 for further details. ■

Help the Staff

Help stave off the visual impairment of the *80* staff. A recent study conducted by the editors links the rise in myopia among *80* employees with the influx of single-spaced verbiage.

Help the fight against myopia—send your material to *80* DOUBLE-SPACED. Or give to *80* Fund for Bifocals.

Thank you.

TRS-80 and Superman comic book

TRS-80 Guards Metropolis

Superman has inhaled poisonous kryptonite crystals and his super human powers are fading.

How will he save Metropolis from the evil designs of Major Disaster? How will he rescue the crashing jetliner, turn the flood waters back to their basin and contain the nuclear accident at the Metropolis power plant?

This is a case for . . . TRS-80.

Radio Shack and the creators of Superman, D. C. Comics, Inc., have teamed up to produce a Superman comic book, "The Computers that Saved Metropolis." The TRS-80 co-stars, helping the world famous Good Guy in his fight against Evil.

Radio Shack considers the comic a teaching aid. It is available free from them at Advertising Dept. CC-1, 1300 One Tandy Center, Fort Worth, TX 76102. ■

Microsette Becomes Personal Micro Computers

Microsette Co. has changed its name to Personal Micro Computers, Inc., to reflect its expanded product line. The company will be offering peripheral products as well as continuing to produce Microsette blank cassettes and Microsette program duplication services.

New products from the company include Fastload, Joy-80, ROM Extender and Pro-80.

Fastload is an interface between the CTR-41 recorder and the TRS-80 parallel port which loads standard tapes 16 times faster than the usual baud rate.

Joy-80 is an analog-to-digital converter which may be used as a joy-stick for games or an input device for light level sensing, voice input and sound sensing, etc.

ROM Extender plugs into the TRS-80 to decode and access unused 2K space in the memory map. It is possible to gain up to 2014 bytes for common machine language programs.

Pro-80 is a prototyping printed circuit board with a 40-pin connector for assembling

peripheral circuits, such as those which are printed in computer magazines.

All of these products are add-on peripherals for the TRS-80 Model I, Level II. For further information write Personal Micro Computers, Inc., 475 Ellis St., Mountain View, CA 94043.

Reader Service ✓ 160

Lowercase and Symbols Generator

CG-16, a lowercase and graphic symbols generator for the TRS-80, is available from G. P. Ass., P.O. Box 22822, Sacramento, CA 95822.

It provides video display of lowercase letters with descenders for word processing, electronic symbols, game symbols and, for video graphing or graphics, thin line graphics and half-tone characters.

CG-16 is compatible to all disk operating systems, Level II and Disk BASIC with modifications. It comes fully assembled and with installation instructions, however, installation requires soldering jumpers and cutting traces on the circuit board.

The same video memory chip required for the electric pencil is needed for CG-16. It can be ordered separately for $18.50. CG-16 costs $94.50.

Reader Service ✓ 179

TRS-80 Playing in the Band with The Music Box

The Music Box is a hardware/software tool that plugs into the TRS-80 keyboard (or the expansion interface extension bus) to produce music and sound effects.

With the box attached, you can play up to four notes simultaneously within a seven octave range. The sound can simulate up to four different instruments at a time. Sound effects, such as explosions, gun shots and phasors, are also possible.

The Music Box includes a volume control, a 400 mW power amp and a phono jack for connection to external speakers.

Software is supplied on Level II cassette. The minimum hardware required is 32K Level II.

The Music Box is sold for $252 from Newtech Computer Systems, Inc., 230 Clinton St., Brooklyn, NY 11201.

Reader Service ✓ 169

Summer Computer Camp

Rancho OSO Computer Camp will open this summer in the mountains above Santa Barbara. With a ratio of one computer per two campers, the camp will be open to youngsters ages 10 to 15.

Computer topics will include programming in BASIC, games and educational films. More advanced campers will work with floppy disks, color graphics, computer generated speech and music, robots and COBOL, APL, RPG and Pascal programming languages.

Activities will be balanced with traditional summer camp activities such as horseback riding, tennis, swimming and hiking.

There will be five two-week sessions beginning June 22, July 6, July 20, Aug. 4 and Aug. 17. The cost per session is $795. Contact Computer Camp, Inc., 1235 Coast Village Rd., Suite G, Santa Barbara, CA 93108 for further information.

Reader Service ✓ 180

Model II Editor Assembler

EDAS 4.0 has been released by Galactic Software, Ltd. It is a RAM-resident text editor and assembler for the TRS-80 Model II running under TRSDOS. The editor provides text editing facilities for the modification of alphanumeric text files. Command syntax is identical to the Model II's Disk BASIC editor. EDAS is capable of text block move, global change, string search and line scroll.

The assembler portion facilitates the translation of Z-80 symbolic language (ZILOG mnemonics) source code programs into machine code. Assembler switches provide the user with options to suppress source and symbol table listings, suppress object code generation, and to output the assembled code directly to memory or disk, among other things.

All TRSDOS commands can be executed from within EDAS. This feature gives you the capability of displaying directories, listing files, setting FORMS, or entering other commands within EDAS. Interfacing to DEBUG has been provided to enable a direct approach to debugging user generated code.

EDAS is available with the instruction manual for $229.00 from Galactic Software, Ltd., 11520 N. Port Washington Rd., Meguon, WI 53092. *Commands & Parameters*, an additional manual, is available for $29.00.

Reader Service ✓ 161.

Taped-based Word Processor

G. B. Ass., P.O. Box 3322, Granada Hills, CA 91344, is selling a cassette-based word processor for the Level II with 16K or more memory. The word processor is compatible with RS's Line Printer II and Centronics 730 Printer.

The program includes entry from keyboard or cassette, line edit, scroll, save to tape and line print. The user may select right-justified margins, line length to 80 characters, upper/lowercase, expanded characters, adjustable margins and text centering.

It is priced at $19.95.

Reader Service ✓ 162

Direct-connect Modem

Emtrol Systems, Inc., 1262 Loop Rd., Lancaster, PA has a direct-connect phone modem which eliminates the need for a separate expansion interface, an interface board and a tele-

The Music Box

Lynx direct-connect modem

phone coupler.

The Lynx has the ability to transmit and receive. The instruction manual describes time-share access methods such as The Source, CBBS, Forum-80 and TRS-80 to TRS-80 links.

Including a terminal cassette program, the instruction manual and power pack, the Lynx modem costs $239.95.

Minimum hardware requirements are Level I or II 4K RAM.

Reader Service ↙ 174

MMSFORTH Data Management

The Datahandler is an interactive data base management utility, running in MMSFORTH on a Model I with 32K RAM or more and disk drive. Datahandler runs in conjunction with the MMSFORTH system disk.

The package is suited to single disk drive use because the program area is software write-protected, while the data file is left open. The disk may be removed once its program is loaded to be replaced by a data disk.

The manufacturer claims that typical multiple-field sorts on 100-record files take five seconds, while look-ups take less than one second.

Datahandler with manuals costs $62.90 by mail order. The MMSFORTH system disk costs $79.95. They are available from Miller Microcomputer Services, 61 Lake Shore Rd., Natick, MA 01760.

Reader Service ↙ 167

Accessing ROM by the Book

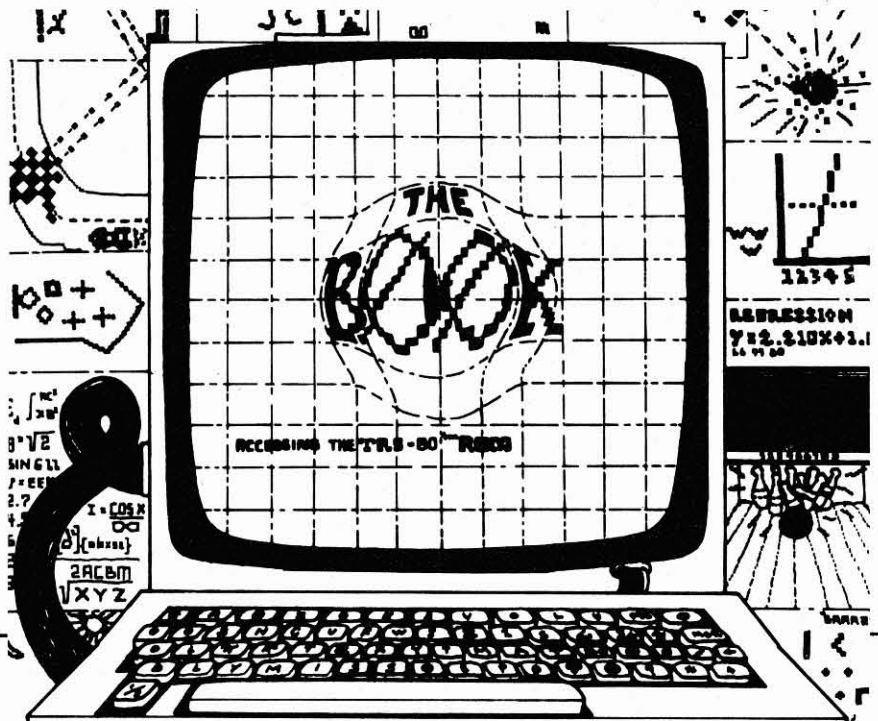
The Book: Accessing the TRS-80 ROM, Vol. 1 is the first of three volumes on machine and assembly language access to the Level II BASIC ROM.

This volume details the mathematic subroutines and data formats, including all logarithmic, trigonometric and arithmetic operations. A fully commented listing of the routines and a complete memory map, which describes the 500 plus memory locations, are included.

Volume One is available at local computer stores or from Insiders Software Consultants, P.O. Box 2441, Springfield, VA 22152 for $15.45 including postage.

Reader Service ↙ 170

The Book



Mail Label Package

Labelmaker, which has the ability to code each record and selectively printout labels by a user assigned code, is available from The Peripheral People, P.O. Box 524, Mercer Island, WA 98040.

The program offers rapid entry and error correction. Names can be sorted in memory alphanumerically or by zip code in less than 10 seconds. Printout is in tabular form on label stock. There is a provision for a test run for label alignment.

System requirements are at least one disk drive and a minimum memory of 32K. The package costs $99.50. The company offers a full refund if the product does not perform as promised.

Reader Service ↙ 166

UCSD Pascal for Model II

PCD Systems, Inc. is releasing UCSD Pascal for the TRS-80 Model II. The standard package includes an interactive operating system with run time support routines, a P-code interpreter, a compiler, a screen editor, a character-oriented editor, a Z-80 macro assembler, a linking loader and a patch/dump utility program.

The package also offers the ability to read and write single- or double-density diskettes in most standard formats, a diskette formatting program, a program to configure serial I/O ports and a module which can copy screen data directly into a Pascal memory array.

The operating system requires the 64K Model II, and may be purchased from PCD Systems, Inc., P.O. Box 143, Penn Yan, NY 14527.

With documentation including the *UCSD Pascal User's Manual*, Jensen and Wirth's *Pascal User Manual and Report*, and Ken Bowles' *Beginner's Guide for the UCSD Pascal System*, it costs $350. Without manuals or texts, it costs $300.

A turn-key package which includes P-code interpreter and BASIC I/O system alone is $85.

For an additional $50 each, a TRSDOS-to-Pascal file conversion, a CP/M-to-Pascal file conversion and a Z-80 disassembler/dump program are also available.

Reader Service ↙ 177

Mod II Text Editor Is a Word Processor

Text Editor for the Model II is available from Computer Bugs, P.O. Box 789, Boynton Beach, FL. The word processing system requires a 64K system with one disk drive and costs $39.00. It contains all the features of their Model I Text Editor that was announced earlier for $29.00.

Features include upper and lower case, the ability to move, copy or delete a line or paragraph, inserting or replacing lines, finding or changing a word or phrase, and merging multiple lines or paragraphs.

Print control commands may be optionally inserted into the document to control the formatting as it is being printed. Thus, several different formats may exist within a single document such as a right justification, varying line length and indentations, single or double spacing, varying page lengths, and printing and centering of double sized characters.

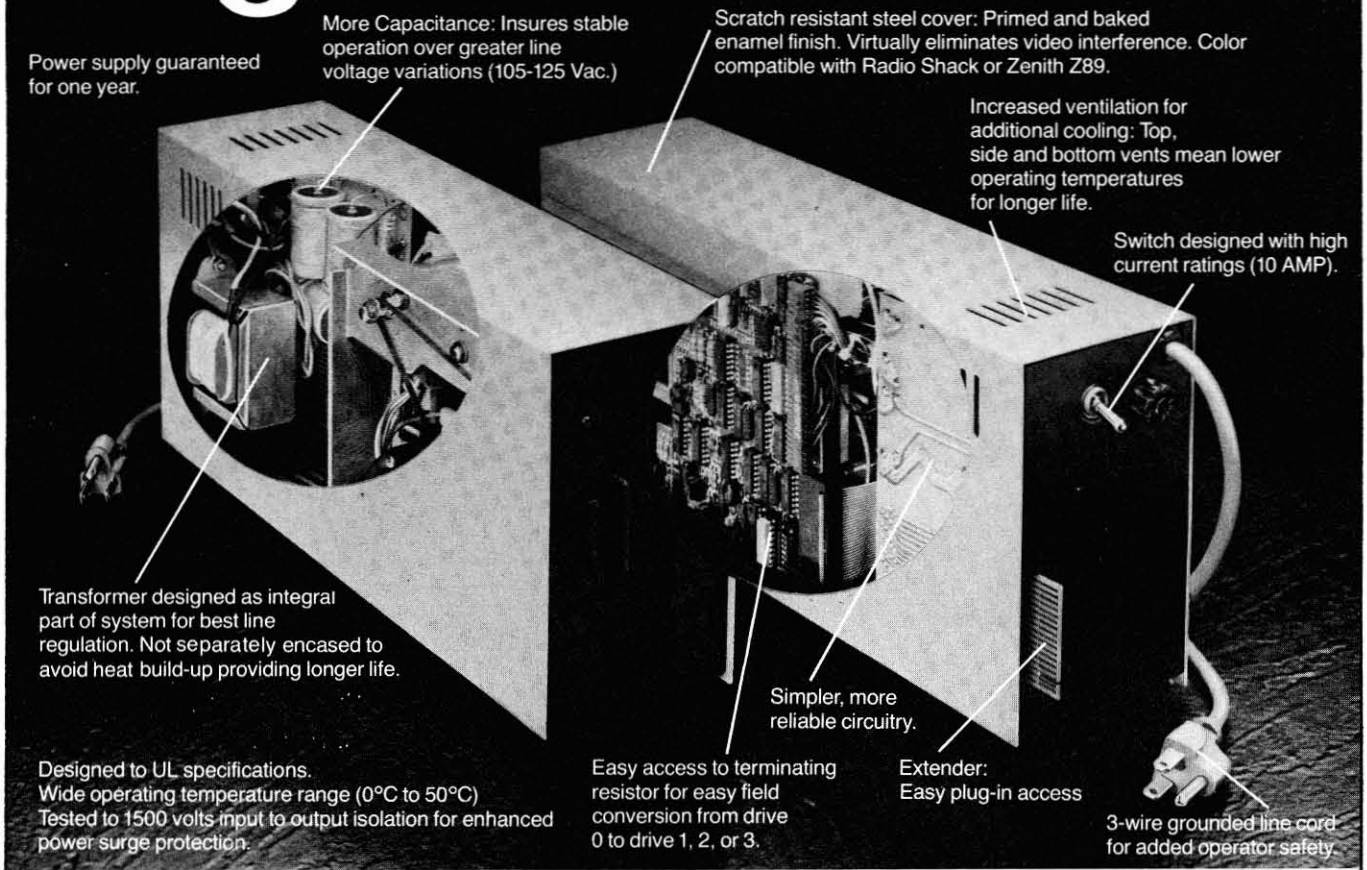
Reader Service ↙ 172.

Model II Cartridge Disks

Cameo Data Systems is shipping a TRS-80 Model II Adapter for the Cameo DC-500 Cartridge Disk Controller. The new DC-504 Model II Adapter allows attachment of up to four 2½-20 M-byte cartridge drives, adding a very large database capability to the TRS-80.

Cameo believes the benefits of cartridge disks are especially important in business applications. Removable cartridges facilitate multi-generation backup, which are needed to recover from program or operating errors, and can

Precision Engineered Drives...



With the number of disk drives on the market increasing, more and more people are beginning to ask what's underneath that cover.

The CCI™ series of disk drives have been designed for long life and ease of operation. The features shown above are what set our CCI drives apart from the rest. With a CCI drive you get an integrated professional design!

If you're still not convinced that you get the most for your money with a CCI drive, just ask for our complete specifications sheet. Then, compare our disk drives to anyone else's.

5¼" DRIVES

CCI-100 40 Track (102K Bytes) for TRS-80* Model I	**$399.00**
CCI-189 40 Track (102K Bytes) for Zenith Z89	**$499.00**
CCI-200 77 Track (197K Bytes) for TRS-80* Model I	**$675.00**

8" DRIVES

CCI-800 77 Track (1/2 Meg Bytes) for TRS-80* Model II	**$895.00**

All CCI drives are also available for 220 Vac (50Hz) operation.

Operating Systems

NEWDOS Plus for 5¼", 40 and 77 Track Drives—with over 200 modifications and corrections to TRSDOS	**$110.00**
CP/M for Model I, Zenith	**$150.00**
CP/M for Model II, Altos	**$199.00**

Software by S&M Systems

INSEQ-80™—Indexed Sequential Access Method (**ISAM**) for the TRS-80 Model I.

Four machine language programs that can be called from your BASIC program via USR functions to access records either sequentially or randomly. The INSEQ-80 programs maintain all indexes and chains for you. Includes reorganization utility to consolidate files. **$49.95**

Professional Business Software using INSEQ-80 for the TRS-80* Model I and Zenith Z89.

Accounts Payable, Accounts Receivable, General Ledger, Payroll	per package **$99.00**
Inventory	per package **$125.00**

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For detailed technical information, call 617/242-3350.
Freight Collect, F.O.B. Charlestown.
*TRS-80 is a trademark of the Tandy Corporation

Products also available from: Radio Shack, NEC, Centronics, Paper Tiger, TI, Altos, MPI, Zenith, ATARI, Mattel, PET, OKIDATA, Apple, Eaton/LRC.

FRANCHISE AND DEALER (NATIONAL/INTERNATIONAL) INQUIRIES INVITED ✓215

Retail Stores: MA: Burlington, Charlestown, Framingham, Hanover **NH:** Manchester **RI:** Providence

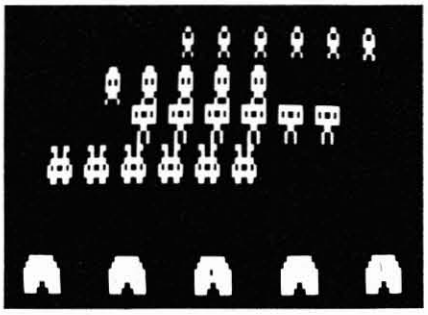
master charge THE INTERBANK CARD VISA

be used for archival storage as well. The utility of the microcomputer is also extended by the ability to simply exchange databases from one set of applications to another.

Cameo Data System, Inc., 1928 S. Anaheim Blvd., Anaheim, CA 92805, is selling the DC-500 Controller, DC-504 Adapter, and all cables together for $1500.

Reader Service ✓ 173.

Two Graphic Games



Alien Invasion

Software Innovations has released two TRS-80 Level II 16K games. Cosmic Intruders is a machine-language space game with sound effects. It is a real time game in which the player must destroy alien space creatures in his gun sight.

The program retails for $9.95.

Alien Invasion is the latest TRS-80 version of Space Invaders. The player must shoot down aliens while evading the bombs they drop. A new feature is the gradual movement of the aliens toward the player. Speed, sound and graphics have been improved.

It sells for $9.95 from Software Innovations, 320 Melbourne Rd., Great Neck, NY 11021.

Reader Service ✓ 182.

Personal Finance and Auto Leasing Packages

Small Business Systems Group (SBSG) is marketing the Deluxe Personal Finance Package and a software package for auto leasing companies.

The auto leasing package programs provide vehicle maintenance files, account maintenance, monthly billing and report generation.

Besides balancing your checkbook, Deluxe Personal Finance provides monthly summaries of income VS spending, estimate and average monthly expenses, calculate profit or loss and provide data summaries by category.

The Deluxe Personal Finance Package requires the TRS-80 Level II 32K with two disks. The auto package requires the same equipment plus a line printer.

Contact SBSG, Corner Main St. & Lowell Rd., Dunstable, MA 01827 for further information.

Reader Service ✓ 175

Two Adventure-type Games

Dungeon Explorer 2.0, for the TRS-80 Level II with at least 16K, is a revision of the earlier game Dungeon Explorer. A single player tries to become a super-hero by battling monsters within the Dungeon of Xanadu.

The revisions have improved the command input routine (using INKEY$) and combat sequences, and added more monsters and mapping graphics.

Cosmic Trader is a game of interstellar trade. Up to four people try to amass a fortune by commanding their own star freighter in a quadrant consisting of nine star systems with nine categories of trade goods.

Both programs are sold on cassette for $13.95 by Simulation Software, P.O. Box 1368, Warren, MI. Owners of the original Dungeon Explorer can have their programs updated for $4.

Reader Service ✓ 183.

BASIC Translator

Structured BASIC Translator (SBT), sold by Acorn Software, Inc., is a utility which helps programmers write structured programs.

The elements are PROCEDURE, CALL, CASE-CALL, IF-THEN-ELSE, WHILE and UNTIL. There are no line numbers and no GOTO's.

After a programmer writes a structured program (which may require structure elements, comments and BASIC statements), SBT converts the file to a BASIC program.

The translator written for disk-based Level II systems can translate its own code in less than four minutes.

SBT is sold for $29.95 by Acorn Software, Inc., 634 North Carolina Ave., S.E., Washington, DC 20003.

Reader Service ✓ 176

Fast LOADs and SAVEs

Hisped is a new system program for the TRS-80 designed to reduce the amount of time required to SAVE, VERIFY and LOAD BASIC and system programs, and/or array data. Its transfer rate is 260 bytes per second which is about four times faster than normal. However, when SAVing, VERIFYing or LOADing array data, Hisped's effective transfer rate is up to 30 times faster than normal (based on 10K of array data).

In the normal transfer process, each time a PRINT# or INPUT# statement is executed by a BASIC program a new leader is written on tape and it takes a lot of PRINT# statements to SAVE a large amount of data.

The program requires 870 bytes of protected memory in Level II 16K, 32K or 48K, and is available now for $25.95 from Palomar Software, 170 S. Palomar Dr., Redwood City, CA 94062.

Reader Service ✓ 168.

Standard Tax Program

CPAids has converted its Federal Tax Software to run on the TRS-80 Level II with at least two disks and 64K.

It includes federal tax forms 1040; 1040A with schedules A, B, C, D, E, G, R/RP, SE and TC; forms 2106 and 2441; sales tax tables; tax tables A, B, C, D; tax schedules X, Y, Z; and instruction manual.

One and three percent medical limitations are incorporated. There are also automatic checks for FICA over-withholding, earned income credit and dividend exclusion.

Federal Tax Software is priced at $495 from CPAids, 1640 Franklin Ave., Kent, OH 44240.

Reader Service ✓ 181.

System Carrying Case

Computer Textile, Inc., 10969 Wilshire Blvd., Los Angeles, CA 90024, is selling a TRS-80 system carrying case.

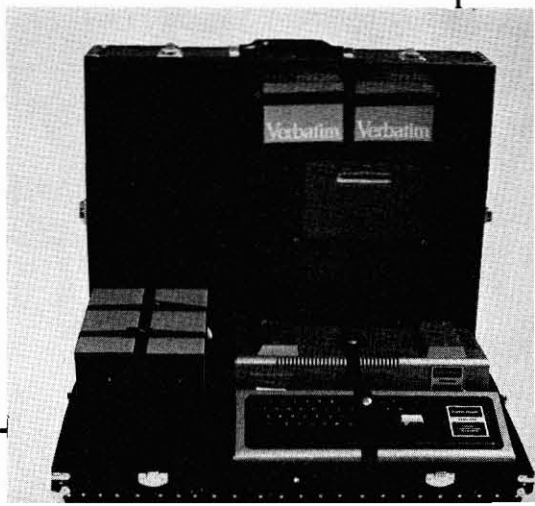
The case has room for the keyboard module, expansion interface, two disk drives, power strip, two boxes of diskettes and manual. It is lined with foam rubber for protection and finished with vinyl and velvet for appearance. It weighs about 17 pounds.

Most cabling does not need to be detached for packing, and the system may be operated in the case.

It is priced at $179.

Reader Service ✓ 171

Carrying case



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A single 1½" by 2" PC board plugs into the expansion connector on the TRS-80 keyboard or the screen printer connector on the expansion interface. This board contains the electronics required to convert the computer output into a high fidelity audio signal. Just plug in the board and connect to the aux/tape/tuner input of any audio amplifier. No external power supply is required.

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Ken Vianello is the principal of the Fort King Middle School in Ocala, Florida, and not only does he believe in the importance of the computer and its impact on the future, but he also acts on his beliefs.

If anyone had told you ten years ago that an eighth grade class in computer education would be the most popular course at that grade level, you might have concluded he was a prime candidate for the "funny farm." Not so! Here, at Fort King a computer education course in BASIC is, infact, most popular withe eighth graders.

The course is taught in a computer laboratory equipped with 16 Level II TRS-80's. Perhaps even more amazing than the fact that such a facility *does* exist in a middle school, is the story of how the lab came to be.

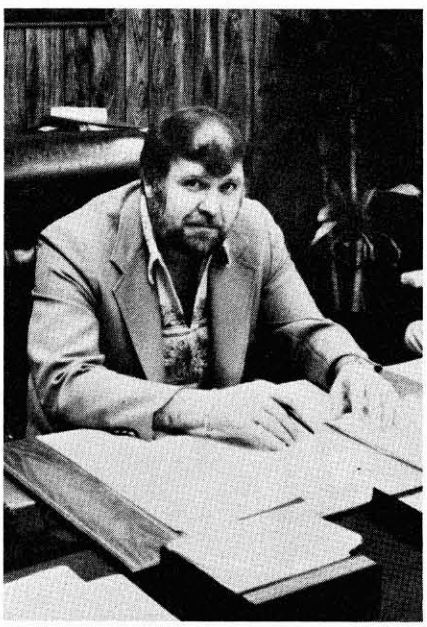

Photo 1. Principal Kenneth Vianello, Ft. King Middle School, Ocala, FL

Irregular Channels

Shortly after his appointment as principal of this middle school (grades 6 through 8), Ken Vianello, convinced that computers were here to stay, laid the groundwork to prepare students for the impact of these devices.

As Vianello observed, "We in education are notorious for reacting but never acting. If the prediction is true that over 40 million microcomputers will find their way into our homes in the next decade, then it makes good sense to start now to train our young people in the practical applications of this equipment."

The funds for this project were not available through regular budget channels, so Vianello elected to raise the money through the sale of spices. With the enthusiastic support of the parents and students, some $19,000 worth of "sneeze-proof" pepper, "cryproof" onions, seasoning salt and bacon bits were sold, providing sufficient profits to finance the program.

In the early part of 1979, with the spice drive funds in hand, Principal Vianello, hopeful that the program could be operational for the 1979-80 school year, assembled his staff, Ms. Jane McClellan, Curriculum Supervisor and Ms. Holley Griffin, a Math Teacher with a flair for computing.

They purchased fifteen Level II 4K TRS-80 units after reviewing most of the microcomputer equipment that could do the job within their budget limitations. Renting, leasing and time sharing arrangements were considered and subsequently discarded, since future budget appropriations could jeopardize the program.

Computer Carpentry

The Fort King Middle School has an enrollment of 1100 with a faculty and staff of 57, yet they found time to build a computer lab. Yes, it was built from scratch—for where else could one find an eighth grade computer laboratory? Moreover, the only space available to house the facility was a multi-level lecture hall that required considerable carpentry work to convert it into a flat-floored lab. Virtually all the lecture hall furniture was adapted for use as computer work desks, saving considerable expense.

If any of the staff were skeptical, they have long since joined the ranks of the believers.

Let's make one point very clear: The course is not elective—it is required of every eighth grade student! And there are 350.

Each student receives eighteen weeks of instruction, in two nine-week segments, separated by a nine-week break. With five 50-minute periods per week, the course provides nearly 75 hours of classroom time.

Despite the fact that the course is required, to date, Vienello reports, only five youngsters have been lukewarm to cool in their reactions to the training, and only two of these asked to be excused.

For the majority of students, the course has

Photo 2. Teacher Holley Griffin (standing); (L to R) Kim Backer, Mary Garr, Leann Brucks, Susan Martz

been a success. School starts at 8:00 AM. Ms. Holley Griffin, who teaches five of the daily classes, usually arrives about 7:00 AM, hoping for a few minutes alone at her newly acquired TRS-80 Level II with disk drive. Invariably, two or three youngsters are already there waiting for her to open the lab. By 7:30 AM most of the first class of the day is on hand with all keyboards in use. After the final class of the day, there are some enthusiasts who must be literally pried loose from the keyboard.

Why is the course so successful?

It's probably a variety of things, not the least of which are good teaching methods, coupled with high student interest. Classroom work is assigned according to the student's capability. In general, two students of comparable ability share the use of a TRS-80.

Grading is on the satisfactory/not satisfactory basis, so none of the students are made to feel they are struggling for a particular grade.

Learning Levels

While most of the pupils are permitted to set their own pace, the high achievers are given additional classroom work and homework on a much tighter and structured schedule. This group is required to turn in fully documented special assignments at least every two weeks.

Ms. Griffin and Ms. McClellan combined their talents to prepare some project material, tailored to the three student learning levels: the gifted, the average and the low achievers. Space does not permit a complete list, but a few from each category are outlined below.

1. Gifted or Advanced Student Projects

- Write a program which asks a person his or her weight; print that person's equivalent weight on each of the planets and the moon.
- Develop a program which translates an alphabetic message into Morse code.
- If you put P dollars into a savings account with an interest rate R, compounded T times a year, how much money would there be in the account at the end of N years? Write the program so that it answers the question for any combination of the parameters P, R, T and N. Now use the program to determine the amount A after one year, starting with $100 at 5 percent interest when it is compounded (1) annually, (2) semi-annually, (3) quarterly and (4) daily.
- You are about to purchase a car. Assume you normally drive 10,000 miles per year and use EPA mileage ratings from 10 miles per gallon (MPG) for a heavy luxury car to 40 MPG for a small economy sedan. Write a program which lists, in three columns, the MPG from 10 to 40, the gallons of gasoline used in one year and how much that gas costs using a current local price for unleaded gas.

2. Average Student Projects

In this category Ms. Griffin has provided eight pages of projects and problems to give the students some good programming practice. Students are asked questions, such as:

- How would you correct it to make it run right?
- How would you modify it to make it a better program?
- Compare two programs shown; tell which you prefer and why.
- Take a listed program and make your own adaptation.

The program guide provides a number of examples to apply to the above practice work.

A section in the Average Student Guide asks the student to translate some word problems into BASIC programming formats. They are asked to copy the finished program on a BASIC Coding Sheet, remembering the steps for developing a program: (1) Feed in the data, (2) Provide an equation (formula) and (3) Print the answer.

Most of this exercise, for the average student, involves taking word problems in arithmetic and converting them into computer language. For example:

- A carton of soft drinks costs 98¢, and a doughnut costs 12¢. What is the total cost of three cartons of soft drinks and ten doughnuts?
- A family drove 2,300 kilometers one summer. The next summer, they drove 1,084 kilometers. How much further did they drive the first summer?

3. The Low Achievers

For this group seven pages of simple program exercises for copy practice on the TRS-80 keyboard have been prepared.

-
```
10 LET X = 100/4 + 75
20 LET Y = 200/20
30 PRINT X/Y
40 END
```

-
```
10 REM * ADDITION PROBLEM *
20 READ A,B,C,D
30 LET E = A + B + C + D
40 PRINT E
50 DATA 25, 3, 17, 12
```

Teacher's note: Remember how we got rid of the "?O.D. error" in another program we did?

-
```
10 PRINT " MY COMPUTER IS A WHIZ AT ARITHMETIC"
20 PRINT 5 + 2 * 4 + 3
30 PRINT 8 - 16/32
40 PRINT (5 + 2) * (8 - 3)
50 PRINT "THAT'S ALL FOLKS!"
60 END
```

It was this third group that surprised school authorities. These youngsters have an extremely short attention span, and they cause discipline problems in many classrooms. Not so here in the computer lab!

When one of these students sat down at the TRS-80 keyboard, he seemed transformed into a totally different student. His interest in the short programs he was given to copy was quite intense.

After copying a number of simple programs, some of these pupils even dream up programs of their own. The following program was written by one of the youngsters:

```
10 FOR I = 0 to 1332
20 X = RND (1023)
30 PRINT X,"*";
40 NEXT I
```

"Students have . . . called the machine an idiot or a dumb-bell, but they do not get mad . . . when it tells them they are wrong."

Teaching Technique

Ms Griffin's expertise in math, coupled with some computer training, made her an ideal choice for her position. In addition to some of the teaching material she has developed herself, she makes liberal use of various TRS-80 manuals including the new *Learning Level II* by David A. Lien. The lab's reference shelves contain a number of publications which the students can consult at any time. A dozen tape sets of the Radio Shack's Learning Level II (Part 1) are available and in constant use. Part 2 of this program will be on the shelf in the near future.

In the laboratory, Ms Griffin has the usual chalk board and overhead projector, which are used to explain and demonstrate various steps in BASIC programming. Considerable material is on transparencies and can be readily copied by students on their keyboards from the projection screen.

Ms Griffin has a TRS-80 Level II with disk drive at her desk. In progress is a project to interface this machine with six 19" TV sets distributed throughout the lab. The staff is currently wrestling with a TVI problem generated by the unshielded keyboards of the TRS-80, so at the moment the monitors are not in daily use.

The Computer Education Program has been well received and enjoyed by the students and there have been few disciplinary problems. Interest in the course is spreading in a contagious way! Members of the faculty, parents and other outsiders have indicated a desire to learn more about microcomputers, as a direct result of student enthusiasm.

At least one adult education class is using the laboratory for an evening computer course in BASIC. There have even been inquiries from county and city service departments concerning training programs for employees. If the demand persists, Ken Vianello's ingenuity may well be tried again.

What about Service?

What about equipment problems?

In general, the staff feels they have received good service and support from the two Radio Shack stores in Ocala.

Local store managers have graciously cooperated by loaning a keyboard or two during repairs. No serious interruptions have occurred because of equipment failures.

The keybounce problem was quite evident at one of the adult evening classes we attended, and it makes one wish that Radio Shack had a hardware solution to the problem rather than the KBFIX software now in use. With the numbers of on/off cycles hard to control because of the class load, much time could be saved by a built-in fix.

What would they change, if they had it to do again? "Very little," said the Curriculum Supervisor, Jane McClellan.

Some of the students doubted they would have chosen computer ed if it had been an elective subject, but now that they are immersed in it, you couldn't pry them loose. Sixth and seventh graders have shown considerable interest in the course and are impatient to get "with it" in the next year or two. Computer education may become commonplace in countless middle or junior high schools in the country.

Several Ocala families have purchased microcomputers for the home as a direct result of the interest sparked by this forward looking program at the Fort King Middle School.

An adult class is using the lab for a Central Florida Community College course in BASIC, and many of them have microcomputers on order. The senior members of the class are just as enthusiastic as the younger members.

The use of the microcomputer as a patient teaching aid has just begun. Youngsters are able to accept that the computer cannot forgive mistakes and will not tolerate sloppy or faulty instructions.

Students have, in exasperation, called the machine an idiot or a dumb-bell, but they do not get mad at the TRS-80 when it tells them they are wrong.

Progressive educators like Ken Vianello and Jane McClellan are providing the direction and leadership for this innovative experience in education.

Teachers Tommy Parker, who works with a group of gifted youngsters, and Holley Griffin are, in a real sense, pioneers in this field, and their contribution will not go unrecognized.

As a result of the excellent work of this group and the efforts of others in this dynamic venture, we can look forward to an interesting future with the computer as a willing helpmate. ■

Photo 3. (L to R) Teacher Holley Griffin, Curriculum Coordinator Jane McClellan, Mark Payne (background)

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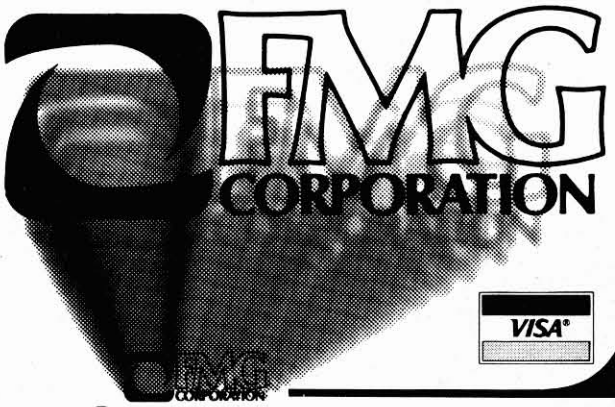

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In Profile—Scott Adams.

How the Gamesman Began

by Nancy Robertson
80 Staff

An advanced computer programmer one day came across a game about adventure and hidden treasure played on a mainframe computer. The game, by Crowther and Woods, changed his life. The programmer is Scott Adams.

Programmer Scott Adams, Author of Ghost Town.

After playing the mainframe game many times, Adams went home and wrote his own adventure game for the TRS-80. He called it Adventureland.

Since then, Adams has written eight more adventures, marketed all nine, sold over 20 thousand of his games and started his own software company in Longwood, FL. He is 28 years old.

Fan mail and phone calls have come from 10-year-old kids and members of a California Adventure Club that have exchanged their weekend poker games for weekend adventures. One college professor even uses the games to improve the logic of his business students.

But games did not originally attract Adams to computers.

Educated in Computer Science

Before Adventureland, his professional experience was in technical applications of large memory computers. At Florida Institute of Technology, where he received his B.S. in Computer Science, he was first employed in the computer center where he eventually improved their ledger and payroll programs. Later, he worked as a computer consultant for the physics department.

He has worked on a civilian contract with the U.S. Air Force in its Space Object Identification project and has written a classified paper on computerizing radar analyses. Working on another government contract, he helped design computerized flood control for West Palm Beach. It was the first computer application to flood control in the country.

When you take a look at his personal interests, Adam's professional switch to writing games for microcomputers isn't so surprising.

When Radio Shack and Tandy first announced that they would be bringing out the TRS-80, Adams had a Sphere home brew micro and had written an assembly language and designed a graphics board for the same firm. He hadn't thought the TRS-80 would find a market, but he bought one anyway.

Because the system was reliable and broke down less often than his own, Adams had more time to develop programs. When it became apparent that the computer was selling, he helped start three of the first 80 clubs.

"For the price, they're still the best system available," Adams said.

"Their biggest problem comes from the inflexibility of the Radio Shack, or Tandy, corporate structure—their inflexibility in their approach to marketing hardware. They're tied to Radio Shack outlets.

"They ought to let privately owned computer stores, that are already in existence and have the experience, sell their product. At Radio Shack stores they're used to selling hifis and don't know much about computers. It seems to me they should offer the Model II, especially, through local stores."

Adams called the Radio Shack Computer Centers "company landmarks" rather than computer information centers. But he emphasized that the product itself, the TRS-80 computer, is good.

"I think it will still be in use 10 years from now, which is saying a lot in an industry that is changing so quickly."

Besides his interest in micros, Adams has always been a games freak and a science fiction fan. He has a personal library of nearly 3,000 volumes, most of which are sci fi. Before computer games were available, he played Stratego, Contact 4, bridge, etc. One of the games for microcomputers that has interested him recently is Word Challenge by Richard Taylor.

Back in 1978, Crowther and Woods' game excited him, he said, because it combined the challenge and logic of a good game with the imagination of storytelling and it was computerized.

Wanting to explore the same possibilities on a microcomputer, Adams wrote his first adventure. He devised a split screen, which he still uses in all his adventures. The top portion states the player's location, visible objects and possible exits. Using two-word English sentences (verb and object), the player types instructions and answers questions which appear on the bottom section of the screen.

The Adventure

The player must explore the land to devise a map, find and save treasures and hope to escape alive. At the beginning, you have no idea what the treasures are or what words the computer will accept. Every discovery comes through trial and error with the help of logic and imagination.

When Adams wrote his first adventure in the summer of 1978, "it was 95 percent then, what it is now," he said. "In fact, it was just about all there, except the speed."

He showed it to friends at home and took it around to the TRS-80 clubs. He hadn't expected much reaction, but everywhere he went, people were enthusiastic. Finally, he decided to show it to Lance Micklus.

"He's well established as a programmer, and he had more knowledge about the market than I did." After several months of "gentle nagging" from Micklus, Adams rewrote the

✓Reader Service—see page 178

BASIC program in machine language.

"I thought it was all right the way it was. People seemed to like it. I didn't think they cared about speed. But Lance kept saying I should make the change. I didn't get around to it for a long time, maybe six months. But I finally did it. Looking back," said Adams, "I realize it made a big difference."

After transposing Adventureland to machine language, Adams wrote what he called his own adventure language. He described it as quick and flexible, and spoke about it with an excitement that was carried by his tone. With the new language, the new game-like concept and more ideas for other games, Adams began his own company.

"Adventure International became an entity around March of '79, but I had been developing programs for it since the beginning of the year." Most of the time between January and March, he spent working on revisions and refinements.

That's the way it generally goes with these games, Adams explained. "I had the original one up and running within two weeks of getting the idea. I spent the next six months reworking and elaborating it."

Pirates Adventure, Mission Impossible (to avoid a nuclear power accident), Voodoo Castle, The Count (Dracula), Strange Odyssey (a space adventure), Mystery Funhouse, Pyramid of Doom and Ghost Town followed Adventureland.

Adams said, "I tend to lean toward The Count and Mystery Funhouse (as favorites). There's no particular reason, except, it may be because it felt good writing them."

Programs for Adults

Graphics are noticeably absent from any of the Adams' game. But he does not consider this a drawback.

"People ask me about that," he said, "and they also ask about adding maps. But figuring out your own map is part of the game. I do expect to add new features, but I'm thinking more in terms of sound effects."

"Most people tell me they supply their own images, their own pictures in their minds." He explained that these programs are like computer novels as much as they are like computer games. They are played by a single person who must draw on his imagination.

"If you go to a bookstore and look through the children's books, of course they have pictures. But books written for adults usually don't have any drawings. What a person can supply in his mind is so much better than what I could give them on the screen."

In the past, none of his material has been researched. Adams has been writing to thrill his audience and to indulge his own sci fi whims and adventure fantasies. But he is looking in new directions. He is beginning to research the underground railroad as it existed just prior to the Civil War. His next adventure may revolve around this network, which smuggled runaway slaves to freedom.

Adams is enjoying his lot. In his free time, there are novels to read, games to share with his wife, Alexis, and the Orlando sunshine.

Alexis helps with the business. The Adamses expect Adventure International to continue to expand, offering utilities and recreational software written by several programmers. Company software will keep pace with advancements in hardware, Adams asserted.

In the Future

Adams hopes to concentrate his own business time on what was once a lark and has since become a creative obsession: the adventure series.

"Sometimes I sweat blood trying to get the original idea worked out and down. Other times it just flows." ■

✓Reader Service—see page 178

If learning BASIC gives you problems, get on the 80 express.

The BASIC Switchyard

Gene Perkins
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A computer, given the same set of instructions and data, will always arrive at the same conclusion. A railroad train, given the same track and switch settings, will always arrive at the same destination. This predictability of the results enhances the value of both computers and trains. But there are other similarities as well.

The computer programs which you write normally consist of a series of statements. The statements in programs form a path or track down which the ROM interpreter travels to carry out your instructions. The interpreter proceeds from statement to statement, branching or switching to new tracks at the IF statements, taking side roads at GOSUB statements, circling occasionally in FOR-NEXT loops, and finally stopping at an END or STOP statement.

Determine the Path

Within each statement the sequence and type of operators also determine a path which the interpreter must follow. For example, the following two BASIC statements will give quite different results:

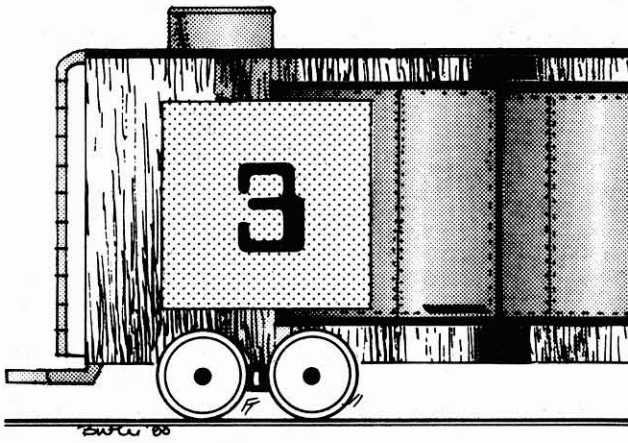
```
A=5+6*2
B=(5+6)*2
```

Here A will be set to 17 while B will be set to 22. The difference is due to the different sequence of operations.

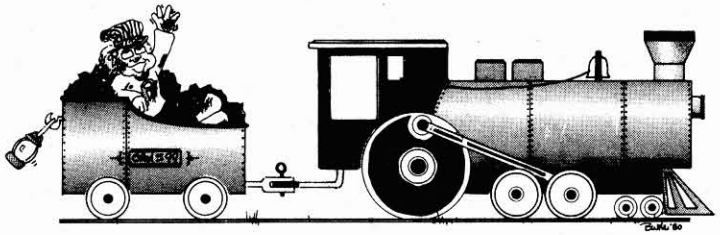
But did you ever wonder how the interpreter knows which operations to perform first? In the first statement above, why was the multiplication done before the addition? Sure, you and I know that multiplication and division are performed before addition and subtraction, but how does the computer make this decision?

One approach would be to scan each line looking for operations which have high priority or precedence and carrying out those operations first. But such a technique would require saving a large amount of information and/or rescanning the statement several times.

What is needed is a method which requires only one scan of the statement, has relatively little overhead, and is simple to implement. The method described below is used, in one



". . . ever wonder how the interpreter knows which operations to perform first?"

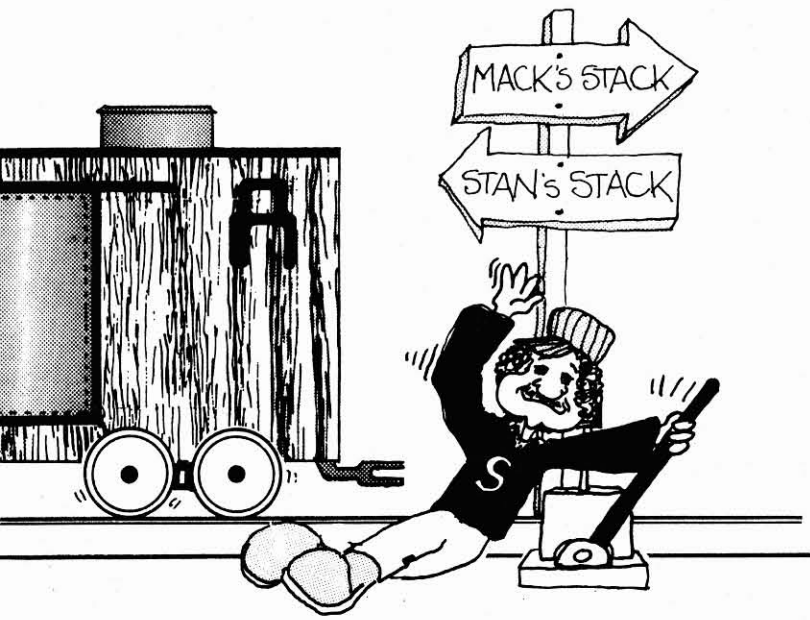


form or another, by almost all interpreters and compilers for many different programming languages. An analogy to a railroad switchyard is used which should make the method easy to understand and remember.

Notation

First, let us define a few basic terms. An "operator" is a symbol which indicates what type of operation is to be performed. An "operand" is the thing which will be operated upon. Thus, in the BASIC statement A = 2*COS(R + 4) – Y/3 the operators are:

= * COS + – and /



The operands are the variables A, R and Y; and the constants are 2, 4 and 3. The parentheses are used only to control the sequence of operations, but will be treated in what follows as operators.

When the human eye scans this statement to select the proper sequence of operations, it sees that the multiplication cannot be done until the cosine of R + 4 is calculated, and, further, that the cosine cannot be calculated until the sum of R and 4 is computed. Scanning further to the right, we note that it is not Y that is to be subtracted from the first result, but rather it is the quotient of Y divided by 3.

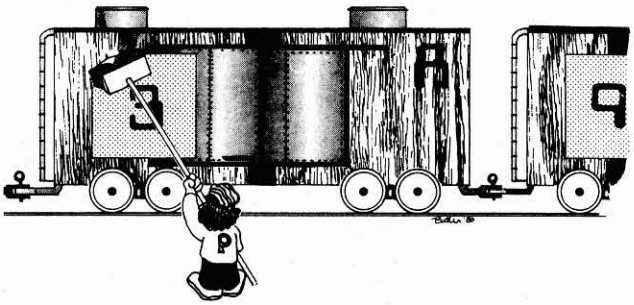
The knowledge used in making these determinations is that operators have precedence. This must be expressed in numbers to the computer. The higher the number the sooner that operation will be performed. A typical precedence scheme is given in Table 1.

Most people are used to "infix" notation. This notation places the operator between its operands, as in R + 4. If we were all in agreement, we could just as easily use "postfix" notation such as R 4 +. Or we could use prefix notation: + R 4. In fact, we do use prefix notation for many functions. For example, the function MAX(X,Y) could be written as X MAX Y. On the other hand, we could convert our infix terms such as Y/3 to the prefix form DIV(Y,3) or QUOTIENT(Y,3). In this way the BASIC statement given above could be written:

ASSIGN(A,SUBTRACT(MULT(2,COS(ADD(R,4))),DIV(Y/3)))

The same statement in postfix notation would be:

A 2 R 4 + COS * Y 3 / – =



Evaluating Postfix

It is important to distinguish between binary and unary operators. No, a binary operator does not operate only on binary numbers. A binary operator must have two operands, while a unary operator has only one operand. To evaluate the above postfix statement the following rules are used:

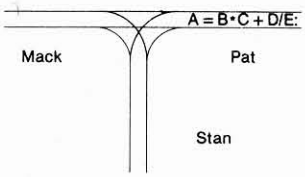


Figure 1. The three workers are in place ready to interpret a statement.

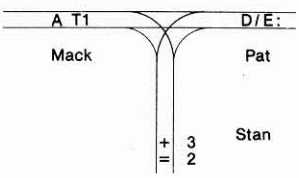
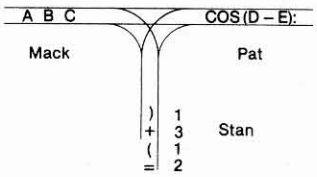
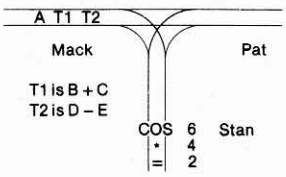


*Figure 2. Mack has transformed B*C into T1.*

*Figure 3. Stan will now send the + to Mack, discard the parentheses, and then stack the *.*

Figure 4. Stan sees the colon, so he will send all the remaining operators to Mack.





1. Scan from left to right until an operator is found.
2. If it is a binary operator, perform the operation on the two operands immediately to the left. (If it is a unary operator, use only the one operand to the left.)
3. Remove the operator and its operand(s) from the list, replacing them with the result of the operation.
4. Repeat from step 1 until the list is empty. (The operator = causes the result to be stored in A and the assignment is complete.)

These rules will cause the statement to be reduced, as shown in Table 2.

This is a very simple and efficient technique. The problem now becomes: How can we reassemble the BASIC form of the statement into the postfix form? For the solution, let us turn to the railroad switchyard, which has many years of experience in reassembling strings of railroad cars.

Let us assume that the operands and the operators of the BASIC statement represent the cars of a train entering the switch yard from our right. First, we will need a side track which will allow reversing the sequence of some of the cars. In Fig. 1 the train consists of the statement A = 2*COS(R + 4) – Y/3. A colon has been added as a caboose.

Now as the train arrives with the A at the head, the three switchmen, Pat, Stan and Mack, have been given very explicit instructions.

Pat's instructions are: If the car is an operand, set the switch so that it goes straight ahead to Mack. If the car is an operator, mark the precedence of the operator on the car and send it to Stan. Pat understands that he is to send no cars to Mack or Stan until they are ready for them.

Stan's instructions are: As a car approaches from Pat, note the precedence number written on its side. If the number is greater than the number of the last car in Stan's "stack," push all the cars farther down the stack and add the car to the stack.

If the number is less than the number of the last car, send the last car from the stack to Mack. Keep sending cars from the stack until it is empty or the next car in the stack has a number which is less than the approaching car's number. Then let the approaching car enter the stack. (Initially the stack was empty, so Stan just accepts the first car. When Pat signals that there are no more cars, Stan starts sending Mack all the remaining cars from the stack one by one.)

Mack is the workhorse of this operation. Mack's instructions are: Consolidate all the cars into one car! But he can't consolidate cars without an operator. So he keeps accepting cars from Pat and Stan until he gets an operator. If the operator is binary, he carries out the required operation on the last two operands received and places the results on one car, switching the other two onto a siding.

If the operator is unary, he just consolidates two cars into one. When he gets down to one car, he knows the train is finished (because this is such a well planned operation) and he sends the single car off to be stored in memory. (When he gets a one-car train marked END, he goes home to ROM.)

Now let's see how this works on a simple example, such as:

A = B*C + D/E.

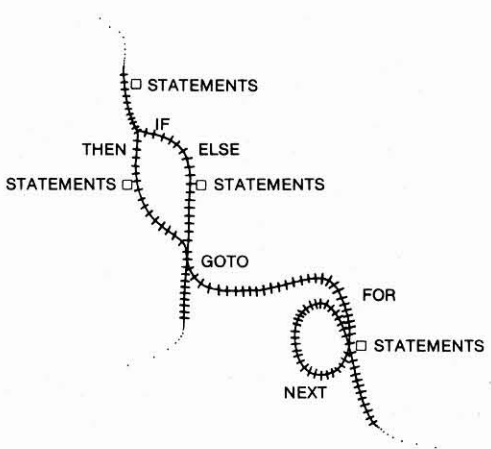


Figure 5. Some statements control the flow through the program.

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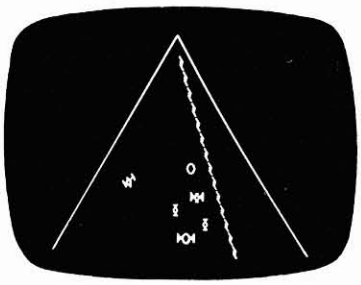

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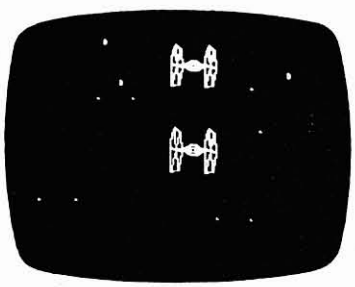

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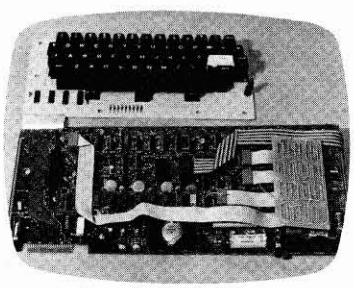

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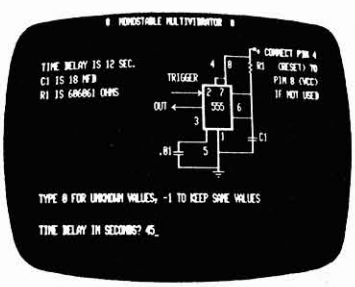

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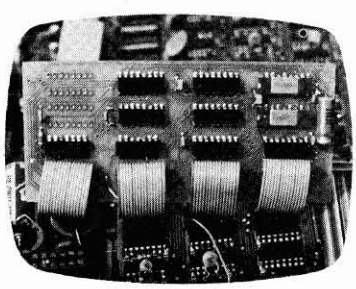

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Precedence	Operator	
7	functions	
6	+ and −	(unary)
5	[	(exponentition)
4	* and /	
3	+ and −	(binary)
2	=	(assignment)
1	(and)	
0	:	(end of statement)

Table 1. Operations with higher precedence are performed first.

Instruction Sets

Draw the diagram in Fig. 1 on a piece of paper. Move the cars around according to the following steps:

1. Pat sends A to Mack because it is an operand.
2. Pat marks a 2 on the side of the = card and sends it to Stan.
3. Stan places the = in the stack because the stack is empty.
4. Pat sends B to Mack (who is still waiting for an operator).
5. Pat marks the * with a 4 and sends it to Stan.
6. Stan notes that the 4 is larger than the 2 already on the stack so he pushes the = down and adds the * to the stack.
7. Pat sends the C to Mack (still waiting).
8. Pat marks a 3 on the side of the + and sends it to Stan.
9. Stan sees the approaching car has a 3 on it which is less than the 4 on the top of the stack so he pops the * off the stack and sends it to Mack. Since the 3 is greater then the 2 of the = which is now at the top of the stack, Stan places the + on the stack.
10. Mack, at last, receives the operator * from Stan and peforms a multiplication on B and C, places the result on the B car (renaming it T1), and switches the C car and the * car off the track. The situation is shown in Fig. 2.
11. Meanwhile, Pat sends the D toward Mack, marks the / with a 4, and sends the / to Stan.
12. The 4 on the / is greater than the 3 on the +, so Stan pushes it onto the stack.
13. Pat sends the E to Mack, marks the caboose (:) with a 0, and sends it to Stan. Pat waits for the next train (statement).
14. Stan sees the 0 on the approaching caboose and quickly sends the /, the +, and then the = to Mack.
15. Mack gets busy and performs the division operation on D and E creating a new car called T2. Mack's cars now consists of A, T1 and T2.
16. The + arrives, and Mack adds T1 and T2, getting T3. Mack now has A and T3.
17. When the = arrives, Mack performs a store operation placing the contents of T3 into the memory location reserved for A. Mack now waits for more cars, since he did not get a STOP or END.

New Rules

To handle parentheses, Stan needs two new rules: (1) always place a (on the stack regardless of the precedence of the object on the top of the stack; and (2) when a) arrives, pop all operators on the stack and send them to Mack until a (is found. Then discard the matching (and).

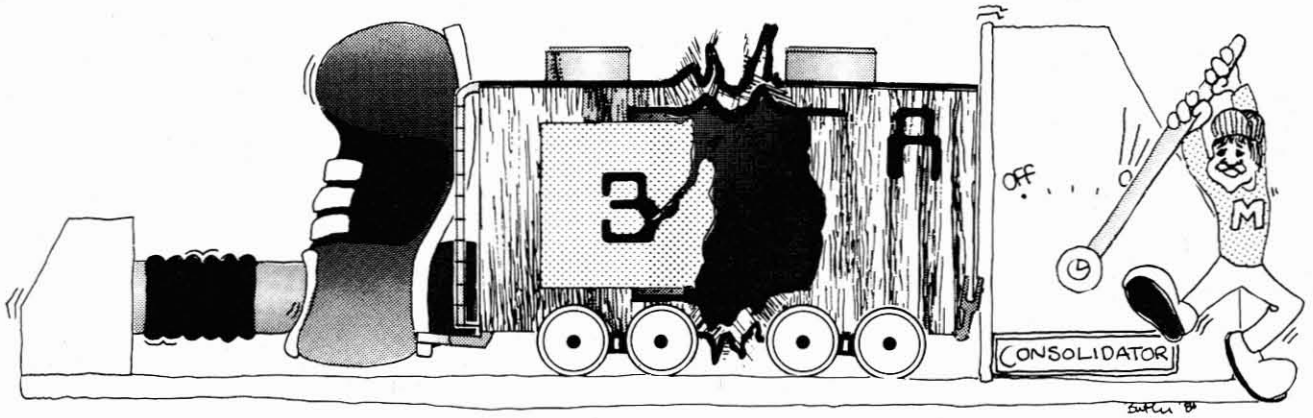
A	2	R	4	+	COS	*	Y	3	/	−	=	
A	2		T1		COS	*	Y	3	/	−	=	T1 is R + 4
A	2			T2		*	Y	3	/	−	=	T2 is COS(T1)
A			T3				Y	3	/	−	=	T3 is 2*COS(R + 4)
A			T3					T4		−	=	T4 is Y/3
A					T5						=	T5 is T3 − T4

Table 2. Sequence of postfix operations. The last operation is to store T5 in A.

Now we can try the statement: A = (B + C)*COS(D − E). Remember that COS in a unary operator with precedence 6. Figs. 3 and 4 show two of the intermediate states in interpreting this statement. In Fig. 4 the next step is to send COS to Mack who will take the cosine of T2, giving him T3. This will give him the operand stack A, T1 and T3.

Other types of statements, such as IF-THEN-ELSE and FOR-NEXT, may be processed in a similar manner. It is primarily the operations performed by Mack which are different. That is, some of the operations cause a change in the program counter (which determines which statements are to be interpreted), rather than computing a result. See Fig. 5.

Some computerists use their computer to control their model railroad layout. As we have seen, it may be a case of one railroad system controlling another. ■



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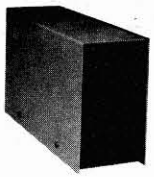

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The next time you're in a control room take a good look at all the meter dials. And then, just for the fun of it, estimate the number of man-hours that were required just to calculate the value for linear dials.

When a linear meter dial is produced, you must first define the minimum and maximum points of the X and Y coordinates. After you decide what the increment of X will be and where you want alarm conditions to be shown, then the work begins.

Calculations

For each increment of X you must now calculate: 1) the corresponding value of Y; 2) the meter deflection in electrical units at each increment; 3) the angular deflection of the meter pointer at each increment and; 4) all of the above for each alarm point.

Fig. 1 gives a typical example of this problem. The X and Y coordinates are expressed in terms of gallons versus tank depth.

The following program was written in BASIC programming language for use with Radio Shack's TRS-80, Level I computer. It can be easily modified for use with Level II systems, if a printout is required. The program will use 3409 bytes of memory if typed exactly as shown in Program Listing 1.

The program asks for all pertinent information. See Fig. 2. There are a total of 16 questions, but not all of them may be nec-

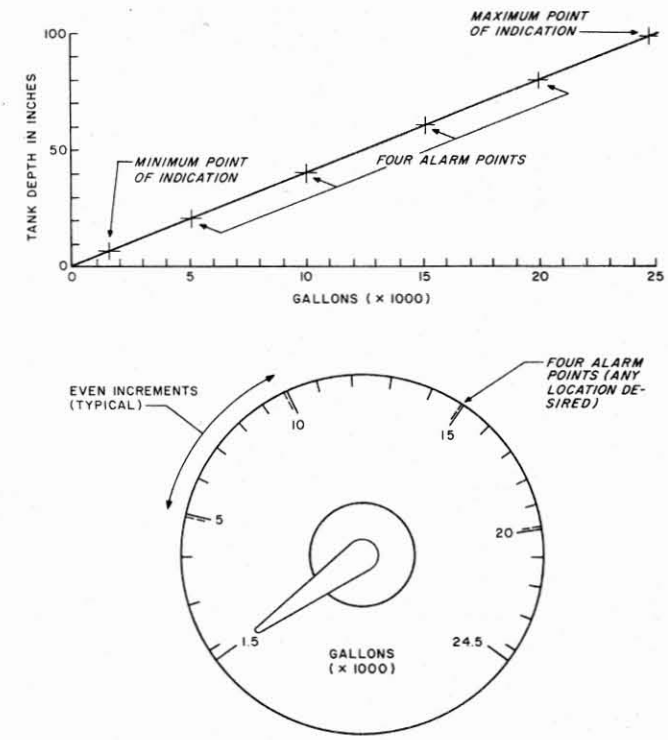


Fig. 1

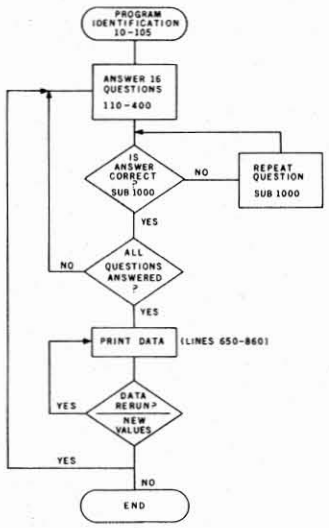
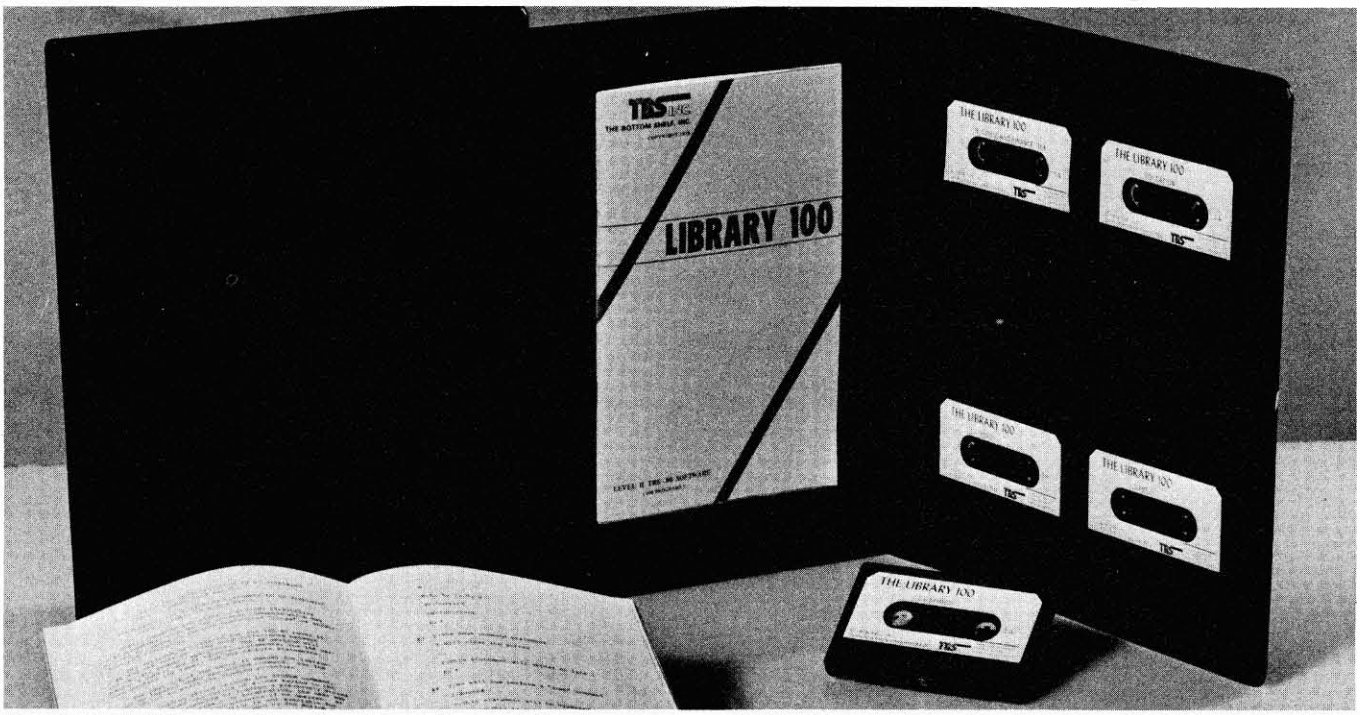


Fig. 2

A = Highest level indicated (Gal/Lit).
B = Lowest level indicated (Gal/Lit).
C = Highest level indicated (Inch/Met).
D = Lowest level indicated (Inch/Met).
E = Increment required (Gal/Lit).
F = Full scale deflection of meter in microamps.
G = Full scale deflection of meter in degrees.
H = Integer (A/E). (Sets up number of loops.)
I = Job number.
J = Date.
K = Number of alarm points.
L = Decision command to correct incorrect entry.
M = Used to continue the program at line 580.
N = Timing chain and logical decision. See lines 890–920.
O = Used in subroutine to test answers.
P = 1st alarm point.
Q = 2nd alarm point.
R = 3rd alarm point.
S = 4th alarm point.
T = Not used.
U = Not used.
V = Not used.
W = Y*G/F. (Calculates angular deflection in degrees).
X = (Z – B)*((C – D)/(A – B)) + D. (Calculates the value of tank depth relative to gallonage).
Y = (Z – B)*F/(A – B). (Calcuates meter deflection in electrical units).
Z = Integer (B/E)*E. Establishes 1st increment value.
Z = Z + E. Establishes each additional increment within the FOR-NEXT loop.
A$ = Customer name.
B$ = Dial identification.

Table 1. List of Variables

LIBRARY 100



The **LIBRARY 100** from **TBS** is without doubt the greatest software bargain ever. Released in November 1978, it has sold thousands in 44 countries. Written for the TRS-80, **LIBRARY 100** contains 100 programs on five tapes. Most of the programs can be run on a 4K, Level II computer. Designed to be a basic computer library, it provides a series of programs over a broad range of topics. All programs but one are written in BASIC and can easily be modified to suit your own purposes.

"The program mix is eclectric, interesting, and curious... If I had a Level II TRS-80 and one or more grade-school children, or if I were a hardcore software collector, or if I had little software and wanted to get a lot of it with a minimum of bother, I'd buy the Library 100." *Stephen Gray, Creative Computing, April, 1979.*

"...a basic computer library for the hobbyist, parent or businessman." *Kilobaud Microcomputing, December 1978.*

The programs are spread over five general categories; Finance, Education, Graphics, Home and Games. As an added bonus, the **LIBRARY 100** contains Tiny PILOT, a condensed version of the high level language primarily used in education. It is perfect for teachers, parents, students and sales trainees. Using only six commands, even a child could be programming in minutes. The other programs are as follows:

FINANCE: Present Value of Future Sum, Simple Interest for Days, Future Value of Present Sum, Amortization Schedule, Interest Rate-Compound Interest, Interest Rate-Installment Loan, Days Between Dates, Term of Installment Loan, Present Value of Series of Payments, Real Estate Investment Analysis, Nominal-Effective Interest, Internal Rate of Return, Future Value, of Regular Deposits, Regular Deposits for Future Value, Depreciation (Amount, Rate, Salvage Value, Schedule), Bond Present Value, Bond Yield to Maturity, Sale-Cost-Margin-Day of Week, Moving ad.

EDUCATION: Multiplication & Division, Addition, Subtraction, Fraction & Decimal, States & Capitals, States and Order of Entry, States and Date of Entry, States and Abbreviations, Inventors and Inventions, World Capitals & Countries, Urban Areas and Population, Authors & Books, Presidents and Order, States and Largest City, Base Numbers.

GRAPHICS: Front Cover, Wierd, Rat Race, Random Ad, Fireside, Left-Right Ad, Blocks, Herring, Launch, Blinker, Snoopy, Snow, Step Ad, Step Ad Two, Graphic Words, War Games.

HOME: Bartender, Nutrition, Conversion, Perpetual Calendar, Base Conversion, Calculator, Vacation Check-off List, Telecode, Message Board, Night Check-off List, Expense Account, Babysitter, Drunkometer, Remember, Christmas List, Mileage.

GAMES: Jumble, Search, Memory Quiz Letters, Sting Ray, Russian Roulette, Wheel of Fortune, Towers, Decision, Memory Quiz Numbers, Doomsday, Star Trek,™ Sketch, Flipper, Life, Fifteen, Speedy, Count, Road Race, Stars, Odd One, Spy Ship, Horse Race, Scissors, Craps, Star Blazer, Tiger Shark, Unjumble, Mind Reader, Roach Race, Jumble 2, Gypsy.

The price for the **LIBRARY 100** is only $49.50. That's less than $.50 per program. Join the thousands of users who are already enjoying this exceptional software package. Only from **TBS.** (We are currently working on a Library for the **APPLE.**)

TBS has other great software for your TRS-80. **CHECKBOOK II, INFO SYSTEM, & EXERCISER** are general applications. **BASIC TOOLKIT, SYSTEM DOCTOR & TERMINAL CONTROL** are systems utilities. **BUSINESS MAIL LIST, DATA MANAGER, CHECK REGISTER ACCOUNTING SYSTEM & ANALYSIS PAD** are strong applications for business. **TBS** also has **DISK HEAD CLEANERS** for **TRS-80** and **APPLE** and **GRAN MASTER DISKETTES,** the best on the market.

TBS is **YOUR COMPANY,** and to you we pledge to produce quality software at a price you can afford. The above products are available **NOW** at Computer Stores and Associate Radio Shack Stores nationwide or directly through us. For more information please contact us at the numbers below.

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✓Reader Service—see page 178

essary in your application. The first four questions are useful only if a printout in Level II is being used. Any of the questions may be deleted from the program by modifying lines 440-490 and lines 1070-1080.

After each question has been answered, the program allows the user to change any answers that may have been incorrectly entered. See Fig. 3. When all questions have been answered, the screen will display each question and answer. See Fig. 4.

The computer is now ready to display the data. The flow of data can be stopped and continued at any time by using the BASIC commands BREAK and CONTINUE. See Fig. 5. When all the data has been displayed, an option is offered the user to either rerun the data or enter a new set of meter dial instructions. See Fig. 6.

Table 1 is a list of all variables used.

Lines 10-105 identify the program function. Values are assigned to the variables (questions) in lines 110-400. All questions and answers are displayed in lines 410-560. Lines 570-640 instruct the user in how to stop or continue the flow of data. A FOR-NEXT loop for the flow of data is set up in lines 650-780. The necessary equations are included.

Lines 790-860 print the alarm points and their associated values. Lines 870-950 offer the user a choice to rerun the data

```
1. CUSTOMER NAME (16 CHARACTERS MAXIMUM)? J. DOE

CHECK YOUR ENTRY. ENTER # 20 IF CORRECT. ENTER THE NUMBER SHOWN
ABOVE TO CHANGE THE INFORMATION. ?
```

Fig. 3

Program Listing 1

```
10 CLS
20 PRINT@335,"THIS PROGRAM PROVIDES THE DATA FOR
30 PRINT@399,"METER DIAL MARKINGS OF LINEAR
40 PRINT@463,"SYSTEMS.
50 FORX=22TO100:Y=13:SET(X,Y):SET(X,Y+13):NEXTX
60 X=22:FORY=13TO26:SET(X,Y):SET(X+78,Y):NEXTY
70 PRINT@768,"TRANSAMERICA - DELAVAL INC.
80 PRINT@832,"GEMS SENSORS DIVISION
90 PRINT@896,"FARMINGTON, CONNECTICUT
100 FORN=1TO3000:NEXTN
105 CLS
110 INPUT"1.CUSTOMER NAME (16 CHARACTERS MAXIMUM).";A$
115 O=1:GOSUB1000
120 INPUT"2.JOB NUMBER (NO LETTERS)";I
125 O=2:GOSUB1000
130 INPUT"3.DIAL IDENTIFICATION (16 CHARACTERS MAXIMUM)
    .";B$
135 O=3:GOSUB1000
140 INPUT"4.DATE (EX. 1.479=JAN 4,1979. USE PERIOD).";J
145 O=4:GOSUB1000
150 INPUT"5.HIGHEST LEVEL INDICATED (GAL/LIT).";A
155 O=5:GOSUB1000
160 INPUT"6.LOWEST LEVEL INDICATED (GAL/LIT).";B
165 O=6:GOSUB1000
170 INPUT"7.HIGHEST LEVEL INDICATED (INCH/MET).";C
175 O=7:GOSUB1000
180 INPUT"8.LOWEST LEVEL INDICATED (INCH/MET).";D
185 O=8:GOSUB1000
190 INPUT"9.INCREMENT REQUIRED (GAL/LIT).";E
195 O=9:GOSUB1000
200 INPUT"10.FULL SCALE DEFLECTION OF METER IN MICROAMP
    S.";F
205 O=10:GOSUB1000
210 INPUT"11.FULL SCALE DEFLECTION OF METER IN DEGREES.
    ";G
215 O=11:GOSUB1000
220 INPUT"12.NUMBER OF ALARM POINTS (MAXIMUM OF 4).";K
230 IFK=0THEN390
240 IF(K<0)+(K>4)THEN380
250 O=12:GOSUB1000
260 INPUT"13.FIRST ALARM POINT (GAL/LIT).";P
270 O=13:GOSUB1000
280 IFK=1THEN410
290 INPUT"14.SECOND ALARM POINT (GAL/LIT).";Q
300 O=14:GOSUB1000
310 IFK=2THEN410
320 INPUT"15.THIRD ALARM POINT (GAL/LIT).";R
330 O=15:GOSUB1000
340 IFK=3THEN410
350 INPUT"16.FOURTH ALARM POINT (GAL/LIT).";S
360 O=16:GOSUB1000
370 GOTO410
380 CLS:PRINT"INCORRECT ENTRY !":FORN=1TO1000:NEXTN:CLS
    :GOTO220
390 PRINT"NO ALARM POINTS."
395 O=12:GOSUB1000
400 FORN=1TO1000:NEXTN
410 CLS
420 PRINT"YOUR DATA WAS ENTERED AS FOLLOWS :"
430 PRINT
440 PRINT"1.CUSTOMER:";A$;TAB(31),"7.MAX HEIGHT:";C;"IN
    CH/METER"
450 PRINT"2.JOB # :";I;TAB(31),"8.MIN HEIGHT :";D;"INCH
    /METER"
460 PRINT"3.DIAL # :";B$;TAB(31),"9.INCREMENT:";E;"GAL/
    LIT"
470 PRINT"4.DATE:";J;TAB(31),"10.SCALE:";F;"MICROAMPS"
480 PRINT"5.MAX LEVEL:";A;"GAL/LIT";TAB(31),"11.SCALE:"
    ;G;"DEGREES
490 PRINT"6.MIN LEVEL:";B;"GAL/LIT"
500 IFK=0THEN560
510 PRINT
520 PRINT"12.1ST ALARM:";P;"GAL/LIT":IFK=1THEN570
530 PRINT"13.2CD ALARM:";Q;"GAL/LIT":IFK=2THEN570
540 PRINT"14.3RD ALARM:";R;"GAL/LIT":IFK=3THEN570
550 PRINT"15.4TH ALARM:";S;"GAL/LIT":GOTO570
560 PRINT"NO ALARMS"
570 PRINT
580 INPUT"ENTER ANY NUMBER TO CONTINUE.";M
590 CLS:PRINT"THE DATA WILL NOW BE DISPLAYED ON THE SCR
    EEN.
600 PRINT"DEPRESS THE 'BREAK' KEY TO STOP THE FLOW OF D
    ATA.
610 PRINT"ENTER 'C.' TO CONTINUE THE DATA (INCLUDE THE
    PERIOD).
620 PRINT
630 INPUT"ENTER ANY NUMBER TO DISPLAY THE DATA.";M
640 CLS
650 H=INT(A/E):Z=INT(B/E)*E
660 PRINT"GAL/LIT","INCH/MET","MICROAMPS","DEGREES"
670 PRINTB,D,"0","0"
680 FORN=1TOH
690 Z=Z+E
700 Y=(Z-B)*F/(A-B)
710 X=(Z-B)*((C-D)/(A-B))+D
720 W=Y*G/F
730 IFZ>=ATHEN760
740 PRINTZ,X,Y,W
750 NEXTN
760 PRINTA,C,F,G
770 PRINT"GAL/LIT","INCH/MET","MICROAMPS","DEGREES"
780 PRINT
790 PRINT"ALARM POINT","GAL/LIT","MICROAMPS","DEGREES"
800 IFK=0THEN860
810 PRINT
820 Y=(P-B)*F/(A-B):W=Y*G/F:PRINT"FIRST",P,Y,W:IFK=1GOT
    O890
830 Y=(Q-B)*F/(A-B):W=Y*G/F:PRINT"SECOND",Q,Y,W:IFK=2GO
    TO890
840 Y=(R-B)*F/(A-B):W=Y*G/F:PRINT"THIRD",R,Y,W:IFK=3GOT
    O890
850 Y=(S-B)*F/(A-B):W=Y*G/F:PRINT"FOURTH",S,Y,W:GOTO890
860 PRINT"NONE"
880 PRINT
890 PRINT"1.RERUN DATA.":PRINT"2.NEW DIAL."
900 PRINT
910 INPUT"ENTER THE NUMBER SHOWN FOR YOUR SELECTION.";N
920 IF(N<=0)+(N>2)THEN940
930 ON N GOTO640,105
940 CLS:PRINT"INCORRECT ENTRY !":FORN=1TO1000:NEXTN:CLS
    :GOTO890
950 END
1000 PRINT@704,"CHECK YOUR ENTRY. ENTER # 20 IF CORRECT
    . ENTER
1010 PRINT@768,"THE NUMBER SHOWN ABOVE TO CHANGE THE IN
    FORMATION.
1020 INPUTL
1030 IFL=0GOTO1060
1040 IFL=20GOTO1070
1050 CLS:PRINT"INCORRECT ENTRY !":FORN=1TO1000:NEXTN:CL
    S
1055 L=0
1060 CLS
1070 ONLGOTO110,120,130,140,150,160,170,180,190,200,210
1080 ONL-11GOTO220,260,290,320,350
1090 CLS:RETURN
9999 END
```

or to enter new dial information. Subroutine 1000 checks all answers and allows the user to change any incorrect entries.

The program can be greatly reduced if a printout or alarm points are not required. The only lines used in this instance would be lines 150 through 215, and, of course, the remainder of the program would have to be modified accordingly. ■

```
YOUR DATA WAS ENTERED AS FOLLOWS

 1. CUSTOMER:J.DOE
 2. JOB#:12345
 3. DIAL#:TANK#
 4. DATE:9.2779
 5. MAX LEVEL:24500 GAL/LIT
 6. MIN LEVEL:1500 GAL/LIT
 7. MAX HEIGHT:98 INCH/METER
 8. MIN HEIGHT:8 INCH/METER
 9. INCREMENT:1000 GAL/LIT
10. SCALE:200 MICROAMPS
11. SCALE:250 DEGREES

12. 1ST ALARM:4800 GAL/LIT
13. 2ND ALARM:9700 GAL/LIT
14. 3RD ALARM:1495 GAL/LIT
15. 4TH ALARM:19800 GAL/LIT

ENTER ANY NUMBER TO CONTINUE.?
```

Fig. 4

```
 22000      88.2174      178.261      222.826
 23000      92.1304      186.956      233.696
 24000      96.0435      195.652      244.565
 24500      98           200          250
 GAL/LIT    INCH/MET     MICROAMPS    DEGREES

ALARM POINT   GAL/LIT     MICROAMPS    DEGREES

FIRST          4800        28.6956      35.8696
SECOND         9700        71.3043      89.1304
THIRD         14500       113.043      141.304
FOURTH        19800       159.13       198.913

1. RERUN DATA
2. NEW DIAL.

ENTER THE NUMBER SHOWN FOR YOUR SELECTION?
```

Fig. 5

```
GAL/LIT     INCH/MET     MICROAMPS    DEGREES
   1500            8             0          0
   2000      9.95625       4.34783    5.43478
   3000      13.8696       13.0435    16.3043
   4000      17.7826       21.7391    27.1739
   5000      21.6956       30.4348    38.0435
   6000      25.6087       39.1304    48.913
   7000      29.5217       47.8261    59.7826
   8000      33.4348       56.5217    70.6522
   9000      37.3478       65.2174    81.5217
  10000      41.2609        73.913    92.3913
  11000      45.1739       82.6087    103.261
  12000      49.0869       91.3043    114.13

BREAK AT 720

>_

C.
```

Fig. 6

Computerize your Amway earnings.

Get the Whole Story

Amway Product Distributor Programs
Blechman Enterprises
Canoga Park, CA 91307
Price: $25 on cassette or Stringy Floppy wafer.

Fred Blechman
7217 Bernadine Ave.
Canoga Park CA 91307

If you're involved in one of the many home distributorships or vending is your business this article will show you how to use your Radio Shack TRS-80 to save time and money! Although these four Level II 16K programs are specifically designed for Amway product distributors, (home and personal care products), they can be modified for most other BASIC microcomputers and used in many other small business applications. Neither printer nor disk is required.

Four programs are useful to the larger Amway product distributor. Program Listing 1 is Order Verification. Over 300 products are listed in the distributor price list, and each has various numbers associated with it, such as stock number, quantity per case, discount percentage and prices.

Once found, the prices (called PV, BV, cost and suggested retail, for each item) must be multiplied by the quantity ordered and the results entered in four columns of the order form.

A typical full-page order that would take 15 or 20 minutes to check manually takes two or three minutes using this program and yields more accuracy, since non-taxables are not overlooked.

Totals, tax and handling appear on command, and non-taxable items are automatically deducted.

Program Listing 2 is a Distributor Organization and is most handy if you have a printer available. It uses a menu and either screen or printer output. This is like a super card file program, where all distributors or outlets are listed and are selected, alphabetically, by selected groups.

Program Listing 3, Bookkeeper, adds all twelve columns of a ledger and accumulates page totals for monthly or annual grand totals.

Program Listing 4 calculates and displays for screen and/or printer the Monthly Gross Profit Summary.

All of these programs can be modified for more general use, and are available on cassette or Stringy Floppy wafer for the TRS-80.

Instead of:	Use:
Blusher Stick	BLUSHER
Blush, Powder	BLUSH
Cover Up	COVER
Eyebrow Pencil	PENCIL
Eyeshadow	SHADOW
Eyeliner	LINER
Face Powder	FACE
Lip Glosser	LIPS
Lipstick	LIPS
Natural Lipstick	NAT LIPS
Foundation	FOUNDATION
Mascara	MASCARA
Pressed Powder	PRESSED
Men's Socks	SOX
Knee-Hi Hosiery	KNEE
One-Size Stretch Hosiery	STRETCH
Control Top Hosiery	CONTROL
Panty Hosiery	PANTY
Soft-Sheer Hosiery	SOFT
Support Hosiery	SUPPORT
EAD-9540 Sales Kit	KIT
Literature Kit Only	LIT KIT
Distributor Order Form	PAD
SA-13 Price List	SA13

Table 1. Generic Product Names

Order Verification Program

This program uses virtually all of the TRS-80 16K memory, since it is filled with DATA statements and uses a lot of array space. The listing just shows a few of the statements, so that you can see the format. Each DATA statement contains: quantity per case, stock number, PV, BV, cost, and suggested retail. Decimal points are omitted from the prices.

Let's RUN the sample order (Fig. 1), so you'll see how this works. CLOAD the Order Verification program, type RUN and

ENTER. The display screen clears and asks for your patience while it loads DATA. A string-array is being loaded with stock numbers (or generic names), while a numeric array is loaded with all the other DATA items. This takes about 13 seconds.

The screen clears and a message at the top asks you if this is an Amway Regional Distribution Center (RDC) order (no handling charge). Type N and ENTER. (If you type Y, the handling charge added later will be zero.)

The screen clears, column headings appear and, in about two seconds, a screen prompt asks for your entry.

Look at Fig. 1 again. Line 1 shows a 3 in the *each* column and a stock number of E-8023. Type in 3,E,8023 and ENTER. Don't forget the commas! The "E" stands for "each". For "cases", you would use a C instead of E. The stock number is always preceded by an A- or E-, which must *not* be entered.

The computer searches the string array for a match with the stock number (8023 in this example). When it locates this *exact* match, the quantity per case, PV, BV, cost and suggested retail are pulled from the adjacent numeric array locations, processed by the program and the results printed under the column headings.

This takes several seconds for the first item after array loading, as the computer does some internal housekeeping. After that, the action is normal. The screen prompt instantly appears again. Type 2,E,4211 and ENTER.

Notice the next two items (lines 3 and 4) are case quantities. Type in 1,C,8220. When the results appear on the screen, an N appears after the last number. This indicates this item is non-taxable.

Next enter 2,C,8268 and then 5,E,47. For line 6 use the generic word KIT (see Table 1): 1,E,KIT. Similarly, for the next line use 1,E,SA13.

Now, the next item, line 8, is a sales aid not in memory. The prefix is not an E- or A-, so the stock number is not 5. What to do? Simple!

Type in 9,9,9 and ENTER. The program jumps to the hand-entry mode and prints an entry prompt at the bottom of the screen. The program also does this if it can't find a match for your typed stock number in the normal-entry mode. Type 4,BOTTLE,0,0,.32,.32 and ENTER. The computer will multiply the last four numeric entries (include the decimal point!) by the first number and display the results in the proper columns.

You could type anything (up to 9 characters) in place of BOTTLE; whatever you type appears in the stock number column. In the hand-entry mode, the quantity is always EACH.

Similarly, type 9,9,9 and ENTER, then 1,TAPE,0,0,1.75, 1.75 and ENTER for line 9. The last item is lipstick. Enter this as 2,E,LIPS.

For totals, type 0,0,0 and ENTER. A line is drawn below the last numbers, the four right columns are totaled, and tax and handling are added for a grand total.

The N after the last column total means the sales tax of the item with an N in that column has been subtracted.

The sales tax is calculated by line 820 and displayed by line 855. The variable H is retail value. For a different percentage, change lines 820 and 855.

The handling in this example is two percent of the retail value, variable H. This is calculated by line 835 and displayed by line 860. Change this if it's necessary. If handling is to be based on cost, variable G should be used instead of H. For example, for three percent of cost, line 835 should be S = .03•G and the two percent displayed by line 860 should be changed to three percent.

At this point, it's only necessary to compare the computer totals with the order being verified. If they are the same, the order is correct.

A screen prompt asks if you wish to make changes. If you ENTER a Y, the normal screen prompt appears. To subtract a wrong entry, use a *negative* sign in front of the quantity. 0,0,0 gives new totals.

Suppose some of the numbers you wish to verify have scrolled off the top of the screen? Don't worry. Just bypass the CHANGES? prompt with N and the computer will ask you if you wish a review. Type Y and ENTER. The screen clears, and the last four column numbers march down the screen starting with line 1.

You can keep these numbers from going off the top of the screen by holding down the SHIFT key and pressing the ' key to stop and start the scrolling.

If you type N to the review request, the computer will ask if you wish to check another order. If you type Y you'll be at the start of another order instantly with none of the start-up delays experienced on your first order.

All this sounds terribly complicated, but it's really a breeze, and you'll learn very quickly. There are some limitations and hints that will help you. For example, the arrays will only allow 27 lines maximum for the entries, including hand entries. You can enter 1,ERROR,0,0,0,0 to the lower screen prompt to return to the normal entry prompt without effecting column totals.

Non-taxable stock numbers can be added or removed in lines 450 and 630.

If the program bombs out because of improper entries (forgotten commas, letters where there should be numbers, hitting the CLEAR or BREAK key by mistake, etc.) you can usually recover by typing GOTO 270 to continue the order, or GOTO 200 to start another order.

If you wish to exit the program at any time, such as to perform a calculation, press BREAK and re-enter with CONT to continue from where you were. (This will *not* work if you LIST after BREAK. Use GOTO 270.)

If all else fails, RUN always gets you back into the program with the 13 second wait for DATA loading, and the slight delay for first entry processing.

Distributor Records Program

CLOAD and RUN the Distributor Records program. An introduction appears on the screen. Press ENTER and instructions appear on the screen, telling you

DISTRIBUTOR ORDER FORM No. 032092

USE THIS FORM FOR ALL ITEMS

LINE NO.	V	QUANTITY CASE	QUANTITY EACH	STOCK NO.	DESCRIPTION	SIZE	POINT VALUE	BUSINESS VOLUME	DISTRIBUTOR COST	RETAIL (FOR SALES TAX)
1			3	E-8023	SA8+	64	13 80	19 80	17 70	22 65
2			2	A-4211	BIO-C PLUS		32 00	38 40	27 56	41 00
3		1		E-8220	FOOD BAR (ALMOND)		39 30	50 40	36 36	54 00
4		2		E-8268	SA8+	128	53 10	77 40	66 18	85 50
5			5	E-47	SHOE SPRAY		13 75	20 00	15 50	22 50
6			1	EAD9540	SALES & PRODUCT KIT		29 40	40 18	54 70	54 90
7			1	SA-13	PRICE LIST		—	—	34	34
8			4	EAD-5	SQUEEZE BOTTLE @ 32¢		—	—	1 28	1 28
9			1	VA-2129	TAPE - NUTRILITE		—	—	1 75	1 75
10			2	A-1605	GERMANIUM LIPSTICK		4 80	6 70	5 26	7 60
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21					* = NOT-TAXABLE ITEM					

SAMPLE

ABOVE ITEMS RECEIVED AS MARKED: _____ (PLEASE SIGN)

FOR SPONSOR'S USE				MONTHLY TALLY	PV	BV	TOTALS	186 15	252 88	226 83	291 52
CHECK NUMBER	CHECK AMT.	RECEIVED	CASH AMT.	PREVIOUS TOTAL			SALES TAX ON RETAIL TOTAL	6%		14 25	
WE HAVE CHARGED YOU SEE CORRECTION ABOVE $				THIS ORDER			HANDLING	2%		5 83	
WE HAVE CREDITED YOU SEE CORRECTION ABOVE $				NEW TOTAL			TOTAL REMITTANCE WHICH MUST ACCOMPANY THIS ORDER			246 91	

NAME JIM SMITH SPONSOR TOM JONES TODAY'S DATE 9/15/79

SPONSOR COPY

Fig. 1. Sample Order

```
                    MONTHLY GROSS PROFIT STATEMENT

NAME:SMITH    STATE:CA    ADA #: 6579     MONTH:SEPT 1979
UPLINE DIRECT:JONES       HIS NUMBER: 952

  DISTRIBUTOR'S NAME     BONUS %          BV          BONUS
DIXON                        15        1835.17       275.28
ALLEN                         9         726.3         65.37
     DAVIS                    3        126.15          3.78
JOHNSON                      12        1215.37       145.84
     BECKER                   3         180.25         5.41
     SANDER                   6          351.3        21.08
     HESS                     0          75.17            0
NO BONUSES                    0          425.8            0
STEVENS                      18        3008.15       541.47

TOTALS:                                 7943.66      1058.23

LINE 3:PERSONAL RETAIL SALES          217.6
LINE 4:TOTAL BV PURCHASES             7943.66
LINE 5:TOTAL BV SOLD                  8161.26
LINE 6:BONUS BRACKET                  25 %
LINE 7:PERFORMANCE BONUS              2040.32
LINE 8:BONUSES PAID OUT               1058.23
LINE 9:BONUS GROSS PROFIT             982.09
LINE 10:RETAIL PROFIT                 65.28
LINE 10A:SERVICING FEES               78.35
LINE 11:3% DD BONUS                   628.2
LINE 12:....TOTAL GROSS INCOME        1753.92
```

Fig. 2. Monthly Profit Statement

how to enter your own DATA statements. The listing shows only names A-C and W-Z to illustrate the format. The larger the organization, the more value this program has.

Press ENTER. The screen asks you to enter 1 for printer, 0 for screen. Type 0 and ENTER, and a menu of six choices appears on your screen.

Type 1 and ENTER. The screen asks for the distributor's last name. Type ANDERSON and ENTER. The screen shows the "sponsor" (BURLEW), one Amway classification, and "group"(SCOTT). The group refers to the name of the head of that leg of the organization. A prompt asks for a 1 if you want to go again, or a 0 if you don't.

Bookkeeper

This program assumes you are using 12-column ledger for your bookkeeping. CLOAD and RUN. The instructions are simple.

When ready, press ENTER. The program assumes column 1 in your ledger is the dollar amount of the item. Type and ENTER this figure. A prompt then asks you what column this should go under. Type in the column number (2-12) and another AMOUNT? prompt appears.

Keep answering the prompts until you are at the end of the ledger page entries. At that point, enter 0 for AMOUNT? and the computer displays column number headings, totals for each column and the grand total (column 1) set aside by a simple graphic bracket.

If you have additional entries, type and ENTER 1. These are then added (or subtracted, if you use the minus sign) from the previous total.

When you have completed the entries for this page, the computer will ask if you want cumulated totals—that is, the total of previous pages plus this page. Respond with a 1 for yes and the cumulated totals are displayed. Of course, on the first page, these are simply the page totals repeated. To do another page, enter 1 to the AGAIN? prompt.

Monthly Profit Statement

In order for distributors to qualify for profit sharing, various recognition levels and several highly-lucrative bonuses, a Monthly Gross Profit Statement must be submitted to Amway. This summary requires various calculations and is a natural for computerization. This program uses prompts to enter raw data and does all calculations.

A sample printer run is shown in Fig. 2. The screen display, which can be entered manually on the statement, looks the same.

These programs are specifically designed for Amway product distributors, except for Program Listing 3. Obviously, that

program can be used anywhere 12 columns need to be added.

But how about Program Listing 1? Well, it can be adapted to any business where invoices need to be checked using pricing data in memory. You may find less than four columns of pricing information is needed, thus simplifying the program.

Program Listing 2 is an in-memory filing system. The DATA statements can be structured with names of prospects, clients, customers or whatever. Code numbers can be used to segregate customers by whatever categories apply. You can use zip codes, cities or states as geographical separations. Of course, some BASIC programming knowledge is required to make any changes, but the framework is here.

Program Listing 4 illustrates how a form can be reduced to computer language and use. As you run this program you'll find several formatting techniques that could be applied to other programs—particularly the placement of the input statements on the screen.

While these programs are not sophisticated, they do work. If you wish to bypass the painful and time-consuming experience of troubleshooting your own entry, the four programs, with the necessary documentation are available for $25

Addendum

Since these programs were submitted to *80 Microcomputing*, a number of significant improvements have been made in the Order Verification Program. The output can now be directed to both screen and printer, or to screen alone. Therefore, this program can now be used to generate orders as well as verify them! Also, the output is formatted with two aligned decimal places for each of the four columns.

Furthermore, since DATA statements are now entered in numerical and alphabetical order, an added search program yields almost immediate access to any item in memory.

The cassette/wafer and documentation in this article contain the latest hi-speed version of this program, with current USA prices. The other programs are unchanged.

Program Listing 1. Order Verification

```
100 REM LEVELII 16K AMWAY ORDER VERIFICATION - VERSION
     4/20/79
110 REM COPYRIGHT 1979 FRED BLECHMAN
120 DEFINT A,D,N,Q,X,Y,Z
130 DIMA(1450),A$(290),B(108),T$(108)
140 CLS:N=1:Y=1:PRINT@460,"...PATIENCE...LOADING DATA..
    ."
150 READA(N),A$(Y),A(N+1),A(N+2),A(N+3),A(N+4)
160 IFA(N)=999GOTO 200
170 N=5*Y+1:Y=Y+1:GOTO 150
200 CLS:PRINT
210 INPUT"RDC ORDER (NO HANDLING) Y/N";R$
220 IF LEFT$(R$,1)="Y" OR LEFT$(R$,1)="N" GOTO 230 ELSE
      210
230 CLS:Z=1:Z1=1:PRINT
240 PRINTTAB(0)"QTY";TAB(5)"C/E";TAB(15)"#";TAB(25)"PV"
    ;
250 PRINTTAB(35)"BV";TAB(45)"COST";TAB(55)"RETAIL"
260 X=128:E=0:F=0:G=0:H=0:I=0:D=0
270 IFX>832THENX=832
280 IFX=832PRINT:PRINT
300 PRINT@X,"QTY.,CASE(C) OR EACH(E),STOCK #";
310 INPUTQ,A$,S$
320 IFQ=0THENX=960:GOTO 800
330 IFS$="9"GOTO 400
340 A=Q:N=1:Y=1
350 N$=A$(Y)
360 IFN$="END"GOTO 400
370 IFN$=S$GOTO 600
380 N=5*Y+1:Y=Y+1:GOTO 350
400 PRINT@896,"ENTER:QTY.,#,PV,BV,COST,RETAIL";
410 INPUTQ,S$,PV,BV,C,R
420 IFQ=0THENX=960:GOTO 800
430 PRINT@832,CHR$(30):A$="E"
440 P1=PV*Q:B1=BV*Q:C1=C*Q:R1=R*Q
450 IFS$="8383"ORS$="8218"ORS$="8220"THEND=1
460 B(Z)=P1:B(Z+1)=B1:B(Z+2)=C1:B(Z+3)=R1
470 IFD=1THENT$(Z+3)="N"
480 Z=Z+4:Z1=Z1+4
490 PRINT@X,Q;TAB(5)A$;TAB(15)S$;TAB(25)P1;TAB(35)B1;TA
    B(45)C1;TAB(55)R1;
500 IFD=1PRINT"N"
```

```
510 PRINT:PRINT@896,CHR$(30)
520 X=X+64:E=E+P1:F=F+B1:G=G+C1:H=H+R1
530 IFD=1THENI=I+R1
540 D=0:GOTO 270
600 B=A(N):PV=A(N+1):BV=A(N+2):C=A(N+3):R=A(N+4)
610 IFA$="C"THENQ=Q*B
620 P1=PV*Q/100:B1=BV*Q/100:C1=C*Q/100:R1=R*Q/100
630 IFN$="8383"ORN$="8218"ORN$="8220"THEND=1
640 B(Z)=P1:B(Z+1)=B1:B(Z+2)=C1:B(Z+3)=R1
650 IFD=1THENT$(Z+3)="N"ELSET$(Z+3)=""
660 Z=Z+4:Z1=Z1+4
670 PRINT@X,A;TAB(5)A$;TAB(15)S$;TAB(25)P1;TAB(35)B1;TA
    B(45)C1;TAB(55)R1;
680 IFD=1PRINT"N"
690 PRINT:X=X+64:E=E+P1:F=F+B1:G=G+C1:H=H+R1
700 IFD=1THENI=I+R1
710 D=0:GOTO 270
800 PRINT"-----------------------------------------
    ------------------"
805 PRINT"TOTALS...";TAB(25)E;TAB(35)F;TAB(45)G;TAB(55)
    H;
810 IFI<>0PRINT"N":GOTO 820
815 PRINT
820 T=.06*H
825 IFI<>0THENT=T-(.06*I)
830 T=INT(T*100+.5)/100
835 S=.02*H
840 S=INT(S*100+.5)/100
845 IF LEFT$(R$,1)="Y" THENS=0
850 M=G+T+S
855 PRINTTAB(28)"6% SALES TAX....";TAB(45)T
860 PRINTTAB(28)"2% HANDLING.....";TAB(45)S
865 PRINTTAB(28)"GRAND TOTAL.....";TAB(45)M
870 INPUT"CHANGES? Y/N";Y$
875 IF LEFT$(Y$,1)="Y" OR LEFT$(Y$,1)="N" GOTO 880 ELSE
      GOTO 870
880 IF LEFT$(Y$,1)="Y"GOTO 270
885 PRINT:INPUT"REVIEW ORDER? Y/N";Z$
890 IF LEFT$(Z$,1)="Y" OR LEFT$(Z$,1)="N" GOTO 895 ELSE
      GOTO 885
895 IF LEFT$(Z$,1)="Y"GOTO 925
900 PRINT:INPUT"ANOTHER ORDER? Y/N";X$
905 IF LEFT$(X$,1)="Y" OR LEFT$(X$,1)="N" GOTO 910 ELSE
      GOTO 900
910 IF LEFT$(X$,1)="Y"GOTO 200
915 PRINT:PRINT"      SEE YOU ANOTHER TIME. 'BYE...."
920 END
925 CLS:PRINT:Z=1
930 PRINTTAB(25)B(Z);TAB(35)B(Z+1);TAB(45)B(Z+2);TAB(55
    )B(Z+3);T$(Z+3)
935 Z=Z+4
940 IFZ=Z1GOTO 800
945 GOTO 930
1000 DATA12,744,300,425,332,480
1005 DATA12,8204,330,410,368,470
1010 DATA6,831,800,1005,874,1125
1015 DATA18,796,165,280,217,315
1020 DATA12,929,245,350,273,395
1025 DATA12,928,245,350,368,490
1030 DATA12,860,285,390,314,450
1035 DATA12,8371.250,315,255,365
2275 DATA1,PANTY,275,360,305,395
2280 DATA1,SOFT,210,255,227,290
2285 DATA1,SUPPORT,510,650,533,695
2290 DATA6,8347,360,515,400,580
2295 DATA6,8294,410,555,421,615
2300 DATA6,8348,440,625,477,695
2305 DATA6,8349,750,1075,839,1215
2310 DATA12,848,280,440,341,495
2315 DATA12,849,225,335,258,375
2320 DATA12,888,145,260,230,295
2325 DATA12,899,145,260,230,295
2330 DATA12,50,170,255,211,300
2335 DATA12,8419,315,405,309,450
2340 DATA1,KIT,2940,4018,5490,5490
2345 DATA1,LIT KIT,0,0,1882,1882
2350 DATA1,PAD,0,0,140,140
2355 DATA1,SA13,0,0,34,34
2500 DATA999,END,1,1,1,1
```

Program Listing 2. Distributor Organization

```
10 CLS
20 REM * DISTRIBUTOR SPONSORSHIP PROGRAM *
30 REM * COPYRIGHT 1979 FRED BLECHMAN *
40 PRINT:PRINT"          THE PURPOSE OF THIS PROGRAM IS
     TO ALLOW"
50 PRINT"YOU TO QUICKLY FIND THE SPONSOR AND GROUP LEAD
     ER OF"
60 PRINT"ANY OF YOUR DISTRIBUTORS, AND ALSO TO FIND ALL
     THE"
70 PRINT"DISTRIBUTORS UNDER ANY SPONSOR OR GROUP LEADER
     ...."
75 PRINT:PRINT"ASTERISK (*) MEANS NON-RENEWED DISTRIBUT
     OR!!"
80 PRINT:PRINT"        JUST FOLLOW THE INSTRUCTIONS AS
     YOU GO."
90 PRINT:INPUT"PRESS ENTER WHEN READY....";Z$
```


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```
92 GOSUB 5100
95 CLS: PRINT:PRINT:PRINT"DO YOU WANT PRINTER OR SCREEN
     ? (PRINTER=1, SCREEN=0)";:INPUT P
100 CLS:PRINT:PRINT"WHICH OF THE FOLLOWING DO YOU WANT?
    "
110 PRINT:PRINT"(1) DISTRIBUTOR'S SPONSOR & GROUP LEADE
    R"
120 PRINT"(2) ALL DISTRIBUTORS UNDER A GROUP LEADER"
130 PRINT"(3) DISTRIBUTORS DIRECTLY SPONSORED BY SPONSO
    R"
135 PRINT"(4) LIST ALL DISTRIBUTORS"
136 PRINT"(5) TWO GENERATIONS BELOW SPONSOR...."
137 PRINT"(6) DISTRIBUTORS NOT RENEWED"
140 PRINT:PRINT"(TO EXIT PROGRAM, PRESS BREAK KEY...)
150 PRINT:INPUT"ENTER 1,2,3,4,5 OR 6.....";A
155 IF P=1 GOTO 170
160 ON A GOTO 200,300,400,500,600,700
170 ON A GOTO 5200,5300,5400,5500,5600,5700
200 CLS:PRINT:PRINT"DISTRIBUTOR'S LAST NAME?";:INPUT D$
210 READ A$,B$,C$,R
220 IF A$=D$ THEN GOTO 250
230 IF A$="END" GOTO 280
240 GOTO 210
250 PRINTTAB(5)"DISTRIBUTOR";TAB(25)"SPONSOR";TAB(45)"G
    ROUP"
260 PRINTTAB(5)A$;:IFR=1 PRINT" *";
265 PRINTTAB(25)B$;TAB(45)C$
270 GOTO 285
280 PRINT:PRINT"NOT ON LIST. SPELLED CORRECTLY??"
285 RESTORE
290 PRINT:PRINT:INPUT"ANOTHER? YES=1,NO=0";X
295 IF X=1 GOTO 200
296 GOTO 100
300 CLS:PRINT:PRINT"GROUP LEADER'S NAME?";:INPUTG$
310 READ A$,B$,C$,R
320 IF C$=G$ GOTO 360
330 IF C$="END" GOTO 380
340 GOTO 310
360 PRINTA$;:IFR=1PRINT" *",:ELSE PRINT" ",
370 GOTO 310
380 PRINT C$
385 RESTORE
390 PRINT:PRINT:INPUT"ANOTHER? YES=1, NO=0";Y
395 IF Y=1 GOTO 300
396 GOTO 100
400 CLS:PRINT"SPONSOR'S LAST NAME?";:INPUT S$
410 READ A$,B$,C$,R
420 IF B$=S$ GOTO 460
430 IF B$="END" GOTO 480
440 GOTO 410
460 PRINT A$;:IF R=1 PRINT" *",:ELSE PRINT" ",
470 GOTO410
480 PRINT B$
485 RESTORE
490 PRINT:PRINT:INPUT"ANOTHER? YES=1,NO=0";Z
495 IF Z=1 GOTO 400
496 GOTO 100
500 CLS:PRINT"LISTING OF ALL DISTRIBUTORS:"
510 READ A$,B$,C$,R
520 PRINT A$;:IF R=1 PRINT" *",:ELSE PRINT" ",
530 IF A$="END" RESTORE:GOTO540
535 GOTO 510
540 PRINT:INPUT"AGAIN? YES=1,NO=0";W
550 IF W=1 GOTO 500
560 GOTO 100
600 CLS:DIMB$(100)
610 PRINT:PRINTTAB(15)"DISTRIBUTORS IN LINES OF SPONSOR
    SHIP"
615 PRINTTAB(20)"(TWO LEVELS DOWN ONLY)":PRINT
620 PRINT:PRINT"GROUP LEADER'S NAME?";:INPUTG$
625 I=0:A=0:B$(A)=" "
630 READ A$,B$,C$,R
632 IF A$=B$(A) THEN A=A+1:GOTO630
640 IF B$=G$ PRINTTAB(I)A$;:IF R=1 PRINT" *" ELSE PRINT
    " "
645 IF B$=G$ I=I+5:GOTO900
650 IF B$="END" GOTO 670
660 GOTO630
670 PRINT:INPUT"AGAIN? YES=1,NO=0";V
675 RESTORE
680 IF V=1 CLS:GOTO610
690 GOTO 100
700 CLS:PRINTTAB(20)"NON-RENEWED DISTRIBUTORS!"
710 READ A$,B$,C$,R
720 IF R=1 PRINTA$,
730 IF A$="END" PRINT "END":RESTORE:GOTO750
740 GOTO 710
750 PRINT:INPUT"AGAIN? YES=1,NO=0";U
760 IF U=1 GOTO700
770 GOTO100
900 L$=A$:RESTORE
910 READ A$,B$,C$,R
920 IF B$=L$ PRINTTAB(I)A$;:IF R=1 PRINT" *" ELSE PRINT
    " "
925 IF B$=L$ GOTO910
930 IF B$="END" THEN B$(A)=L$:RESTORE:I=0:A=0:GOTO630
940 GOTO910
1000 DATA ABUNDO,CUPINO,SCOTT,0
1010 DATA AGUILERA,PARRY,PARRY,0
1020 DATA ALBAUGH,DAVIS,PARRY,1
1030 DATA ALEMAN,OLSON,OLSON,0
1040 DATA ANDERSON,BURLEW,SCOTT,0
1045 DATA ARNOLD,GALLANT,OLSON,0
1050 DATA ARROYO,PARRY,PARRY,0
1070 DATA BABB,BLECHMAN,BLECHMAN,1
```

```
1074 DATA BANKS,DIXON,SCOTT,0
1076 DATA BARNES,PARRY,PARRY,0
1080 DATA BAUM,BLECHMAN,BLECHMAN,0
1090 DATA BAUTISTA,SCOTT,SCOTT,1
1100 DATA BECKER,SCOTT,SCOTT,0
1110 DATA BELLOG,BLECHMAN,BLECHMAN,0
1120 DATA BERTONI,BLECHMAN,BLECHMAN,0
1124 DATA BLANCO,OLSONL,OLSON,0
1130 DATA BLECHMANS,BLECHMAN,BLECHMAN,0
1140 DATA BONDRA,SCOTT,SCOTT,0
1150 DATA BOWEN,MUELLER,PARRY,0
1152 DATA BORNCAMP,KAVON,KAVON,0
1154 DATA BORUFF,OLSON,OLSON,0
1160 DATA BRAMMER,BLECHMAN,BLECHMAN,0
1164 DATA BREESE,BLECHMAN,BLECHMAN,0
1170 DATA BRENNAN,BLECHMAN,BLECHMAN,0
1180 DATA BRICKLEY,BLECHMAN,BLECHMAN,1
1190 DATA BROSS,ROZAS,OLSON,0
1192 DATA BROWN,TOPLIFFE,SCOTT,0
1200 DATA BROWNE,MARTIN,OLSON,0
1210 DATA BRUNS,SCOTT,SCOTT,0
1220 DATA BRUSIE,JORDANC,SCOTT,0
1230 DATA BURBANK,THOMPSON,SCOTT,0
1234 DATA BURLEWS,BURLEW,SCOTT,0
1240 DATA BURLEW,SCOTT,SCOTT,0
1250 DATA BUTT,OLSON,OLSON,0
1260 DATA BYE,DAYS,DAYS,0
1270 DATA BYRAM,MUELLER,PARRY,0
1280 DATA BYRD,THOMPSON,SCOTT,0
1284 DATA CALDERON,BLECHMAN,BLECHMAN,0
1290 DATA CALLAHAN,MUELLER,PARRY,0
1300 DATA CARPENTER,MUELLER,PARRY,1
1310 DATA CARSTENSENJ,CARSTENSENV,LOCKWOOD,1
1320 DATA CARSTENSENV,LOCKWOOD,LOCKWOOD,0
1330 DATA CARTER,CARSTENSENV,LOCKWOOD,0
1340 DATA CARVER,HEGGE,SCOTT,0
1350 DATA CASTELL,WILSON,SCOTT,0
1360 DATA CECI,OLSON,OLSON,0
1370 DATA CHARETTE,SCOTT,SCOTT,0
1380 DATA CHASE,BURLEW,SCOTT,1
1390 DATA CHEVALIER,MUELLER,PARRY,1
1400 DATA CLARK,MARTIN,OLSON,0
1410 DATA COKER,SENSENBAUGH,FROMM,1
1420 DATA CONANT,SCOTT,SCOTT,0
1424 DATA CONEJO,TOPLIFFE,SCOTT,0
1430 DATA CONTRERAS,SCOTT,SCOTT,0
1440 DATA CRAMER,BLECHMAN,BLECHMAN,1
1450 DATA CROSS,OLSONL,OLSON,1
1454 DATA CUMMINGS,DAYS,DAYS,0
1460 DATA CUPINO,STODDARD,SCOTT,0
3320 DATA UNDERHILL,KENT,KENT,0
3330 DATA URIAS,OLSON,OLSON,0
3340 DATA URQUIDI,THOMPSON,SCOTT,0
3350 DATA VAN WORMER,BLECHMAN,BLECHMAN,0
3360 DATA VEGA,BLECHMAN,BLECHMAN,0
3370 DATA VOLMERANGE,SCOTT,SCOTT,0
3380 DATA WADE,RADDATZB,OLSON,0
3390 DATA WALES,MUELLER,PARRY,0
3400 DATA WALINSKI,DAYS,DAYS,0
3410 DATA WATKINS,OLSON,OLSON,1
3420 DATA WEBER,DONALDSON,OLSON,0
3430 DATA WEIGEL,OLSONGL,OLSON,0
3440 DATA WEISS,GEORGE,SCOTT,0
3450 DATA WHITE,BLECHMAN,BLECHMAN,0
3460 DATA WILKEN,OLSON,OLSON,1
3470 DATA WILLIAMS,OLSON,OLSON,0
3480 DATA WILLIAMSR,DIXON,SCOTT,0
3490 DATA WILLIAMST,MARTIN,OLSON,1
3500 DATA WILSON,SHELLMAN,SCOTT,0
3510 DATA WITTMAN,ICKES,SCOTT,1
3520 DATA WOODBRIDGE,BLECHMAN,BLECHMAN,1
3530 DATA WRIGHT,MUELLER,PARRY,1
3540 DATA YANCEY,STODDARD,SCOTT,1
5000 DATA END,END,END,0
5100 CLS:PRINT:PRINT"      ONLY SOME OF THE DISTRIBUTORS
     IN THIS
5105 PRINT"ORGANIZATION ARE SHOWN IN THIS LIST TO ILLUS
     TRATE"
5110 PRINT"HOW THE PROGRAM WORKS. YOU'LL WANT TO PUT IN
      THE"
5115 PRINT"NAMES OF YOUR OWN DISTRIBUTORS. TO DO THIS:"
5120 PRINT"(1) TYPE ''DELETE 1000-3540'' AND ENTER
5125 PRINT"(2) ENTER YOUR OWN DATA STATEMENTS, AS FOLLO
     WS:"
5130 PRINT"    DATA DISTRIBUTOR,SPONSOR,GROUP,0"
5135 PRINT"   (IF NOT RENEWED, USE 1 INSTEAD OF 0)"
5140 PRINT:PRINT"LEAVE 10 SPACES BETWEEN LINE NUMBERS F
     OR LATER NAMES,"
5145 PRINT"AND BE SURE LAST DATA STATEMENT IS: DATA END
     ,END,END,0 .
5150 PRINT:INPUT"PRESS ENTER TO CONTINUE.....";Z$
5155 RETURN
5200 CLS:PRINT:INPUT"DISTRIBUTOR'S LAST NAME";D$
5205 LPRINT:LPRINT"DISTRIBUTOR'S LAST NAME?";D$
5210 READ A$,B$,C$,R
5220 IF A$=D$ THEN GOTO 5250
5230 IF A$="END" GOTO 5280
5240 GOTO 5210
5250 LPRINTTAB(5)"DISTRIBUTOR";TAB(25)"SPONSOR";TAB(45)
     "GROUP"
5260 LPRINTTAB(5)A$;:IFR=1 LPRINT" *";
5265 LPRINTTAB(25)B$;TAB(45)C$
5270 GOTO5285
5280 LPRINT:LPRINT"NOT ON LIST. SPELLED CORRECTLY??"
5285 RESTORE
```


✓Reader Service—see page 178

```
5290 PRINT:PRINT:INPUT"ANOTHER? YES=1, NO=0";X
5295 IF X=1 GOTO5200
5296 GOTO100
5300 CLS:PRINT:INPUT"GROUP LEADER'S LAST NAME";G$
5302 LPRINT:LPRINT"GROUP LEADER'S LAST NAME?";G$
5305 C=1
5310 READ A$,B$,C$,R
5320 IF C$=G$ GOTO 5360
5330 IF C$="END" GOTO 5380
5340 GOTO 5310
5360 LPRINTA$;:IF R=1 LPRINT" *",:ELSE LPRINT" ",
5365 C=C+1:IF C=5 THEN LPRINT:C=1
5370 GOTO5310
5380 LPRINTC$
5385 RESTORE
5390 PRINT:PRINT:INPUT"ANOTHER? YES=1, NO=0";Y
5395 IF Y=1 GOTO 5300
5396 GOTO 100
5400 CLS:PRINT:INPUT"SPONSOR'S LAST NAME";S$
5402 LPRINT:LPRINT"SPONSOR'S LAST NAME?";S$
5405 C=1
5410 READ A$,B$,C$,R
5420 IF B$=S$ GOTO 5460
5430 IF B$="END" GOTO 5480
5440 GOTO 5410
5460 LPRINTA$;:IF R=1 LPRINT" *",:ELSE LPRINT" ",
5465 C=C+1:IF C=5 THEN LPRINT: C=1
5470 GOTO 5410
5480 LPRINTB$
5485 RESTORE
5490 PRINT:PRINT:INPUT"ANOTHER? YES=1, NO=0";Z
5495 IF Z=1 GOTO 5400
5496 GOTO 100
5500 CLS:PRINT:PRINT"LISTING OF ALL DISTRIBUTORS IN PRO
     CESS..."
5502 LPRINT:LPRINT"LISTING OF ALL DISTRIBUTORS:"
5505 C=1
5510 READ A$,B$,C$,R
5520 LPRINT A$;:IF R=1 LPRINT" *",:ELSE LPRINT" ",
5530 IF A$="END" RESTORE:GOTO5540
5532 C=C+1:IF C=5 THEN LPRINT:C=1
5535 GOTO 5510
5540 PRINT:INPUT"AGAIN? YES=1,NO=0";W
5550 IF W=1 GOTO 5500
5560 GOTO 100
5600 CLS:DIMB$(100)
5605 PRINT:PRINT"TWO-LEVEL LINE OF SPONSORSHIP...."
5610 LPRINT:LPRINTTAB(15)"DISTRIBUTORS IN LINES OF SPON
     SORSHIP"
5615 LPRINTTAB(20)"(TWO LEVELS DOWN ONLY)":LPRINT
5620 PRINT:INPUT"GROUP LEADER'S LAST NAME";G$
5622 LPRINT:LPRINT"GROUP LEADER'S LAST NAME?";G$
5625 I=0:A=0:B$(A)=" "
5630 READ A$,B$,C$,R
5632 IF A$=B$(A) THEN A=A+1:GOTO5630
5640 IF B$=G$ LPRINTTAB(I)A$;:IF R=1 LPRINT" *" ELSE LP
     RINT" "
5645 IF B$=G$ I=I+5:GOTO 5900
5650 IF B$="END" GOTO 5670
5660 GOTO 5630
5670 PRINT:INPUT "ANOTHER? YES=1, NO=0";V
5675 RESTORE
5680 IF V=1 CLS:GOTO5610
5690 GOTO 100
5700 CLS:PRINT:PRINT"NON-RENEWED DISTRIBUTORS BEING LIS
     TED..."
5702 LPRINT:LPRINTTAB(20)"NON-RENEWED DISTRIBUTORS!!"
5705 C=1:LPRINT
5710 READ A$,B$,C$,R
5720 IF R=1 LPRINTA$,
5725 IF R=1 THEN C=C+1:IF C=5 THEN LPRINT:C=1
5730 IF A$="END" LPRINT"END":RESTORE:GOTO5750
5740 GOTO 5710
5750 PRINT:INPUT"AGAIN?OUTYES=1, NO=0";U
5760 IF U=1 GOTO 5700
5770 GOTO 100
5900 L$=A$:RESTORE
5910 READ A$,B$,C$,R
5920 IF B$=L$ LPRINTTAB(I)A$;:IF R=1 LPRINT" *" ELSE LP
     RINT" "
5925 IF B$=L$ GOTO 5910
5930 IF B$="END" THEN B$(A)=L$:RESTORE:I=0:A=0:GOTO5630
5940 GOTO 5910
```

Program Listing 3. Bookkeeper

```
100  REM * COPYRIGHT FRED BLECHMAN 1978 *  VERSION 9/8/
     79
110 REM * SHOWS PAGE, MONTHLY AND RUN TOTALS *
120 DEFDBL A-L,S
130 CLS:PRINT
140  PRINT"                SIMPLIFIED BOOKKEEPING":PRINT
150  PRINT"     THE PURPOSE OF THIS PROGRAM IS TO ALLOW
      YOU TO"
160  PRINT"ADD UP TO TWELVE COLUMNS OF FIGURES AT ONCE,
      SUCH AS IN"
```

```
170  PRINT"A SIMPLE LEDGER BOOK. FOR EXAMPLE, USE COLUM
     N 1 AS THE"
180  PRINT"AMOUNT OF AN EXPENSE, AND THE OTHER ELEVEN C
     OLUMNS FOR"
190  PRINT"EXPENSE CATEGORIES. COLUMN 2 MIGHT BE MERCHA
     NDISE, COLUMN"
200  PRINT"3 MIGHT BE UTILITIES, AND SO ON. THE AMOUNTS
      ENTERED ALL"
210  PRINT"FALL IN COLUMN 1 AND ARE TOTALLED WHEN 0 ENT
     ERED."
220 PRINT:PRINT
230 PRINT"     FORMAT ALLOWS TOTALS TO $ 99,999,999.00!
     !"
240 PRINT:PRINT
250  INPUT"WHEN READY TO PROCEED, HIT 'ENTER' ";A$
260 REM * INITIALIZE VALUES AT ZERO *
270 A=0:B=0:C=0:D=0:E=0:F=0:G=0:H=0:I=0:J=0:K=0:L=0:M=0
    :P=0:R=0:S=0:W=0:X=0:Y=0
280 S1=0:B1=0:C1=0:D1=0:E1=0:F1=0:G1=0:H1=0:I1=0:J1=0:K
    1=0:L1=0
290 S2=0:B2=0:C2=0:D2=0:E2=0:F2=0:G2=0:H2=0:I2=0:J2=0:K
    2=0:L2=0
300  CLS:PRINT:PRINT
310  PRINT"     ENTER THE AMOUNT AND COLUMN # FOR EACH
     EXPENSE":PRINT
320  PRINT"           ENTER 0 FOR COLUMN TOTALS
330 A=0:B=0:C=0:D=0:E=0:F=0:G=0:H=0:I=0:J=0:K=0:L=0:S=0
340 IF R=1 THEN S1=0:B1=0:C1=0:D1=0:E1=0:F1=0:G1=0:H1=0
    :I1=0:K1=0:L1=0
350 X=0:Y=0:P=0:M=0:R=0
360 PRINT:PRINT
370  INPUT"AMOUNT";A
380  IF A=0 THEN 560
390  S=S+A
400  INPUT"                          COLUMN";X
410  IF(X<2)+(X>12)PRINT"COLUMN ENTRY ERROR!! ONLY 2-12
     VALID":GOTO400
420  REM * SELECT COLUMN AND ADD TO PREVIOUS TOTAL *
430  ON X-1 GOTO 440,450,460,470,480,490,500,510,520,53
     0,540
440  B=B+A:GOTO550
450  C=C+A:GOTO550
460  D=D+A:GOTO550
470  E=E+A:GOTO550
480  F=F+A:GOTO550
490  G=G+A:GOTO550
500  H=H+A:GOTO550
510  I=I+A:GOTO550
520  J=J+A:GOTO550
530  K=K+A:GOTO550
540  L=L+A
550  GOTO 370
560 CLS:PRINT:PRINT"* PAGE * TOTALS:":PRINT:GOTO 580
570 CLS:PRINT:PRINT"** MONTH ** TOTALS:":PRINT
580 PRINT"COLUMN #"TAB(12)"1";TAB(26)"2";TAB(40)"3";TAB
    (54)"4"
590 IF M=1 GOTO 630
600 IF P=1 GOTO 620
610  PRINT"TOTAL $"TAB(9)S;TAB(23)B;TAB(37)C;TAB(51)D:G
     OTO640
620 PRINT"TOTAL $"TAB(9)S1;TAB(23)B1;TAB(37)C1;TAB(51)D
    1:GOTO640
630 PRINT"TOTAL $"TAB(9)S2;TAB(23)B2;TAB(37)C2;TAB(51)D
    2
640  PRINT:PRINT
650 PRINT"COLUMN #"TAB(12)"5";TAB(26)"6";TAB(40)"7";TAB
    (54)"8"
660 IF M=1 GOTO 700
670 IF P=1 GOTO 690
680 PRINT"TOTAL $"TAB(9)E;TAB(23)F;TAB(37)G;TAB(51)H:GO
680 PRINT"TOTAL $"TAB(9)E;TAB(23)F;TAB(37)G;TAB(51)H:GO
    TO710
690 PRINT"TOTAL $"TAB(9)E1;TAB(23)F1;TAB(37)G1;TAB(51)H
    1:GOTO710
700 PRINT"TOTAL $"TAB(9)E2;TAB(23)F2;TAB(37)G2;TAB(51)H
    2
710 PRINT:PRINT
720 PRINT"COLUMN #"TAB(12)"9";TAB(26)"10";TAB(40)"11";T
    AB(54)"12"
730 IF M=1 GOTO 770
740 IF P=1 GOTO 760
750 PRINT"TOTAL $"TAB(9)I;TAB(23)J;TAB(37)K;TAB(51)L:GO
    TO780
760 PRINT"TOTAL $"TAB(9)I1;TAB(23)J1;TAB(37)K1;TAB(51)L
    1:GOTO780
770 PRINT"TOTAL $"TAB(9)I2;TAB(23)J2;TAB(37)K2;TAB(51)L
    2
780 REM * DRAW LINES TO SET ASIDE GRAND TOTAL *
790 V=15:FOR W=18 TO 43:SET(W,V):NEXT W
800 FOR V=9 TO 15:SET(W,V):NEXT V
810 IF P=1 GOTO 910
820 IF M=1 GOTO 960
830 PRINT
840  INPUT"DO YOU WANT TO ADD MORE ENTRIES? YES=1,NO=0"
     ;Y
850 IF Y=1 GOTO 360
860 S1=S1+S:B1=B1+B:C1=C1+C:D1=D1+D:E1=E1+E:F1=F1+F
870 G1=G1+G:H1=H1+H:I1=I1+I:J1=J1+J:K1=K1+K:L1=L1+L
880 PRINT:INPUT"ADDITIONAL PAGES THIS MONTH?? YES=1, NO
    =0";W
890 IF W=1 GOTO 300
900 P=1:GOTO 570
910 S2=S2+S1:B2=B2+B1:C2=C2+C1:D2=D2+D1:E2=E2+E1:F2=F2+
    F1
920 G2=G2+G1:H2=H2+H1:I2=I2+I1:J2=J2+J1:K2=K2+K1:L2=L2+
    L1
```


✓Reader Service—see page 178

```
930 M=1
940 PRINT:INPUT"PRESS ENTER FOR GRAND TOTALS THIS RUN..
    ..";A$
950 CLS:PRINT:PRINT"*** TOTALS THIS RUN ***":PRINT:P=0:
    GOTO 580
960 PRINT:INPUT"ANOTHER MONTH? YES=1, NO=0";R
970 IF R=1 GOTO 300
980 CLS:PRINT:PRINT:PRINT:PRINT
990 PRINT"        END OF PROGRAM - SEE YOU AGAIN SOMETI
    ME...."
1000 PRINT:PRINT:PRINT:PRINT
1010 END
```

Program Listing 4. Monthly Gross Profit Statement

```
10 CLS
15 CLEAR(100)
20 PRINTTAB(20)"MONTHLY GROSS PROFIT STATEMENT"
30 PRINT:INPUT"INSTRUCTIONS? Y/N";I$
31 IF I$="N" GOTO90
40 CLS:PRINT:PRINT"      THIS PROGRAM IS DESIGNED TO DO
    ALL THE"
45 PRINT"CALCULATIONS OF YOUR SA-434 MONTHLY GROSS PROF
    IT STATEMENT."
50 PRINT"IT WILL PRINT ON BOTH THE SCREEN AND THE PRINT
    ER. IF YOU"
60 PRINT"DON'T HAVE A PRINTER CONNECTED, DELETE ALL ''L
    PRINT''"
70 PRINT"STATEMENTS WHEN THEY APPEAR IN THE PROGRAM LIS
    TING OR"
75 PRINT"THE PROGRAM WILL ''FREEZE UP''!"
80 PRINT:PRINT"      JUST FOLLOW THE PROMPTS. WHEN YOU W
    ANT THE"
82 PRINT"TOTALS OF THE BV AND BONUS COLUMNS (2A & 2B),
    ENTER"
84 PRINT"''TOTAL,0,0''....."
86 PRINT:INPUT"PRESS ENTER TO CONTINUE.....";A$
90 CLS:PRINT@325,"IF YOU ARE USING A PRINTER, BE SURE I
    T IS"
92 PRINT"TURNED ON, OR AT LEAST CONNECTED, OR THE PROGR
    AM WILL"
93 PRINT"'FREEZE UP'!"
95 PRINT:INPUT"PRESS ENTER TO START PROGRAM....";A$
```



```
99 CLS
100 REM * COPYRIGHT 1979 FRED BLECHMAN *
110 REM * 7217 BERNADINE AVE., CANOGA PARK, CA  91307 *
120 PRINTTAB(15)"MONTHLY GROSS PROFIT STATEMENT"
130 LPRINTTAB(20)"MONTHLY GROSS PROFIT STATEMENT"
135 PRINT:LPRINT:X=128
140 PRINT@X,"ENTER YOUR NAME,STATE AND ADA #";:INPUTA$,
    B$,A
145 PRINT@X,"NAME:";A$;"   STATE:";B$;"   ADA #:";A;CHR
    $(30)
146 GOSUB1000
150 LPRINT"NAME:";A$;"   STATE:";B$;"   ADA #:";A;
160 PRINT@X,"REPORT MONTH AND YEAR (EXAMPLE:DEC,1978)";
    :INPUT C$,B
165 PRINT@168,"MONTH:";C$;B
166 GOSUB1000
170 LPRINT"   MONTH:";C$;B
180 PRINT@X,"UPLINE DIRECT NAME, NUMBER";:INPUT D$,C
185 PRINT@X,"UPLINE DIRECT:";D$"   HIS NUMBER:";C
190 LPRINT"UPLINE DIRECT:";D$;"     HIS NUMBER:";C
195 LPRINT:LPRINT:X=X+128
200 F=0:G=0:J=0:K=0:F1=0:G1=0
205 PRINT@X,TAB(2)"DISTRIBUTOR'S NAME";TAB(25)"BONUS %"
    ;
206 PRINTTAB(42)"BV";TAB(53)"BONUS"
207 GOSUB1000
210 LPRINTTAB(2)"DISTRIBUTOR'S NAME";TAB(25)"BONUS %";
220 LPRINTTAB(42)"BV";TAB(53)"BONUS"
230 PRINT@X,"DISTRIBUTOR.% BRACKET,BV";:INPUT E$,D,F
235 IF E$="TOTAL" GOTO 390
236 G=D*F*.01
237 G=INT(G*100+.5)/100
238 PRINT@X,E$;TAB(28)D;TAB(40)F;TAB(52)G
240 LPRINT E$;TAB(28)D;TAB(40)F;TAB(52)G
250 F1=F1+F:G1=G1+G:GOSUB1000
255 PRINT@X,"     ANY SERVICED? Y/N";:INPUT F$
260 IF F$="N" GOTO 230
270 PRINT@X,"     SERVICED DISTRIBUTOR,% BRACKET,BV";:I
    NPUT G$,H,J
271 PRINT@X,CHR$(30)
275 K=H*J*.01
276 K=INT(K*100+.5)/100
277 PRINT@X,TAB(5) G$;TAB(28)H;TAB(40)J;TAB(52)K
280 LPRINTTAB(5) G$;TAB(28)H;TAB(40)J;TAB(52)K
290 F1=F1+J:G1=G1+K:GOSUB1000
300 PRINT@X,"     ANY MORE SERVICED? Y/N";:INPUT H$
305 PRINT@X,CHR$(30)
310 IF H$="Y" GOTO 270 ELSE 230
390 PRINT@X,CHR$(30):PRINT@X,"ANY NON-QUALIFIED DD'S? Y
    /N";:INPUT J$
391 PRINT@X,CHR$(30)
392 IF J$="Y" GOTO 230
395 GOSUB1000:PRINT@X,"TOTALS:";TAB(40)F1;TAB(52)G1
400 LPRINT:LPRINT"TOTALS:";TAB(40)F1;TAB(52)G1
410 GOSUB1000:GOSUB1000:LPRINT
420 PRINT@X,"PERSONAL SALES THIS MONTH (RETAIL VALUE)";
    :INPUT L
422 PRINT@X,CHR$(30)
425 PRINT@X,"LINE 3:PERSONAL RETAIL SALES";TAB(35)L
430 LPRINT"LINE 3:PERSONAL RETAIL SALES";TAB(35)L
435 GOSUB1000:PRINT@X,"LINE 4:TOTAL BV PURCHASES";TAB(3
    5)F1
440 LPRINT"LINE 4:TOTAL BV PURCHASES";TAB(35)F1
445 GOSUB1000:PRINT@X,"LINE 5:TOTAL BV SOLD";TAB(35)F1+
    L
450 LPRINT"LINE 5:TOTAL BV SOLD";TAB(35)F1+L
460 GOSUB1000:PRINT@X,"WHAT IS YOUR BONUS BRACKET?";:IN
    PUT M
465 PRINT@X,"LINE 6:BONUS BRACKET";TAB(35)M;"%"
470 LPRINT"LINE 6:BONUS BRACKET";TAB(35)M;"%"
475 F2=(F1+L)*M*.01
476 F2=INT(F2*100+.5)/100
478 GOSUB1000:PRINT@X,"LINE 7:PERFORMANCE BONUS";TAB(35
    )F2
480 LPRINT"LINE 7:PERFORMANCE BONUS";TOCONT5)F2
485 GOSUB1000:PRINT@X,"LINE 8:BONUSES PAID OUT";TAB(35)
    G1
490 LPRINT"LINE 8:BONUSES PAID OUT";TAB(35)G1
495 GOSUB1000:PRINT@X,"LINE 9:BONUS GROSS PROFIT";TAB(3
    5)F2-G1
500 LPRINT"LINE 9:BONUS GROSS PROFIT";TAB(35)F2-G1
505 L1=L*.3:L1=INT(L1*100+.5)/100
508 GOSUB1000:PRINT@X,"LINE 10:RETAIL PROFIT";TAB(35)L1
510 LPRINT"LINE 10:RETAIL PROFIT";TAB(35)L1
520 GOSUB1000:PRINT@X,"ENTER SERVICING FEES. IF NONE, E
    NTER 0";:INPUT O
521 PRINT@X,CHR$(30)
525 IF O<>0 PRINT@X,"LINE10A:SERVICING FEES";TAB(35)O
530 IF O<>0 LPRINT"LINE 10A:SERVICING FEES";TAB(35)O
540 GOSUB1000:PRINT@X,"ENTER ANY 3% DD BONUS, IF NONE,
    ENTER 0";:INPUTN
541 PRINT@X,CHR$(30)
545 PRINT@X,"LINE 11:3% DD BONUS";TAB(35)N
550 LPRINT"LINE 11:3% DD BONUS";TAB(35)N
555 GOSUB1000:PRINT@X,"LINE 12...TOTAL GROSS INCOME";TA
    B(35)F2-G1+L1+O+N
560 LPRINT"LINE 12:....TOTAL GROSS INCOME";TAB(35)F2-G1
    +L1+O+N
565 LPRINT:LPRINT:LPRINT
570 PRINT:PRINT
600 END
1000 X=X+64
1010 IF X>832 THEN X=832
1020 IF X=832 THEN PRINT:PRINT
1030 RETURN
```

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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Turn your 80 into a sketching pad with this tiny program.

Simple Graphics

Ted Hommel, W7LFL
6810 Willshire Blvd.
Cheyenne, WY 82001

This simple graphics program for the TRS-80 fits easily into a 4K Level II system. The coded program is in BASIC and requires less than 1700 bytes. The remaining RAM is used for storing graphic information input from the keyboard.

What It Does

The user is given a blinking cursor in the upper left-hand corner of the screen. From this location he can move the cursor using the arrow keys. The cursor leaves a trail wherever it goes.

Several options are available to the user: the trail can be lit or not; the cursor can be double width, but seen only every other horizontal position; the screen can be cleared along the way; or, when the user likes his art work, he can tell the computer to duplicate what he has done.

The computer follows everything step by step, beginning at the location where the cursor was last placed.

The program automatically wraps around, so if the cursor comes to one of the four edges of the screen, it continues at the opposite side of the screen.

The only keys recognized during the program are the arrow keys to direct the cursor; the S key to turn the trail of the cursor on or off; the B key (big) to make the cursor and its trail narrow or wide; the CLEAR key to clear the screen; the G key (go) to initiate the duplicating process; the BREAK key to stop the program and the SHIFT@ key to make the program pause.

All other keys are ignored except when signaling the computer to resume after a pause.

Using the wide and narrow command (B key) several consecutive times makes the art work appear to flash. Using the cursor trail (S key) or the wide and narrow (B key) commands alternately causes every other duplication to be an opposite.

Simple patterns seem to be the most effective for display.

Theory of Operation

The program, divided into four modules, is designed for speed.

The first module contains instructions from lines 0 to 9. The second module initializes values and extends from line 10 to line 50. All values are stored, so the computer is not slowed down by making conversions.

The ASCII values of the keys to be used are also saved, as is the location in memory where the keyboard input is to be saved.

The third module, line 90 to line 210, is for keyboard input. The SET and RESET statements are used to rapidly blink the cursor at its current location whether or not the trail is lit.

Once input from the keyboard is received, line 110 either marks or erases the location, while line 120 converts the key value to an ASCII value.

Because the user wants a fast response, nested IF statements are used. Line 130 is the first of these. Each section of the nested IF is set off by a down arrow (linefeed and return) to make it easy to read the IF statement. Line 130 checks for the arrow keys.

If an arrow key is pressed, the ELSE corresponding to the IF is activated. The ELSE stores a number code for that key in A and changes the horizontal (H) or vertical (V) position. The IF statement within the ELSE checks whether or not the screen limits have been exceeded and adjusts accordingly.

If the pressed key is not an arrow key in line 200, another nested IF group is used. Line 200 checks for the other keys that may be used. If the pressed key is not part of the set, then the program only returns to line 100 for the next keyboard input.

If a keyboard input is recognized after the number code is stored in A, line 150 takes two inputs at a time and stores them every other time into RAM, starting at location 19000, using the POKE statement.

Program Listing

```
0 CLS
1 REM TED HOMMEL, W7LFL, CHEYENNE, WYO. 4/15/79
2 REM ALL RIGHTS GIVEN AS PUBLIC DOMAIN BY AUTHOR.
3 PRINT"SIMPLE GRAPHICS FOR THE TRS-80."
4 PRINT:PRINT"ARROW KEYS MOVE CURSOR"
5 PRINT"S KEY WILL TOGGLE SPOT ON & OFF"
6 PRINT"B KEY WILL TOGGLE SIZE NARROW & WIDE"
7 PRINT"CLEAR KEY CLEARS SCREEN"
8 PRINT"G KEY SAYS GO AND DUPLICATE PATTERN WHERE YOU STOPPED."
9 PRINT:INPUT"PUSH ENTER TO START";B1$
10 CLEAR20:DEFINT A-Z
20 A=0:C0=A:C1=1:C2=2:C3=3:C4=4:CX=127:CY=47:C5=5:C6=6:C7=7
30 M=8:C8=8:C9=9:CA=10:CN=91:S=83:B=A:D2=A:Q1=A:H=0:V=0
40 CL=31:E=69:G=71:BI=66:I=18999:I0=I+C1
50 K$="":N$=K$:B1$=CHR$(23):B2$=CHR$(28)
90 CLS
```

```
100 SET(H,V):K$=INKEY$:RESET(H,V):IF K$=N$ THEN 100
110 IF Q1=C0 THEN SET(H,V) ELSE RESET(H,V)
120 A=ASC(K$)
130 IFA<>C9THEN
IFA<>CATHEN
IFA<>C8THEN
IFA<>CNTHEN
GOTO200
ELSEA=C3:IFV=C0THENV=CYELSEV=V-C1
ELSEA=C2:IFH=C0THENH=CXELSEH=H-C1
ELSEA=C1:IFV=CYTHENV=C0ELSEV=V+C1
ELSEA=C0:IFH=CXTHENH=C0ELSEH=H+C1
140 IF A>M THEN 100
150 IF D2=C0 THEN D=A*M:D2=C1:I=I+C1 ELSE D=D+A:D2=C0:POKE I,D
160 IF A<>C7 THEN 100 ELSE POKE I,D:D2=C0:GOTO400
200 IFA<>STHEN
IFA<>BITHEN
IFA<>CLTHEN
IFA<>G THEN
GOTO100
ELSEA=C7
ELSEA=C6:B=C0:CLS
ELSEA=C5:IFB=C0THENB=C1:PRINTB1$;ELSEB=C0:PRINTB2$;
ELSEA=C4:IFQ1=C0THENQ1=C1ELSEQ1=C0
210 GOTO140
400 FOR L=I0 TO I
410 IF D2=C0 THEN D1=PEEK(L):A=INT(D1/M):D1=D1-A*M:D2=C1 ELSE D2=C0:A=D1
430 IFA<>C0THEN
IFA<>C1THEN
IFA<>C2THEN
IFA<>C3THEN
IFA<>C4THEN
GOTO500
ELSEIFQ1=C0THENQ1=C1ELSEQ1=C0
ELSEIFV=C0THENV=CYELSEV=V-C1
ELSEIFH=C0THENH=CXELSEH=H-C1
ELSEIFV=CYTHENV=C0ELSEV=V+C1
ELSEIFH=CXTHENH=C0ELSEH=H+C1
440 IF Q1=C0 THEN SET(H,V) ELSE RESET(H,V)
450 IF D2=C1 THEN D2=C0:A=D1:GOTO430
460 NEXT L
500 IFA<>C5THEN
IFA<>C6THEN
D2=C0:GOTO400
ELSEB=C0:CLS
ELSEIFB=C0THENB=C1:PRINTB1$;ELSEB=C0:PRINTB2$;
510 GOTO450
```

The POKE and PEEK method of storage saves space by using only one-half of a byte per keyboard input. That is four times less storage than if each keyboard input was stored in an integer dimensioned array (DEFINT and DIM).

Once the letter G is pressed, line 160 POKEs what remains into memory and jumps to the fourth module.

Module Four

Module four reads instructions by PEEKs from memory. The result is displayed on the screen. A loop is set up from the beginning of POKEd memory to the end. When the loop runs out of instructions, it starts over with the first instruction.

However, the location of the cursor does not change because of the restart.

Line 410 unpacks the stored input one byte at a time. Line 430 is one of those nested IF statements that allows fast action once the coded number is found. ■

Reader Service—see page 178

This is an 80 user's true story.

In the Beginning

Mark Herro
948 Valentine Rd.
Oconomowoc, WI 53066

In May, 1978, I decided to take the plunge and buy a microcomputer. Some of the factors I had to consider included reliability, service, features, software support and last, but certainly most important, cost. I considered the choices available and decided on Radio Shack's TRS-80, because it was right for my use and it fit into my modest budget.

Selling my portfolio and pledging my first-born son to Radio Shack, I ordered what they called their engineer system, a Level II, 16K RAM TRS-80 ($988) and the Radio Shack Screen Printer ($599).

I was told by Radio Shack salesmen that the waiting period for Level II units was two months and even longer for peripherals like the Screen Printer. I accepted this fact and plunked down my 10 percent deposit. Actually, it was two orders: I ordered the computer and printer separately, so a delay in one unit wouldn't hold up the other.

Peripheral First

I started waiting, but, not-so-patiently. About mid-July 1978, I got a call from Radio Shack. My computer came?! No. The printer came. Drat! A printer without a computer! Some salesman.

August came and I had to return to college. It was several weeks into the semester before my computer arrived. Two weeks later I managed to get home for a weekend. Without unpacking, I gathered everything together and took stock. The Screen Printer turned out to be a thinly disquised SCI Corporation Rotary Printer.

I set up the computer, without the printer connected, for it's first test. I pressed the ON button and presto! "MEMORY SIZE?" came right up. Everything was working fine. I turned the computer off and connected the Screen Printer to the expansion port.

I turned the computer back on and . . . CRASH. No "MEMORY SIZE?", just a display full of garbage. The RESET button had no affect. Hmmmm . . . I turned everything off and disconnected the printer.

When I turned the computer back on, everything was fine again.

There was nothing to do but call Radio Shack. The salesman on the phone couldn't help me, but called his regional repair center and got back to me.

When he told me the Screen Printer was not compatible with Level II, I was really ticked off.

To cool my temper, the salesman gave me several alternatives: I could receive a full, cash refund, or I could trade the printer in for their Quick Printer. The price of the Quick Printer was $100 less than the Screen Printer, but it needed the expansion interface, another $300.

I decided to trade for the Quick Printer and expansion interface, even though it meant shelling out an extra $200.

The Hardware and Keyboard

The keyboard, only 16 × 8 × 3½", contains the computer itself, up to 16K RAM, Level I or Level II ROMS and connections for the power supply, cassette recorder, video display and an expansion port.

The keyboard itself is the standard-sized, 53 key type. New 16K RAM models also include a numerical keypad. For me, typing on this keyboard is a real pleasure. Usually, anyway. Several weeks after getting the computer, the infamous keyboard keybounce, in which more than one character is displayed when a key is pressed, made itself known. It started with the comma key, spread to the C key, and eventually to several others. Finally, I had to get off my duff and do something about it.

I did three things: I *carefully* cleaned the contacts beneath the offending keys; I found a sheet of transparent plastic to use as a dust cover; and I went to Radio Shack and got a free KBFIX system tape. Cleaning the key contacts really helped, but the problem will return in time as dust creeps in.

KBFIX is a machine language program loaded via the SYSTEM command that modifies how the keyboard accepts input. When KBFIX is running, everything runs normally, except the keybounce and 50 bytes of RAM are gone.

The Video Display

The video display is just a 12" black and white TV, except that it has a slightly wider bandwidth to accept the kind of output the computer supplies and no tuner.

The normal output to the video display is composed of 64 characters per line and 16 lines

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For the TRS-80* Microcomputer MOD I

Time To Go Back To Work ! ! !
The "BOSS" Is Here

written by V.B. Hester

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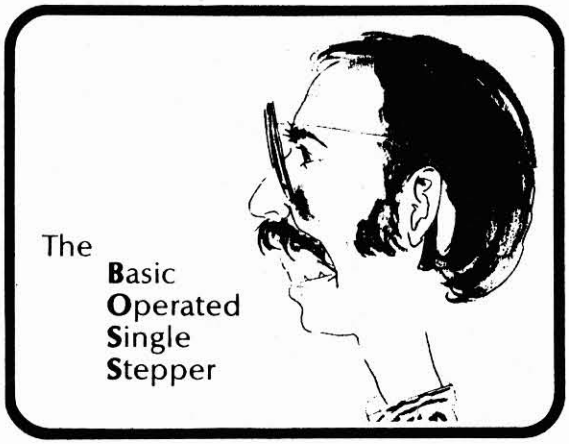

A Machine Language Debugger for your Basic programs. No other program even comes close to the power of this program.

The features are:

1. Modified Trace Function to display only 4 locations at a time in the upper right hand corner of the screen, this permits using the trace function and not destroying the screen display while the program is running. (you can also trace to the printer)

2. Single step option permits the execution of a program one line at a time and permits the checking variables to find where the problem is in your program, or to find where the program goes for those of you that are trying to modify a program to meet your needs but don't understand the program lodgic enough yet.

3. Setting break points. Permits running a program at normal speed until you reach the part in the program that you want to single step through. You can set up to 5 break points.

4. Display variables: keeps track of a select group of variables that you select (and can change at any time) and permits the examining of these. A command swaps the screen memory out to high memory and replaces it with your variable chart. Another command brings your screen memory back from high memory and it is complete (like graphics programs that are hard to continue without the graphics, can now be continued like you never stopped).

5. Stacking programs: permits you to stack one or more basic programs in high memory while you work on or run another program. You can call these programs down at any time to merge to the program that you are working. (limited only by the memory size of your machine).

This program sold on cassette for $29.95 and works in Level II or DOS (works under TRSDOS 2.1, 2.2, 2.3, NEWDOS 2.1 we do not have NEWDOS-80 yet to test) and comes with 13 page manual. Automatically relocates itself to not interfere with other machine language programs that you have in high memory.

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Level I.

Level I BASIC, along with cassette loading and saving routines and a small error message routine, is contained in about 4K of ROM. It's available immediately on power-up. No intermediate steps are needed — turn it on and start programming.

Level I BASIC is what amounts to a Tiny BASIC-like interpreter with some additions. Its statements are summarized in Table 1. An interesting feature of Level I BASIC is Radio Shack's dialect for Level I. This shorthand can effectively save a significant amount of memory, according to the manual.

Two rather severe limitations of Level I BASIC deal with DIMensions and strings. Only one DIMension, A(n), is allowed in Level I. However, since n can be any number up to the maximum available memory, it's possible to get around multiple DIMensions with a little work.

Strings are another problem. Only two string variables, A$ and B$, are allowed, and only 16 letters may be held in each. Since Level I doesn't allow string comparisons, uses for A$ and B$ are limited.

Saving and loading programs to and from cassettes are accomplished through the CSAVE and CLOAD commands. The cassette transfer rate is a rather slow, but reliable, 250 baud. During a CLOAD, two little stars appear on the video display and flash on and off if the program is loading properly. Program variables may be written to or read from the cassette using the PRINT# and INPUT# statements.

Program errors are dealt with simply. There are only three error messages: WHAT? (in which the computer doesn't understand the command); HOW? (in which the computer understands the command, but can't follow it, like a NEXT without a FOR-TO); and SORRY (in which the computer has run out of memory).

When an error occurs, the proper error message is displayed, along with a ? next to the offending statement.

The Level I users manual deserves the high praise it has been given. I recommend this manual to anyone who wants to learn BASIC, whether he owns a TRS-80 or not.

Level II BASIC

In my humble opinion, Level II BASIC is where the TRS-80 really shines. It's very easy to use, especially for an experienced programmer, versatile, powerful and pleasantly surprising.

Radio Shack's Level II BASIC is an extended BASIC written by Microsoft and contained in 12K of ROM. Table 2 summarizes BASIC's repertoire.

Unlike Level I's limited variable set, Level II allows just about anything. Variables can be composed of one letter, two letters, or a letter and a number between zero and nine. Any number of variables can be DIMensioned, and even multi-dimensional arrays are allowed. Variable names of more than two characters are allowed, but cannot contain a reserved word.

For example, while NAME is a valid variable (the computer only sees the first two letters, NA), PRINTER isn't because it contains PRINT, which would cause all sorts of problems.

Finally, any variable may be declared as a specific *type* of variable: single precision (8 digits); double precision (16 digits); integer or string. As you can imagine, quite a number of combinations are possible. Not counting DIMensions or declarations, there are around 900 variable combinations!

Level II BASIC doesn't include a shorthand like Level I, but according to the Level II manual, memory is used more efficiently with Level II than with Level I. Two abbreviations that *are* available in Level II are ? for PRINT and ' for REM.

The Operating System

Level II TRS-80s can do quite a bit more than just load and run programs.

When the computer is first turned on, "MEMORY SIZE?" is displayed. This gives you the opportunity to reserve memory for special purposes, like a machine language subroutine. The only way to unreserve this memory is turn the computer off and on again. After reserving memory, the TRS-80 enters its Command Mode and displays READY.

While in the Command Mode, I can: enter programs (from the keyboard or from tape, using CLOAD or SYSTEM); RUN programs (with a line tracing option) or modify programs (using the optional EDIT mode).

Saving and loading programs in Level II is similar to Level I, with some improvements. The Level II cassette transfer rate is twice as fast as Level I, at 500 baud. In addition, tape programs may be verified to insure a proper save, using CLOAD? and may have a one-character file name for future CLOADs. With the addition of an expansion interface, two cassette re-

Common BASIC statements in Level-II:
Those statements in Table 1, plus . . .

ASC	ATN	CHR$	CLEAR
COS	DELETE	DIM	ELSE
ERL	ERR	EXP	FRE
LEN	LEFT$	LLIST	LOG
LPOS	MID$	PEEK	POKE
POS	USING	RANDOM	RESUME
RIGHT$	SGN	SIN	SQR
STR$	TAN	USR	VAL

Radio Shack additions to Level-II:
Those statements in Table 1, plus . . .
AUTO (automatic line numbering)
CDBL (converts variable to double precision)
CINT (converts variable to integer precision)
CSNG (converts variable to single precision)
CLOAD "X" (loads program named X from cassette)
CLOAD? (verifies cassette load)
CSAVE "X" (saves program named X to cassette)
DEFDBL (defines variables as double precision)
DEFINT (defines variables as integer precision)
DEFSNG (defines variables as single precision)
DEFSTR (defines variables as strings)
EDIT (enters editing mode)
ERROR (depending on use, enters error program trap, or generates a fictitious error)
FIX (truncates variable)
INKEY$ (returns a one-character string form keyboard without pausing program execution)
INP (inputs one byte from a specified port)
STRING$ (prints a special type of string)
SYSTEM (loads and executes machine-language programs)
OUT (sends byte to port)
TRON (turns on line tracing mode)
TROFF (turns off line tracing mode)
VARPTR (returns memory address of a specific variable)

Table 2. Level II BASIC Summary

Command	Effect
n-SPACEBAR	Move cursor *n* spaces to the right.
n-←	Move cursor *n* spaces to the left
SHIFT-↑	Escape from I, H, X commands below.
L	List line.
X	Go to end of line and enter Insert (I) command.
I	Insert at current position.
A	Cancel all changes and restart.
H	Delete rest of line from current position and enter Insert (I) command.
*n*D	Delete *n* characters, starting at current position.
*n*C	Change *n* characters, starting at current position.
*n*S*c*	Search for the *n*th occurrence of character *c*.
*n*K*c*	Delete line from current position to the *n*th occurence of character *c*.
Q	Cancel all changes and return to normal operation.
E	Save all changes and exit to normal operation.
(ENTER)	Same effect as E, above.

Table 3. Level II Edit mode commands (lowercase letters indicate optional parts of a command.)

fill the screen. Normally, if there are more than 16 lines of text, the display will scroll up, eliminating the topmost lines while the new lines appear at the bottom of the screen.

Both Level I and Level II BASIC offer alternatives to this mode of operation. Common to both BASICs are the CLS, AT (@ in Level II) and SET(X,Y) commands. CLS clears the display and homes the cursor to the top left of the screen (this allows for paging text instead of scrolling). AT, when modifying a PRINT statement, prints to a specific screen location. The SET(X,Y) statement lights up point (X,Y) for graphics. RESET(X,Y) will turn the point off, and POINT(X,Y) tests to see if a point is on or off.

The 128 by 48 point resolution graphics may not be the best in the industry, but I'm sure Radio Shack had to deal with a trade-off between the ease of programming the graphics and their resolution. The ease of plotting points is directly proportional to the number of points there are to plot.

Level II computers offer several additional methods of getting information to the video display. Double-wide characters in which PRINTCHR$(23) or SHIFT→ converts the display to 32 characters per line but the screen should be cleared before this change is made or the characters currently on the screen turn to garbage. The CHR$ function prints characters, control commands or specific sets of graphics points. Finally, you can POKE information to the screen as memory.

A little bit more about this last point. If you will notice, 64 characters on a line times 16 lines make 1024 printing positions, or 1K of characters. Convenient, huh? Thinking about this for a while, what does it indicate to you? That's right, the video display is seen as memory to the computer. This permits both a formatted screen for the PRINT AT statement and the ability to POKE information directly to the video display.

Cassette Control

Included with my computer system was a Radio Shack CTR-41 cassette recorder. At the time I bought the computer, the CTR-41 was the standard issue for the TRS-80. As of this writing, computers are being supplied with CTR-80s, almost identical to the CTR-41s, except that the fast-forward and rewind buttons will work with all the remote plugs in.

Dealing with fast-forwarding and rewinding tapes proved to be easier than I thought. I didn't want to keep fooling around with the remote plugs to the cassette, so I fooled the computer into doing it for me. All I had to do was tell the computer to CLOAD (cassette load), which freed the cassette motor. I could then do anything I wanted with the recorder, pressing the RESET button to get back to normal operation.

Then I got the expansion interface and found out I couldn't do that anymore. Pressing the RESET button while the interface is connected automatically clears the memory! Any program in memory is lost. I started to hunt around for an alternative.

I found it in Micro-Mega's Cassette Control Unit. This little (2½ × 5 × 1") box gives both manual control and audio monitoring of the cassette recorder. The unit inserts itself between the computer and the cassette recorder using existing cables—there is no physical modification to either the computer or recorder. It also eliminates some of the possible ground loops that can mess up cassette recordings. Even though I've been using the unit for over eight months and admit that it has improved my cassette handling, I still haven't resolved whether it was worth the $37.50 price tag.

The Expansion Interface

Radio Shack's expansion interface is a kind of traffic cop between the TRS-80 computer and the various available peripherals. It routes signals to and from printers, disks, modems and whatever else someone

↙Reader Service—see page 178

thinks up. It contains the circuitry for driving line printers, disk drives, a second cassettte recorder and a real time clock. It also has space for up to 32K of RAM, and an RS-232-C output port, and extends the TRS-80 bus system from the computer's expansion port (to which the interface is connected), to the interface itself. It all fits snuggly under the video display.

While the expansion interface operates just fine, I have several complaints. One is the price. Three hundred dollars is a lot to pay for a box that only connects other boxes.

Another is the instruction manual. Frankly, I don't think much of it. There are several inaccuracies in the instructions, ranging from vague directions to outright mistakes. Also, there is very little in the manual about the actual operation and uses of the unit.

Finally, the real time clock is awkward to use without a disk. While the clock is on, the cassette recorder can't be used either.

The Quick Printer

In contrast to the expansion interface, I'm very pleased with the Quick Printer (actually a disguised Centronics P-1). This little (4¼ × 13 × 10½") guy can do things some of Radio Shack's bigger, more expensive printers can't do.

As with the Screen Printer described earlier, the Quick Printer uses four-inch wide, aluminum-coated paper. The Quick Printer is electrostatic—the aluminum is burned off the paper, exposing a black backing. While this method looks kind of funny and may not be appropriate in some situations, it's cost-effective (cheaper than a $1200 line printer), versatile, and the aluminum paper makes excellent plain paper copies.

Like the other Radio Shack line printers, the Quick Printer prints only when it's told to, using the LPRINT or LLIST statements. It's possible to print one thing to the video display, while something completely different may be going to the printer.

Unlike other line printers, there are quite a few suprising features only the Quick Printer has. The Quick Printer can print both upper and lowercase letters. Yes, it *is* possible to get lowercase out of an unmodifed TRS-80. And it can print in three different, software selectable modes, no less. Also, software selectable is an audible signal and an underlining capability.

The manual supplied with the printer is very thorough. Topics covered include the different software codes, the theory of operation and maintenance. An abrasive cleaning paper is even included. Very nice.

Level I BASIC

Although I bought a Level II TRS-80, the Level I manual was generously included with my package. In addition, I recently purchased a Level I overlay for my unit, so I think I can speak with a little knowledge about

Common BASIC statements in Level-I:

ABS	CONT	DATA	END
FOR/NEXT/STEP	GOSUB	GOTO	IF/THEN
INPUT	INT	LET	NEW
ON/GOTO/GOSUB	PRINT	READ	REM
RESTORE	RETURN	RND	RUN
STOP	TAB		

Radio Shack additions to Level-I:
CLOAD (load program from cassette)
CLS (clear video screen)
CSAVE (save program to cassette)
INPUT# (input *data* from cassette)
MEM (amount of RAM left)
POINT (graphics on/off test)
PRINTAT (print to specific video location)
PRINT# (saves *data* to cassette)
RESET (turns off graphics point)
SET (turns on graphics point)

Table 1. Level I BASIC Summary

corders may be used. Machine language programs can be loaded and run using the SYSTEM command.

If a program is being entered from the keyboard, an automatic line numbering option, AUTO, is available. Using AUTO, the first line number and the increment between lines can be specified. AUTO 100,25, for example, will generate line numbers of 100, 125, 150, etc.

Anyone who has done any programming at all knows what frustration debugging a program can cause. Only superior self-control has kept me from bashing a computer or a terminal to bits on more than one occasion.

Level II offers a couple of sane alternatives—TRACE and EDIT. TRACE displays the line numbers being executed on the video display. This lets me know if my program is running the way I want it to. EDIT does just what the name implies—selectively inserts and deletes information from a line listing. The EDIT subcommands are listed in Table 3.

While the subcommand itself is not displayed, its effects are immediate. I would estimate my program debugging time has been cut a fourth or a half using the combination of TRACE and EDIT.

Error-Handling

Level II's error handling is far superior to Level I's. ON ERROR GOTO in a BASIC program allows me to trap errors within a program, correct them and continue, without ever stopping the program. There are almost two dozen error messages in Level II, compared to Level I's three.

Level II error messages are summarized in Table 4. Normally, when Level II comes across an error in a program, it specifies the error and what line it occurred in. If there is no error trap within the program, it stops executing.

Syntax errors are the exception—they cause the computer to stop and automatically enter the EDIT mode!

The Last Word

I've really been pleased with my TRS-80. While I may have lingered on some problems I've had with it, they are minor, compared with the overall operation of the system. ■

References

Cowan, "A Look at TRS-80 Peripherals," *Microcomputing*, April, 1979, p. 22.

King, "TRSpeed-up," *Microcomputing*, Sept., 1979, p.138.

Rugg, Feldman, "Basic Timing Comparisons," *Microcomputing*, June, 1977, p. 66 and October, 1977, p. 20.

Radio Shack, *User's Manual for Level I.*

Radio Shack, *Level II Basic Reference Manual.*

Code	Abbreviation	Meaning
1	NF	NEXT without FOR
2	SN	Syntax error
3	RG	RETURN without GOSUB
4	OD	Out of data
5	FC	Illegal function call
6	OV	Overflow
7	OM	Out of memory
8	UL	Undefined line
9	BS	Bad subscript (out of range)
10	DD	Redimensioned array
11	/O	Division by zero
12	ID	Illegal direct
13	TM	Type mismatch
14	OS	Out of string space
15	LS	String too long
16	ST	String formula too complex
17	CN	Can't continue
18	NR	No RESUME
19	RW	RESUME without error
20	UE	Unprintable error
21	MO	Missing operand
22	FD	Bad file data
23	L3	Disk BASIC only

Table 4. Level II Error Messages

✓Reader Service—see page 178

Even though the machine is basically the same, several modifications are available from Radio Shack.

Modification Update

Scott Richards
Address withheld
by request

Occasionally, I sit back during a quiet evening and consider the recent history of technology, especially electronics.

Although I am a rather young chap, approaching my mid 30's, I can remember when television sets really hit the market, when solid state portable radios made their entrance, as well as the hydrogen bomb, the first man-made satellites in orbit. I can also remember the invention of the LASER a mere 19 years ago, when men landed on the moon, when a 7400 TTL I.C. cost $2.50, and an 8080 microprocessor I.C. cost $350.00 – and that was only about five years ago.

Nowadays, if you shop judiciously, you can pick up an I.C. for five bucks. That same five bucks will buy you a calculator that would have cost you $150.00 seven years ago.

Micro Proliferation

What does all this mean to us consumers, especially since we have a keen interest in microcomputing? For one thing, with several single-board micros for sale at a price significantly less than that 8080 of five years past, small businessmen can purchase a computer without fear of bankruptcy. Schools and other institutions can buy several and include them in courses at lower and lower grade levels.

Best of all, you and I can even afford one.

Although it had many predecessors, no single entry in the field of microcomputers has generated so much interest as Radio Shack's TRS-80, and we are seeing little more than the tip of the proverbial iceberg.

It's been nearly two years since the introduction of the TRS-80. In that time, while the basic computer has remained essentially unchanged, Radio Shack has made several improvements, all of which are available to TRS-80 customers at no charge. Radio Shack has either published news of these improvements in their *Microcomputer Newsletter* or made them available to customers through their retail store and Computer Centers.

I mention this because I have seen a great deal of misinformation and missing information in articles in many publications, and I feel that a review of these improvements might benefit those who have not heard of them, or have been misinformed.

The Radio Shack Microcomputing Newsletter I mentioned is an informative monthly bulletin containing programming hints and new product releases for TRS-80 users. It's free to owners, and if you've bought a TRS-80 and are not receiving it, I suggest you get in touch with a Radio Shack Company store or Computer Center. Or write a letter including your name, address, type of equipment and serial numbers to *Microcomputer Newsletter*, 700 One Tandy Center, Fort Worth, Texas 76102.

Some Improvements Reviewed

● If you own a Level II BASIC TRS-80, are experiencing cassette loading problems, and your computer does not have Radio Shack's cassette load modification, then your CPU may be sent to have the modification installed.

If you take it to a company Radio Shack store, it will be sent to the appropriate repair center. If you live near a Radio Shack Computer Center, the work can be done there.

Be sure to remember this modification is made to the computer keyboard and *not* to your tape recorder, as was mistakenly indicated in a recent issue of the newsletter.

All current production Level II computers have the modification already installed and can be identified by a –1 suffix to the catalog number on the bottom label. If there is a stamp or any reference to XRX-III on the bottom, that also indicates the modification. XRX-III is the nomenclature of the added PCB. The modification should eliminate all loading problems.

I also suggest you use a volume level on your tape recorder halfway between that recommended for Level I and Level II and never touch the volume control again.

● If you use a model CTR-80 tape recorder, then look in the battery compartment at the date code label. If it precedes 3A9, then there is a possibility of a glitch being written to tape under certain conditions. This can easily be remedied at no cost to you. Once again, it will have to be sent to a Radio Shack repair center via a Radio Shack store or taken to a Computer Center.

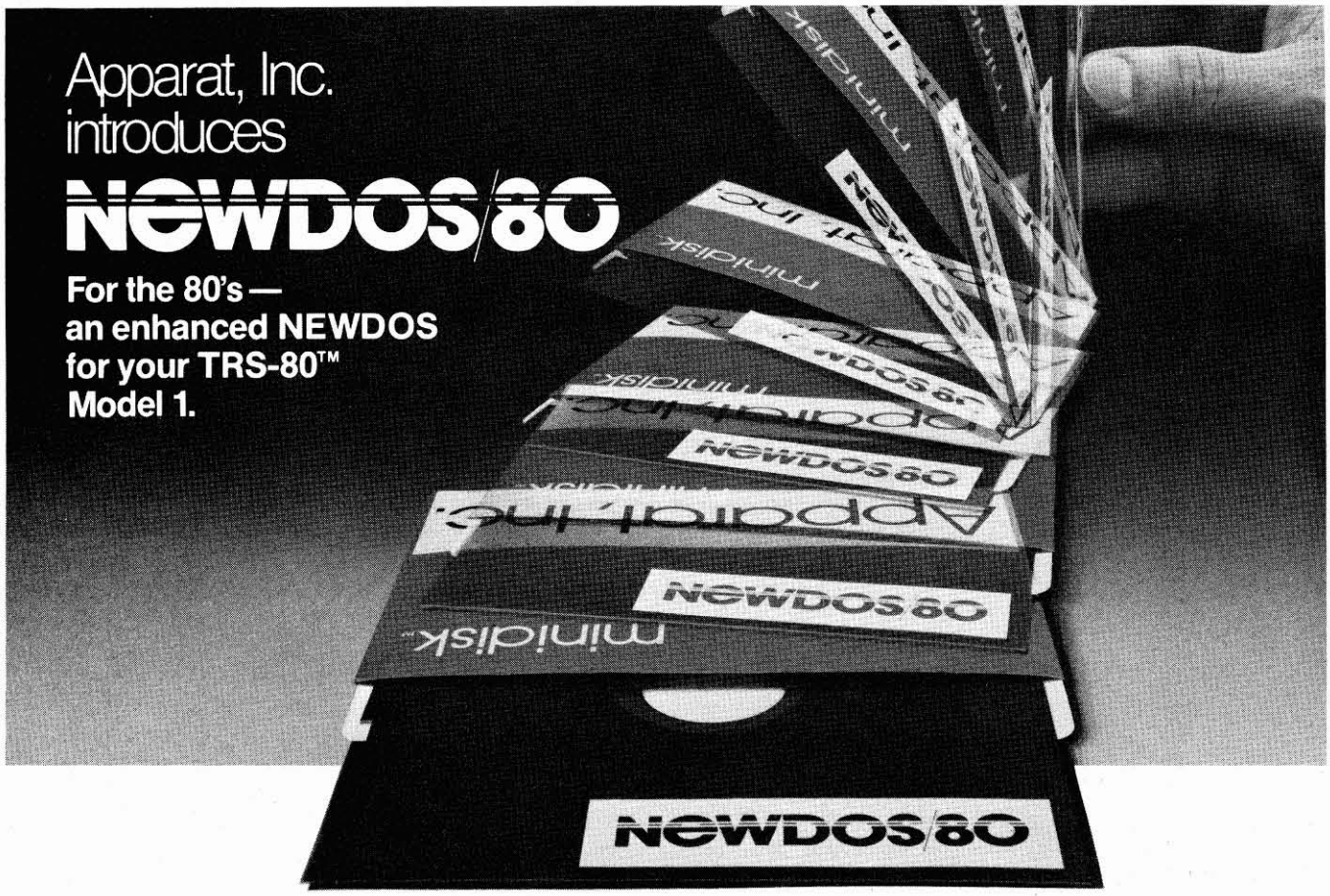
● How many times have you pressed a key that resulted in multiple entries of the character? Hmmm, almost thought you had a TRS-80 with a unique feature—repeating characters!

Unfortunately, this is most unwanted, and something can be done about it. The cause of the problem is dust and other airborne contaminants between the switch contacts under the keycaps. Though it's not a permanent fix, some type of cover should be used on the CPU when it is not in use. I suggest you buy or make yourself a cover, or at least lay a dust free cloth over the keyboard.

Remember to allow the unit to ventilate when powered up or you may find yourself in need of more than just a factory update! Also, try to keep your system a reasonable distance from heat vents and other air ducts. They

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.
- Device handling for routing to display and printer simultaneously.
- CDE function; simultaneous striking of the C, D and E keys will allow the user to enter a mini-DOS to perform some DOS commands without disturbing the resident program.
- Upward compatible with NEWDOS 2.1 and TRSDOS 2.3.
- Includes Superzap 3.0 and all Apparat 2.1 utilities.

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. Previous NEWDOS owners may receive full trade in allowance toward the purchase of NEWDOS/80 by including with their order the *serial number* of their NEWDOS 2.1 diskette, the *price paid* and *where purchased*. In most cases that purchase price will be subtracted from the price of NEWDOS/80. As with NEWDOS 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.

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M 0/1

✓Reader Service—see page 178

are dust blowers.

Radio Shack provides machine language software with all new Level II computers to use if keybounce becomes a problem. The cassette also includes a program activating the Real Time Clock in the expansion interface and is available to customers with Level II TRS-80's delivered before the origination of the keyboard debounce software.

Clean Your Keyboard

A simple alternative to the debounce software is to clean your keyswitch contacts (did I say "simple"?). Of course, this can apply to both Level I and Level II computers, though keybounce problems are relatively rare with Level I machines.

Each keyswitch mechanism consists of a keycap, plunger, spring and two leaf spring type contacts, one solid and one trifurcated (three separations resulting in four fingers). A partition in the plunger keeps the contacts separated until the key is depressed, the partition moves downward, out of the way, and the contacts close.

The keybounce problem occurs when dust or smoke, for example, on the contacts allow them to "make" or "break" two or more times during only one keystroke.

I have seen several suggested methods for cleaning these contacts. Since they each require inserting some device or material between the contacts, I am afraid that some of you will meet with disaster and be left with copper spaghetti where your contacts used to be. For the benefit of the uninitiated, your contacts are VERY DELICATE!

The safest, most effective method I have found is to:

1. Gently remove the key cap using direct, upward pressure only. Pry the cap from the sides.

2. Thoroughly saturate a cotton swab with alcohol. (Ethyl is best, methyl is very good, isopropyl will do.)

3. Carry a very large drop of alcohol on the swab and gently touch it to the top of the contacts, allowing the alcohol to flow to wash them clean.

4. Move the plunger up and down with your finger a few times while the contacts are still wet. Be careful not to damage the contacts with your finger.

5. Replace the key cap and check for keybounce. A second drop may be necessary for stubborn cases.

Do not be concerned about the excess alcohol, as it will evaporate quickly and not damage anything. I suggest you clean your keys as infrequently as possible and only the ones that need it. Also, should a plunger come out as you pull the keycap, separate them before putting the plunger back. Make sure, when inserting the plunger into the housing, that the spring is properly located inside and that the partition separates the contacts without damaging them. Then go ahead and press the plunger down into the housing until the retaining tabs catch.

Of course, all this is rather academic if you are using a disk system with TRSDOS version 2.3. It contains a keyboard debounce routine that is automatically loaded and activated on power up. If you are still using an older version, the debounce software can be transferred from tape to disk.

● If you are using a TRS-80 Expansion Interface, especially with additional RAM, then two modifications should be of interest to you. The first is a buffered cable.

Originally, the expansion interface utilized a flat ribbon cable between it and the CPU. The buffered cable was added later to improve its operation.

More recently, another improvement was added in the form of a grey cable with a DIN type connector on it. This is used in conjunction with the buffered cable and is installed in both the CPU and expansion interface. Both the buffered cable and the DIN connector have to be installed at a Radio Shack repair center or Computer Center.

Alarm Project

Wouldn't it be nice to start running a lengthy program, get up and do something else and not have to worry about when to INPUT some more data? A super simple home-brew project yields a very handy device for your TRS-80—an audible alarm. You can't get any more simple than a piezoelectric buzzer and one transistor and still have your silent partner get your attention from another room. It connects to the AUX IN plug of your tape recorder.

The device operates parallel to the cassette data output line going into the AUX input of your tape recorder (Fig. 1). You can leave it on line permanently, as it does not interfere with the data transmission to the recorder.

Obviously, you could build the device into the CPU and eliminate the cabinet, miniature phone jacks and battery. It makes for a neat installation, but also voids any warranty you may have on your computer; so, proceed at your own risk.

I suggest using an external enclosure. The circuit operates simply. Transistor Q1 serves as a saturated switch to enable current to flow from the nine volt battery to the piezoelectric buzzer. This is accomplished with some very easy and brief software commands that you can alter to respond differently at different prompts.

But how are we going to turn on an external device using a cable that provides data to the input of a tape recorder?

Inspect the schematic of your computer. Data is transferred from the computer to the outside world via a flip-flop. It just so happens that the Q output of this flip-flop is biased in such a way that when the Q output is high, the DC voltage at the cassette jack (output pin, of course) is at approximately 0.8 volts. When the Q output goes low, so does this DC voltage, to about 0.4 volts.

Here we are with a DC voltage that is going from a level below the threshold voltage required to turn on a silicon PN junction (0.6–0.7V) to a level just above. All we have to do now is type the appropriate software command to change those voltage levels, and the alarm will sound.

Construction is also simple. Use a small piece of perf board or a terminal strip. I have glued the transistor to the back of the buzzer's plastic case with instant bonding adhesive, soldered the appropriate wires to the transistor leads and insulated the connections with heat shrink tubing.

A piece of PVC tape to hold the leads on the back of the case helps to keep them from breaking, should the wires be moved around excessively. A terminal strip is probably the safest and easiest method.

Drill two holes in the box to accommodate the miniature phone jacks. Mount the buzzer, terminal strip (etc.), battery and phone jacks into the cabinet. Wire the circuit; construct a reasonably short length of audio cable with a miniature phone plug on each end to go from the alarm to the AUX input on the recorder, and you're in business, that is, if you wired it correctly. Double check your wiring and connections.

The cost depends entirely on your "junk box" and how dressy you want your alarm to be. If you have to buy everything (parts list), you can expect to spend approximately $10 to $12.

Software Commands

The software to drive this little rascal is easy. I'm sure you remember the TRS-80 uses a

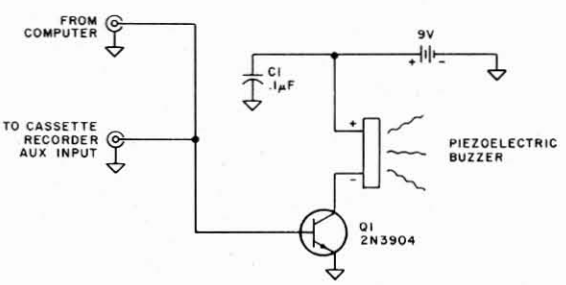


Fig. 1. Alarm Schematic

memory mapped system of addressing, but it does utilize one port and one port decoder for the recorder, 255_D (FF_H). From this we derive the following BASIC commands:

```
OUT 255,1—Turns alarm on
OUT 255,0—Turns alarm off
```

Using these commands in conjunction with some FOR-NEXT timing loops, we can make the alarm sound in any sequence we prefer. For example, consider the following program lines:

```
40000 OUT 255,1:FOR A = 1 TO 450:
NEXT:OUT 255,0
```

This causes the alarm to sound a steady tone for approximately one second.

```
40000 FOR A = 1 TO 5:OUT 255,1:
FOR B = 1 TO 100:NEXT:OUT 255,0:
FOR B = 1 TO 100:NEXT B,A
```

This causes the alarm to sound five brief pulses (approximately 1/5 second) with the length of time between pulses equal to the length of the pulses.

With just a little imagination, you can write software to create any tone sequence you want. The most practical applications that come to mind are several subroutines for different tone sequences to let you know when to input additional data, when a program execution has ended, when an error has occurred or when game sound effects are needed.

If you are using an expansion interface with your system either one of its cassette jacks (for recorder one or two) may be used, if the cassette select relay in the expansion interface is in the appropriate position.

This is no problem if you use the BASIC statement POKE 14308,X, where X = either 0 or 1. If X = 0, then cassette jack one is selected and remains selected until another command changes it—whether it be another POKE statement or a regular cassette command. Of course, X = 1 selects jack two.

There are a couple of things you should remember with regard to the alarm. The signal generated in the computer to select either 64 characters per line or 32 c.p.l., called MODESEL, can be affected by an OUT 255,X command.

If you activate your alarm while in the 32 c.p.l. mode, the computer reverts to 64 c.p.l. This is not disastrous, of course, but it may save you some frustration when trying to dress up your display with 32 c.p.l., while the alarm is sounding.

Also, during a CSAVE operation you can hear the data being sent to the cassette. Although the alarm's volume is much reduced, some may still find the noise objectionable.

If so, a switch can easily be added to the battery and the alarm completely disabled when data is sent to the recorder. You could also, more simply, disconnect the alarm from the computer during these operations.

You might note that the current requirements for the full alarm (the unit I built) are approximately 9 mA, and 4 mA with data being transferred.

There you have it! Good luck with your alarm—it's one of the slickest items I have ever added to my TRS-80. ■

Note: Some TRS-80s are now appearing with a different keyboard, which can be recognized by its somewhat concave surface. This keyboard uses capacitance type switches, is sealed and should never need cleaning. Any attempt at removing a keycap will result in permanent damage.

Qty.	Item	R.S. Catalog #
1	Piezoelectric buzzer	273-060
2	Miniature phone jack	274-297
2	Miniature phone plug	274-286
1	Terminal strip (perfboard, etc.)	274-688
1	9 V Battery connector	270-325
1	NPN transistor (2N3904)	276-2010
1	.1 uF Capacitor	272-135
1	9 V Transistor type battery (alkaline)	
1	Cabinet (or box)	
1	Short length shielded audio cable	

Parts List

Find out how to use random and sequential access for your disk system.

Disk Files

William O'Brien
11 Dongan Place
New York, NY 10040

If you can believe anything in these days of intensive advertising hype, then believe that if there is any "real power" hidden somewhere inside a TRS-80 it's hiding inside the expansion interface, in the confines of the disk controller chip.

The disk function of the TRS-80 allows the volume manipulation of data at speeds which are phenomenal, compared to the capabilities of the cassette based system. However, disks necessitate the precise use of language patterns to efficiently achieve their potential.

Data Files

There are two modes available to us for handling data files through Disk Basic. One is termed sequential and the other random. For the simple storage of programs, a cassette based system is more than adequate.

However, when one is working with data files, the shortcomings of cassette files are glaring. Waiting for data at the end of a half hour data tape or continually rewinding tape is dull and wastes time. Add to that the shortcomings of changing between program and data cassettes and the only conclusion for the serious TRS-80 user is that a disk based system is a must.

With Disk Basic simple program storage and retrieval is accomplished with the SAVE and LOAD commands.

The complicated part is the handling of data files which cannot be simply LOADed or SAVEd. The simplest method of handling data files is through sequential access techniques, which allow data to be placed on the diskette one datum at a time as it becomes available.

The computer contains 15 buffers or holding areas where it stores data. Each of these buffers holds 256 bytes of information, or one 255-byte string.

Information contained on the diskette is stored in units termed granules. Each granule is composed of five sectors.

Because a sector is a 256-byte storage bin, all data files occupy at least 1280 bytes of storage space, whether or not the actual length of the data is that long.

Assume you are working for a research scientist who has been gathering data to find a correlation between the height, weight and age of people. He has assigned you to enter all the data into a TRS-80. Your program might look like this:

```
10   CLS
20   OPEN "O",1,"RESEARCH"
30   PRINT "RESEARCH DATA PRO-
     GRAM"
40   PRINT
50   PRINT "TO END PROGRAM TYPE
     IN A NUMBER LARGER THAN 200
     FOR 'AGE'"
60   PRINT @ 320,"1. AGE?";
70   INPUT A:IF A>200 then 1000
80   PRINT @384,"2. HEIGHT (USE
     FEET.INCHES)?";
90   INPUT H
100  PRINT @ 448,"3. WEIGHT?";
110  INPUT W
120  PRINT#1, A;H;W;
130  CLS
140  GOTO 30
1000 CLOSE 1: END
```

The program puts you into an endless loop that inputs and stores all the data you have until you terminate it by typing in a number larger than 200 in answer to line 70.

> **" . . . the only conclusion for the serious TRS-80 user is that a disk based system is a must."**

Let's analyze the program to find out exactly what it is you are doing.

Program Analysis

All modes of file storage require that you first open one of the 15 available buffers. Sequential access requires that you specify whether the buffer will output or input the information. All access modes require a named file. Line 20 opens buffer number 1 for output (the 0 specifies this) from the buffer into a disk data file named Research.

Lines 60 through 110 accept the data from the keyboard. The specification, "USE FEET. INCHES" in line 80 lets us keep this as a numerically oriented file.

Line 120 is similar to a cassette print, printing the contents of buffer number 1 onto the disk. Line 140 loops the program back for more information. The conditional in line 70 ends the program with a jump to 1000 when the correct prompt is received.

Suppose our researcher decides the state of residence also has some bearing on the data. Attempting to program this additional data, we add the following:

```
112 PRINT @ 512,"STATE OF
RESIDENCE ?";
114 INPUT S$
```

To correctly recover a string entry, when the computer inputs from the disk, it must see the string within quotation marks. The quotation marks must be stored in forms that the computer recognizes as delimiters. To do this we must use the decimal control code for the quote character, 34. Line 120 therefore looks like this:

```
120 PRINT#1,CHR$(34);S$;CHR$(34);A;H;W;
```

The computer understands that CHR$(34) is a quotation mark and reads the enclosed word as a string with the appropriate delimiters.

Now our employer says, "Could you please print all that information out for me?" We do it like this:

```
10 CLS
20 OPEN "I",1,"RESEARCH"
30 IF EOF(1) THEN 1000
40 INPUT#1, S$,A,H,W
50 LPRINT S$,A,H,W
60 GOTO 30
1000 CLOSE 1: END
```

Line 20 opens the file for input (the I) to buffer number 1. Line 30 tells the computer that if it has reached the end of the data contained in the file (EOF is End Of File), then it can take a break.

Lines 40 and 50 input the data into the buffer and print it on your printer. Line 60 loops it back to look for the EOF, and if it finds it, line 1000 closes the buffer (and also the file) and ends the program.

Several words of caution in using CLOSE statements in the sequential access mode: Only close a buffer (and therefore the file) of an OUTPUT coded OPEN statement after you have stored all the data you want to store. Once CLOSEd, any attempt to OPEN a buffer for output to an already existing file will erase the contents of that file.

Always CLOSE a buffer and file before KILLing it. If you don't, you will scramble the diskette beyond human comprehension.

I just finished telling you that you can't reOPEN a buffer for output to an already existing file, and your employer comes in to say he found 20 more pages of data. To accomplish this addition use two buffers, one to input the data from the previously closed file and the other to write it to a new file.

If all you do when the computer asks 'How Many Files?' is press the ENTER key, the computer will automatically assume you will not exceed three files. This is called the default value. With only two buffers used, we have not exceeded this value.

This program combines elements of both of the previous programs:

```
10 CLS
20 OPEN "I",1,"RESEARCH"
30 OPEN "O",2,"RESEARCH/TWO"
40 IF EOF(1) THEN 1000
50 INPUT#1, S$,A,H,W
60 PRINT#2,CHR$(34);S$;CHR$(34);
   A;H;W;
70 GOTO 40
1000 CLOSE 1
1010 PRINT "RESEARCH DATA PRO-
     GRAM"
1020 PRINT
1030 PRINT "TO END PROGRAM ENTER A
     NUMBER LARGER THAN 200 FOR
     'AGE'."
1040 PRINT @ 320," 1. AGE ?";
1050 INPUT A: IF A 200 THEN 2000
1060 PRINT @ 384," 2. HEIGHT ?";
1070 INPUT H
1080 PRINT @ 448," 3. WEIGHT ?";
1090 INPUT W
1100 PRINT @ 512, " 4. STATE OF
     RESIDENCE ?";
1110 INPUT S$
1120 PRINT#2,CHR$(34);S$;CHR$(34);
     A;H;W;
1130 GOTO 1010
2000 CLOSE 2: END
```

Lines 20 and 30 OPEN the two buffers we need, one for inputting the old data file, RESEARCH and the other for outputting the new file RESEARCH/TWO. The extension TWO is used in this case to keep the programs from becoming confused and causing a possible disk I/O error.

Again, line 40 is a trigger line in case all of the data in our original file has been read in. If so, it sends the program to line 1000 which CLOSEs the first buffer, since we are finished with the input operation.

Lines 50 and 60 take the raw data out of the first file and print it into the second. If we haven't reached the end of the data then the program loops back to line 40 again. Lines 1000 through 2000 are virtually the same as the original program that we used to print the data to disk.

Now you see, data files aren't that difficult to handle in sequential access. What bothers some people is the timing involved in this particular access mode. If you have typed in 100 or 200 groups of data, to retrieve the 187th group of the series, you must go through the other 186 groups before you can retrieve the 187th. If you find that you have to do it consistently, it becomes tedious.

Random Access

To overcome this fight with ennui, there is another method of file storage available to us through the TRS-80, random access. In general random access is a highly structured mode, requiring the clear and exact definition of variable length. Although it allows for only string storage, it provides a method of converting numeric data to a generally more compressed string format.

Let's go back and refile all our data using random access techniques. You needed three numeric values: one for the height; one for the weight; and one for age. You also needed a string input for the state of residence.

To maintain efficiency with random access we utilize an entire buffer of information, or as many of the 256 bytes in the buffer as we can. To do this, we organize the buffer into fields of strings. (Remember, there are no numeric values *per se* in this mode.)

The state of residence is already input as a string, S$. We still must define its field length.

Let's assume, for no specific reason, that the maximum length of S$ will never exceed 17 characters. Next, you must define the age value. 'A' is a numeric character set and as such is not allowed. But three operations can be performed on 'A' to change its nature.

If you have been using Level II, you probably are familiar with the STR$(n) function. This operation changes a numeric value to a string. Disk Basic has three similar functions that convert a numeric value into a two- four- or eight-byte string. These are the MKI$(n) for use with integers that do not exceed ±32768, MKS$(n) for single precision numbers and MKD$(n) for double precision numbers.

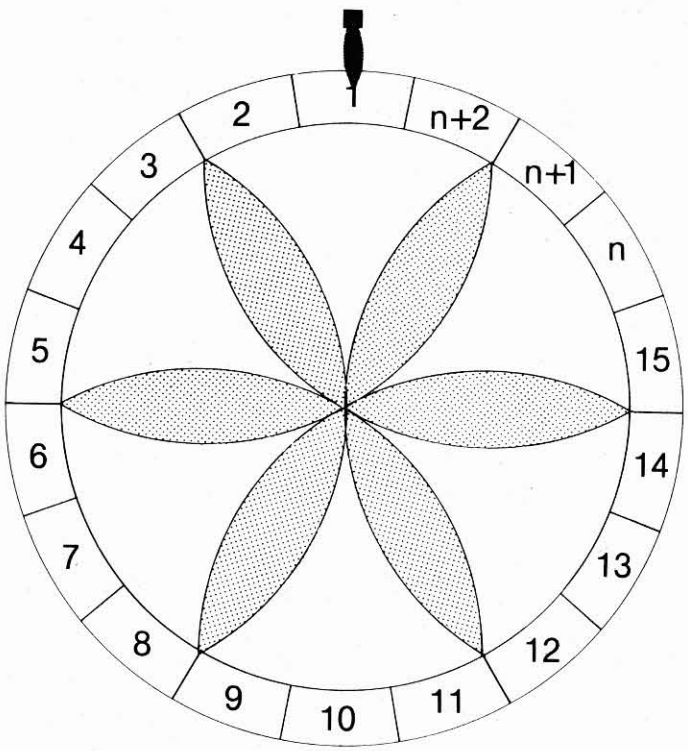
Practically, the range of 'A' will not exceed 125. Nor will you use fractional year values. You can therefore use the integer function on 'A'. This means that we will have a string value, MKI$(A), whose length is two bytes.

Height is inputted as a decimal number, so it does not fullfill our integer requirement. However, since it will always be in single precision form, you can use that function to create a string MKS$(H) with a length of four bytes.

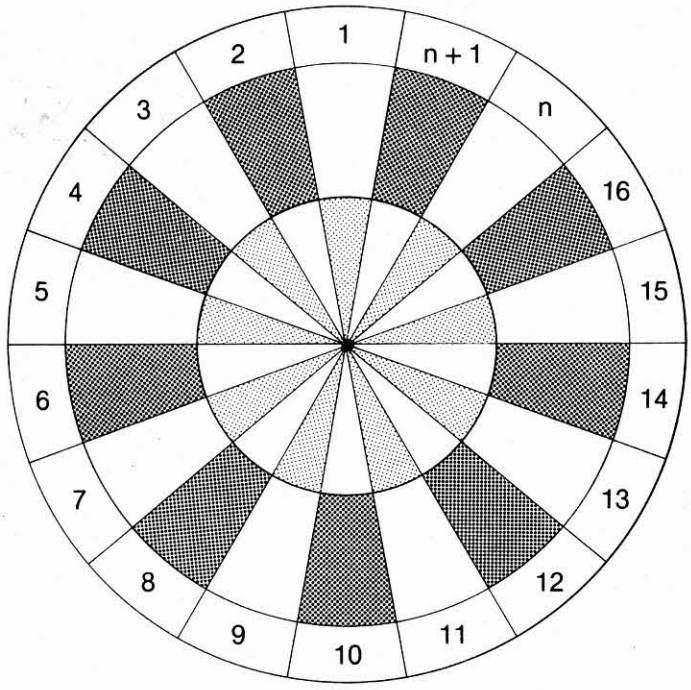
Weight will also always be an integer value, giving us the string MKI$(W), with a length of two bytes.

So we have S$, 17 bytes long; MKI$(A), two bytes long; MKS$(H), four bytes long and MKI$(W), two bytes long.

In order to FIELD (set up the field dimension for the specified buffer) you have also to name



Sequential retrieval is similar to a wheel of fortune because a data file is retrieved by passing through all preceeding data files.



Random retrieval uses the dart board approach: All data files are available, if you know how to use the "dart".

the fields you intend to use. We *cannot* use the names of the variables as the field names, because the field names are dimensional specifiers.

```
10 OPEN "R",1,"RESEARCH"
20 FIELD 1, 17 AS ST$, 2 AS A$, 4 AS H$, 2
   AS W$
```

The AS in this case is used to tell the computer that *n* is the length of the field named whatever name we have chosen. But we've got another problem here.

Random access handles only buffers full of information, a total of 256 bytes at a time, nothing smaller. The total length of our variables is only 25! That means that we are wasting 231 bytes of information. There's more structuring that will solve this too.

In Level II Basic you learned to handle groups of data in matrix form. You can take the length of each element defined in our field length statements and use a matrix.

We have 25 bytes of storable material and a 256 byte room to put it in. Efficiency dictates that we put 10 groups of data in the buffer each time.

Let's write out the lines first, and explain them later.

```
10 FOR PN = 0 TO 9
20 FIELD 1, (PN * 25) AS P$, 17 AS ST$(PN),
   2 AS A$(PN), 4 AS H$(PN), 2 AS W$(PN)
30 Next PN
```

Line 10 set up the dimension of the matrix: a 10 element matrix, zero to nine inclusive.

Line 20 is the organizational statement for the FIELD. P$ is a dummy variable that consists of the length of PN*25 that keeps moving the buffer pointer up past the last entered group of 25 bytes.

At the start, when PN = 0, you are at the beginning of the buffer. As PN is incremented, the pointer keeps pace, always 25 bytes ahead of its last value.

P$ is never included in the buffer value, since you never assign it its own value. It simply points. ST$(PN), A$(PN), H$(PN) and W$(PN) are all valid field names, organized into matrix format.

Let's shuffle some lines and see what happens:

```
10 OPEN "R",1,"RESEARCH"
20 FOR PN = 0 TO 9
30 FIELD 1, (PN*25) AS P$,17 AS ST$(PN),
   2 AS A$(PN), 4 AS W$(PN), 2 AS H$(PN)
40 NEXT PN
```

Now that you've FIELDed the buffer, fill it with data. Simple input statements can be used:

```
50 PRINT "RESEARCH DATA PROGRAM"
60 PRINT
70 PRINT "TO TERMINATE PROGRAM
   ENTER A NUMBER LARGER THAN
   200 FOR AGE"
80 PRINT @ 320,"1. AGE?";
90 INPUT A; IF A>200 THAN 2000
100 PRINT @ 384, "2. HEIGHT (USE
   FEET.INCHES)?";
110 INPUT H
120 PRINT @ 448,"3. WEIGHT?";
130 INPUT W
140 PRINT @ 512,"4. STATE OF
   REDISDENCE?";
150 INPUT S$
```

Now that you have all the data for the first group, how do you tell the computer this data has to be set into the buffer and at which point?

There are two ways. Disk BASIC provides us with two functions, LSET and RSET. Essentially they are the same, with the only difference being one of esthetics.

If, for instance, we input "IDAHO" as the state of residence, we might note that it is not 17 characters long as our FIELD statement requires. RSET or LSET solves this dilemma.

If we had LSET ST$ = S$ and S$ = "IDAHO" as one of our program lines, then the computer understands you wish to place the value S$ into the field specified by ST$. In this specific case, the computer checks out the length ST$ should have and then sets S$ into that field at the *left* of its length and fills any remaining places with blanks.

If we used RSET instead, then the *last* five bytes of the field ST$ are filled with S$ and the leading 12 bytes are set with blanks. The choice is a personal one in most programs.

You can place data where you want it (in which element of the matrix) with another FOR-NEXT statement:

```
75 FOR PN = 0 to 9
```

and continue where we left off:

```
160 LSET ST$(PN) = S$
170 LSET A$(PN) = MKI$(A)
180 LSET H$(PN) = MKS$(H)
190 LSET W$(PN) = MKI$(W)
200 :
210 NEXT PN
```

Writing Data to Disk

But how do you put the data onto the disk?

With Disk BASIC any buffer opened with the "R" option (for random access) may have its contents written to the disk by using a PUT statement. In our program, the line would look like this:

```
220 PUT 1
```

This directs the computer to PUT the contents of buffer one onto the disk.

Optionally, you can select a file number and complete the statement: PUT 1, *n* where '*n*' is any integer from 1 to 335 inclusive, depending on the space available on the disk. In our case, that means a maximum of 3,350 data groups available for storage.

Knowing what data is where is important when you need it later. However, if we don't supply a number, the computer will assume that the first random file accessed is number one and increment that number by the value of one each time the file is accessed. If you chose to supply the file number, you too, must increment its value each time you PUT additional data onto the disk.

Now, conclude your storage program:

```
230 GOTO 55
2000 IF PN = 0 THEN 3000
2010 S$ = "":A = 0:H = 0:W = 0
2020 MC = PN: FOR PN = MC TO 9
2030 FL = 1: GOTO 160
```

Here's where you fill that blank line 200 that I know you've been wondering about:

```
200 IF FL = 1 THEN 2040
```

Continue with:

```
2040 NEXT PN
2050 PUT 1
3000 CLOSE 1: END
```

Line 230 sends the computer back into a loop to acquire more data. If there is no more, it jumps to line 2000. This line determines if a buffer has just been PUT to disk or not. If PN = 0, it means that you have just PUT the buffer, and it will branch to line 3000 which ends the program. If PN is greater than 0, you proceed with the 2000 series

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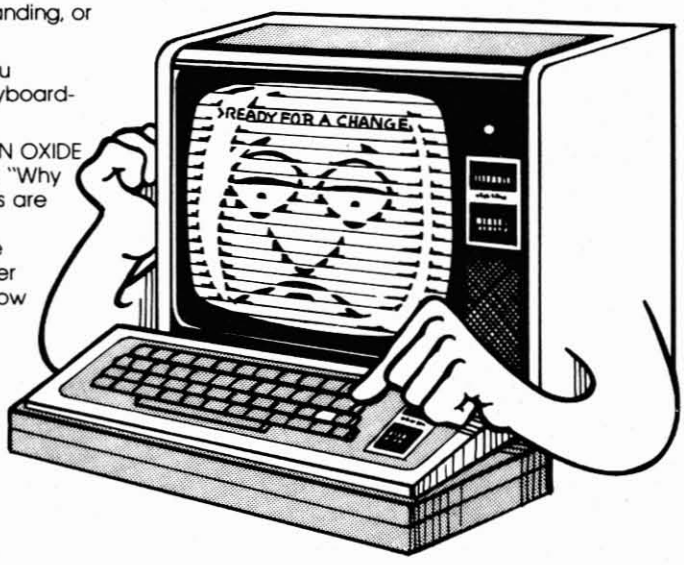

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✓Reader Service—see page 178

statements.

If you were to simply PUT the last LSET information and close the buffer, the TRS-80 would assume that the last set of information higher than the current PN value was to be included in the present file (that is, all of the last matrix values higher than PN).

Line 2010 sets all values to null or zero. Line 2020 creates a new start value for the PN FOR-NEXT statement. Line 2030 sets a flag FL, to be used in line 200 as a pointer and sends the program on to line 160 to complete the data LSET. After that, line 2050 PUTs the completed buffer. The buffer is closed in line 3000 and the program is ended.

Let's say our employer isn't sure the correct data is entered for the 1895th group. He wants us to retrieve the data and check it out.

First, determine the relationship of any one group of data to the total number of data files. If you have stored, in total, 2000 data groups, at 10 groups per file, you have 200 files. If you wish to find one particular data group, the 1895th group, then its position is given by these formulas:

```
FN = INT(DN/10) IF FN<>DN/10
    THEN FN = FN + 1
PN = (DN – (INT(DN/10)* 10)) – 1
    IF PN<0 THEN PN = 9
```

Where DN is the data group number we wish, FN is the file number that contains that group, and PN is its position within the file.

This means if we want data group number 1895 we can find it this way:

```
FN = 189 = INT(1895/10)
```

Remember, we started our matrix at 0, not at 1. Since INT(1895/10) does not equal 1895/10, FN = 189 + 1 = 190; and PN = 4 = (1895-1890) – 1. Data group 1895 is contained in file number 190 at position four. Once you grasp the concept it's not that difficult.

How, do we extract a data group from the disk?

The actual programming is simple when you know the rules

```
 5 OPEN "R",1,"RESEARCH"
10 FOR PN = 0 to 9
20 FIELD 1, (PN*25) AS P$, 17 AS ST$(PN),
    2 AS A$(PN),4 AS H$(PN),2 AS W$(PN)
30 NEXT PN
```

This is the standard opening of a random access file.

```
40 PRINT ' 320, "WHAT DATA GROUP
    ARE YOU LOOKING FOR ?";
50 INPUT DN
60 FN = INT(DN/10)
70 IF FN<>DN/10 THEN FN = FN + 1
80 PN = (DN-(INT(DN/10)* 10))-1
90 IF PN<0 THEN PN = 9
```

These lines make use of the formula we determined above. Disk BASIC random access techniques allow us a GET statement, the converse of the PUT command.

There is only one other thing we should worry about, and that is going past the last file in our grouping. This will produce an error message and terminate the program. To avoid this we use another Disk BASIC statement, LOF(n) gives us the last file number we have stored.

```
100 IF FN>LOF(1) THEN 3000
110 GET 1,FN
```

Now, just print the information that's inside the file. There is a bit of structuring involved in that also.

Restoring Data

When you stored the numeric data on the disk, you converted it into string data. This data, converted by either the MKI$, MKS$, or MKD$ functions, is not directly printable. Instead, you must restore the data to its original form.

Disk BASIC contains the functions CVI, CVS, and CVD which convert a two, four, or eight-character string (respectively) back to its numeric form.

Their use is strictly controlled by the original transposition command, meaning that where we used MKI$ we must use CVI, with MKS$ use CVS and with MKD$ use CVD. The print (to screen) statement will therefore be:

```
120 PRINT S$(PN),CVI(A$(PN)),
    CVS(H$(PN),CVI(W$(PN))
130 PRINT ' 896,"ANOTHER DATA
    GROUP ?";
140 EN$ = INKEY$:IF EN$<>"Y"
    AND EN$<>"N" THEN 140
150 IF EN$ = "N" THEN 2000
160 CLS: GOTO 40
2000 CLOSE 1: END
3000 CLS: PRINT ' 320,"DATA COUNT
    EXCEEDS THE TOTAL OF FILES
    STORED"
3010 PRINT ' 384,"PRESS ENTER TO
    CONTINUE . . . "
3020 EN$ = INKEY$: IF EN$<>CHR$(13)
    THEN 3020
3030 CLS: GOTO 130
```

The use of 'PRINT' in 'INKEY$' allows formatting of the screen prompts and inputted data. The actual format you choose may be anything you are comfortable with. CHR$(13) is the TRS-80 code for a carriage return/linefeed, which is what occurs when you hit ENTER.

If our employer asks us to print out the entire list of data, the task will be no more difficult than the one above. We can pick up the program right after our FIELD definition statements:

```
40 FOR FN = 1 TO LOF(1)
50 GET 1,FN
60 FOR PN = 0 TO 9
70 IF CVI(A$(PN)) = 0 THEN 1000
80 LPRINT S$(PN),CVI(A$(PN)),
    CVS(H$(PN)),CVI(W$(PN))
90 LPRINT CHR$(13)
100 NEXT PN
110 NEXT FN
1000 CLOSE 1:END
```

In line 40 use the LOF(1) statement to indicate the maximum number of files we can retrieve. In this case, we will retrieve all of them.

Line 70 uses the fact that we 'zeroed out' the final elements of our original matrix, and tells the program that it should close the buffer and end if it discovers the zero value. Without this the line printer would print nulls and zeroes after the actual data had been disgorged. The other lines are straightforward print statements, conclusions of FOR-NEXT loops and finally the buffer closing and end.

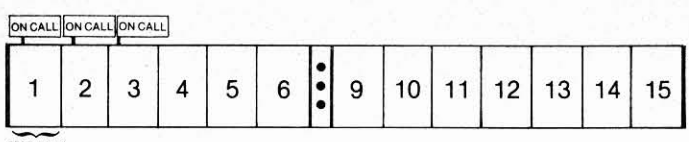
"There is one other thing to worry about, and that is going past the last line in our grouping."

If we maintain the same premise that we did with sequential access – you will find that the problem now is somewhat faster to solve. Picking up this variation of our program at the end of our FIELD statements:

```
 40 IF FL = 1 THEN 140
 50 EN = LOF(1)
 60 GET 1,EN
 70 FOR PN = 0 to 9
 80 IF CVI(A$(PN)) = 0 THEN 120
 90 NEXT PN
100 EN = EN + 1: P2 = 0
110 CLOSE 1: GOTO 130
120 P2 = PN
130 FL = 1: GOTO 5
140 FOR PN = P2 TO 9
```

This finds the last file PUT to disk and whether or not all 10 elements of the matrix within that file were set. Since this is our first run through the program the flag is not set, and we continue.

EN in line 50 is given the value LOF(1) for future reference. Line 60 is GETting the last file, after which lines 70 and 80 check for the last set element in that file. If it finds that the file is not filled with valid data, then the program branches to line 120, leaving the current file number, EN, as the one we are using, and sets the next matrix element of



Of the 15 buffers available, three are used by "How Many Files?". 290 bytes are tied up by each buffer assignment.

that file, P2, equal to the element in which it found its first invalid data.

If all elements of the matrix are filled, the program continues to line 100 which increments the file by one and sets P2 equal to the first (the zero) element of the matrix. The flag is set at line 130 and the program is directed back to the beginning to OPEN the buffer again. This time so that we may add to it.

Since, during this run FL = 1, the program is branched to line 140, which is the beginning of the input statements you created in lines 70 through 150.

There are a few differences here. We must set P2 equal to zero each time the PN loop runs out (after the NEXT PN line). We must change the PUT statement to reflect the number of the additional files (PUT 1,EN). EN must be incremented by a value of 1 after each PUT statement.

Which Method?

Keep in mind the two types of filing techniques: Sequential access is excellent for storing groups of data for recall within the parameters of the group. Its strong points do not rest in adding data to the file or retrieving specific information groups. However, it allows a variety of data to be input with no specific format (just remember the delimiters around strings) as long as the buffer remains open.

Random access, allows a higher speed retrieval but, in order to store the information, all data must be in a specific form and printed to disk under a specified format.

Also a FIELD name cannot be reassigned any other value. For example, in our program we had a field name ST$(PN) for one of our matrix elements. While it is acceptable in the course of the program to set another variable equal to it (V$ = ST$(PN)), you cannot directly assign it a value (ST$(PN) = V$). It is permissible only to assign a FIELDed element through the use of an LSET or RSET statement.■

✓Reader Service—see page 178

Find out how to fool your interpreter into executing your own commands.

White

Jake Commander
2 Shadow Lane
Peterborough, NH 03458

This article describes how any machine code routine, a renumber or utility routine, for example, can be called by specific name from within BASIC.

Whenever the TRS-80 does something outside of BASIC, a machine code routine must be written and loaded into memory. Then, every time it's needed, it has to be called into action by using either the SYSTEM command or the USR function.

Why can't we just give this routine a name and then, whenever we say the word, have it called, like any normally interpreted BASIC function? Because, thankfully, computers are stupid and need help from us humans before they can understand anything. The poor machine only understands what it is programmed to understand, so our new command word will go unheeded. The cleverest response we can expect is to be told that we made a syntax error.

Bending the Machine

Well, the following example will demonstrate how to make that TRS-80 understand anything you want it to. The key lies in that syntax error. Microsoft BASIC is cleverly written to be easily expandable by providing various vectors into RAM at strategic points throughout the BASIC interpreter. One of these (and the one we can commandeer) is an error message vector. This is the vector used by Disk BASIC to print readable error messages rather than the abbreviated Level II error codes. By judicious use of this vector, we can bend that machine around our little finger!

To keep the principle of this thing clear, let's consider a trivial machine code routine to white out the screen. Once you've mastered the idea, it's just a matter of substituting your own code, and calling it by name. The name you use to call the routine must be a non-reserved word, or else the BASIC interpreter will do its own thing with it, ignorantly bypassing your efforts!

So, as we're going to white out the screen, it seems reasonable that the computer should do so after encountering the command: WHITE.

Try it. Type it in. What happens? Exactly as anticipated, we get a syntax error. So, if we can find out what happens during the processing of a syntax error, we can use that information to our own advantage and we will!

The Error Decision

This is how things happen. Whenever the interpreter decides an error has ocurred, an error code is loaded into register E and a pointer to the location of the error is saved. A few pointers are reset, and if no error recovery line is specified, an error message is printed after making a quick vector call to location 16806. This is our foot in the door.

In Level II BASIC, this vector contains a RET opcode and a shortened error message is printed. In Disk BASIC, a call is made to print an expanded error message. We can place our own routine's address at this vector and, as long as no error recovery line is specified, hey presto! We're holding the reins.

Once this has happened, we make our own syntax check and, if this is passed, execute the routine.

So, the final program is in three parts:

1) Place your own vector, pointing to part 2 of the program into RAM at location 16806, after saving the vector

```
10 DATA58,166,65,50,225,127,42,167,65,34,226,127,62,195
    ,50,166
20 DATA65,33,154,127,34,167,65,195,204,6,245,123,254,2,
    32
25 DATA64,229,213,42,230,64,126,183,32,4,35,35
30 DATA35,35,215,6,5,17,217,127,26,190,32,39,19,35,16,2
    48,241
40 DATA241,241,241,229,33,0,60,1,4,0,62,255,119,35,16,2
    52,13,32
50 DATA249,175,50,154,64,225,43,215,195,30,29,87,72,73,
    84,69
60 DATA209,225,241,0,0,0
70 LA=32640
80 FORX=LATOLA+99:READW:POKEX,W:NEXT
90 IFPEEK(16549)=66THENPOKE16526,LA-INT(LA/256)*256:POK
    E16527
,LA/256 ELSE DEFUSR=LA
100 X=USR(0)
```

Program Listing.

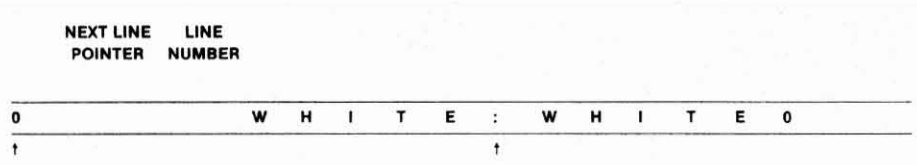


Fig. 1. Two possible locations which may be pointed at by 16614.

that is already there. When altering any vector never assume you know what's there when your program is loaded. Vectors can be changed, and something you don't know about (such as this program) may change one. Hence, if we are not going to disable whatever that vector is pointing at, we must save it and hand control back to it if necessary. Ignore at your peril.

2) Check that the error which occurred was indeed a syntax error. After all it would be somewhat of an overreaction to white out the screen every time a divide-by-zero error occurs! If it is a syntax error, then check that our command caused it.

3) Assuming our command has brought us this far, we can now jump to, or execute directly, our routine and safely ignore the syntax error condition so that the BASIC interpreter can plod onwards.

The program is illustrated in assembler code, but for those of you who are not yet familiar with machine code, a BASIC program is shown which will POKE the routine into memory and initialize it.

The Program

The first part of the program, as already explained, picks up the vector from 16806 to 16808 and saves it at the end of the routine. After this vector is saved, we place our own jump address there, thus receiving a call to part 2 of the program every time an error occurs in BASIC which is not trapped by an 'ON ERROR GOTO' statement. Once the vectors are set up, we jump back to a READY condition so that normal BASIC may continue.

The second part of the program performs our own check in the event of a BASIC error. We know that a syntax error will occur when the command WHITE is encountered, so we check for this by looking at the error code in the E register. If it is not a two, then it's not a syntax error, so we exit via the saved vector at the end of the program.

If it is a two, then we need to check that the syntax error is caused by our command.

We need to know one more thing at this point – the location of the text which caused the error. This is thoughtfully stored for us in location 16614 by the normal error routine, so we load this pointer to the HL register.

Now, this pointer doesn't point exactly at the statement causing the error, but at one byte past the end of the preceding statements. We need to bump this pointer to point at the offender's statement.

One last possible complication here is that if the preceding statement is at the end of a line, location 16614 points at the line terminator byte of zero. So we merely test for a zero byte and, if necessary, bump HL over the next-line pointer (2 bytes) and the line number (2 bytes). Fig. 1 should make this clearer.

Word Match

At this point, HL is pointing directly at the statement and we are able to make a byte by byte comparison with our command to check for a word match. If the comparison fails then, as before, we exit via our saved error vector (after restoring registers), otherwise we drop through to our routine and execute it.

This comparison check can easily be changed to a table search so that we can accommodate as many commands as we need. So, at last, that clever computer understands and does as it is told. We only need to do a little cleaning up and return to BASIC.

We stored three registers on the stack, so we can remove these as they are no longer needed. Also, the original vector call has placed a return address on the stack, so we pop this off and the stack pointer looks rosy.

One last thing: Remove the syntax error code which the BASIC error routine has stored at location 16538. This is the location which, after a syntax error, causes an automatic entry into the EDIT mode, and this we don't need.

Now we can hand control back to BASIC to see if there are any more BASIC commands to be continued. HL is bumped to the next statement using a RST 16 opcode and we make a final jump to 7454, thus BASIC is back in control . . . until the next syntax error. ■

```
00010 ;*************************
00020 ;       "WHITE"
00030 ;  BASIC WHITE-OUT CMND
00040 ;*************************
00050         ORG     7F80H   ;TOP OF 16K
00054 ;
00055 ;*****    PART ONE    *****
00056 ;
00060 SETUP   LD)A,(16806)    ;#
00070         LD      (OUT2),A    ;# OLD VECTOR
00080         LD      HL,(16807)  ;# TO PROG END
00090         LD      (OUT2+1),HL ;#
00100         LD      A,195       ;*
00110         LD      (16806),A   ;* NEW VECTOR
00120         LD      HL,ENTRY    ;* INTO POSITION
00130         LD      (16807),HL  ;*
00140         JP      1740        ;"READY"
00144 ;
00145 ;*****    PART TWO    *****
00146 ;
00150 ENTRY   PUSH    AF      ;SAVE AF REG
00160         LD      A,E     ;ERROR CODE
00170         CP      2       ;SYNTAX ERROR?
00180         JR      NZ,OUT1 ;IGNORE IF NOT
00190         PUSH    HL      ;SAVE
00200         PUSH    DE      ;REGS
00210         LD      HL,(16614) ;LOC OF ERROR
00220         LD      A,(HL)
00230         OR      A       ;TEST FOR ZERO
00240         JR      NZ,NCHR
00250         INC     HL      ;# BUMP PAST
00260         INC     HL      ;# NEXT-LINE POINTER
00270         INC     HL      ;* BUMP PAST
00280         INC     HL      ;* LINE NUMBER
00290 NCHR    RST     16      ;GET NEXT CHR
00300         LD      B,5     ;COMMAND CHR COUNT
00310         LD      DE,CMD  ;POINTER TO COMMAND
00320 CMPR    LD      A,(DE)  ;) CHR BY CHR
00330         CP      (HL)    ;) COMPARE
00340         JR      NZ,OUT0 ;)
00350         INC     DE      ;)
00360         INC     HL      ;)
00370         DJNZ    CMPR    ;)
00380         POP     AF      ;DUMMY POPS
00390         POP     AF      ;TO RECTIFY
00400         POP     AF      ;STACK POINTER
00410         POP     AF      ;
00420         PUSH    HL      ;SAVE POINTER TO TEXT
00430 ;
00431 ;*****    PART THREE    *****
00432 ;
00440         LD      HL,15360 ;SCREEN ADDRESS
00450         LD      BC,4
00460         LD      A,0FFH  ;WHITE GRAPHIC
00470 WHT     LD      (HL),A
00480         INC     HL      ;BUMP SCREEN ADDRESS
00490         DJNZ    WHT
00500         DEC     C
00510         JR      NZ,WHT
00520         XOR     A
00530         LD      (16538),A ;REMOVE ERROR
00540         POP     HL      ;RESTORE TEXT POINTER
00550         DEC     HL
00560         RST     16      ;GET NEXT CHR
00570         JP      7454    ;DO NEXT STATEMENT
00580 CMD     DEFM    'WHITE'
00590 OUT0    POP     DE      ;RESTORE
00600         POP     HL      ;ALL
00610 OUT1    POP     AF      ;REGISTERS
00620 OUT2    DEFS    3       ;SAVED VECTOR
00630         END     SETUP
```

Assembly Code for White Command.

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(Continued on next page)

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Software for Hams

Morse Code
Transmit and Receive Program
TRS-80 Level II
Richcraft Engineering
Chautauqua, NY

Robert M. Richardson
Drawer 1065
Chautauqua Lake, NY 14722

Here is a program that will both transmit and receive Morse code on your Level II TRS-80 and on most microcomputers with 8K or more of Microsoft BASIC. Morse Code Transmit and Receive, written for Level II, allows code speeds of up to 25 words per minute, yet the average user can follow the program logic.

The Morse Code Transmit and Receive program is in three parts. The main program, Part III includes an instruction summary. This article will not duplicate the detailed instructions included in Parts I and II, but is provided for those users who wish to dig deeper into this BASIC program's logic, flow and layout.

How it Works

The program works without any peripheral devices whatsoever. The cassette motor control relay, K1, is used for the keying relay. The cassette EAR plug line is used for receiving Morse code audio of approximately one volt peak to peak derived from the station receiver's speaker terminals.

A unique software solution renders the TRS-80 filp-flop Z-24 invisible to in-coming signals. Since K1 will only handle very low power levels (about six volts at 400-500 mils) it is strongly recommended that a 7406/7507 TTL buffer chip or Radio Shack #275-004 ($2.99) relay be used as a buffer between the TRS-80 and the station transmitter.

The first, or initialization segment, allows you to choose either alphanumeric or Morse code readouts on the video and to choose the Morse code transmit speed (receive speed is automatic). It also reminds the operator that ← calls up the instruction summary and that the CLEAR key is the transmit/receive switch. It defines A to Z as integers for optimum code speed, DIMENSIONs the Morse receive array and CLEARs 2550 bytes for the automatic logbook/file. Lastly, it includes an error trapping function that can be used to obtain immediate return to the TRANSMIT mode.

Transmit Morse Look-up Table

Suprisingly, the fastest means of generating Morse code in 12K without machine code is the simple IF-THEN statement and look-up table. This converts the alpha-numeric/punctuation symbol to its equivalent Morse code character. All 1's = dots and all 2's = dashes, i.e., A = 12, B = 2111, C = 2121.

Each character is followed by GOTO, which directs the program to the transmit Morse timing segment. Though Version 2.2's transmit Morse look-up table is given alphabetically and numerically for convenience, it can be further speeded up by rearranging the alphanumerics in the same order as the DATA table in the RECEIVE Morse decoding segment.

The RECEIVE mode order approximates the most commonly used letters in the English language. For instance, E is the most commonly used letter, so it = a dit (1), and Q the most infrequently used letter, so it = dah dah di dah (2212).

If one were to transpose the 1's to 0's and the 2's to 1's you would have binary numbers equal to the most frequently used alphabet characters in English. Give you any ideas?

In the TRANSMIT mode all generally accepted Morse characters are provided plus EOM (end of message) and EOW (end of work) by using the # and & symbols, respectively. Should a keyboard character, such as $ or % or @, which has no Morse equivalent, be entered, an error-trapping subroutine skips it.

At the end of the look-up table, the ASCII codes for ↑, ←, ↓, → and CLEAR are scanned. The program is directed to the subroutines of Q signal-message, auto-logbook, instruction summary, log book review or RECEIVE mode, as you wish.

The Transmit Morse Timing segment translates the Morse 1's and 2's into properly timed dots and dashes. The correct timing intervals are spaced between each element and character via the LEN and MID string functions. This allows the program to peel off each element of a character, one at a time.

The international standard (dot = 1 time interval, dash = three times 1 dot interval and a space between dot/dash elements = 1 dot interval) is set by this segment.

Transmitting code speed is determined by multiplying each element that forms a Morse character by S, the adjusted speed value that you input at the beginning of the program. Finally, this segment directs the program back to the keyboard, Q signal/message subroutine or proper code practice segment.

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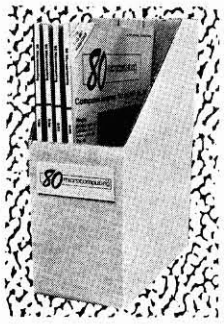

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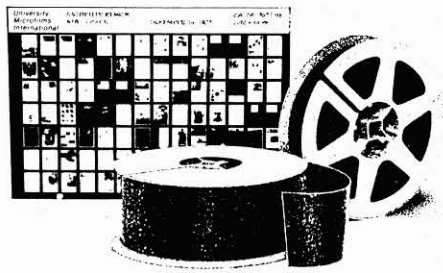

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K1, a tubular yellow capsule on the bottom left side of the lower TRS-80 printed circuit board, the cassette motor control relay, is closed and opened as the keying relay via the OUT (port) 255 statement.

If you are skilled in printed circuit board work, you could install a normally closed miniphone jack on the rear of the TRS-80 keyboard. This must be done in series, between relay K1 and the output of integrated circuit Z-41 to drive a separate relay such as the Radio Shack #275-004 for transmitter keying. This relay can handle 125 volts ac at 1 amp and is fast enough to follow the program up to about 25 words per minute.

Conversely, a high speed 5 to 6 volts dc reed relay can be used which follows this program up to about 40 words per minute. Above this speed, program execution time in BASIC becomes the limiting factor. By utilizing the excellent Mumford Micro Systems 3-speed TRS-80 clock modification, both TRANSMIT and RECEIVE modes can be increased an additional 50 percent.

Q Signal-prepared Message Segment

Twenty prepared Q signal and message formats are given including: CQ, QTH, QRZ, QRX, QSL, QSY, QSY +, QSY –, QRM, QRN, QRS, QRQ, RST, QSL, 73, etc. There is no limit, except available memory, to the number of additional messages you can add.

There is also a SPEED subcommand that can change the transmit code speed without reinitializing the program and losing the data stored in the automatic logbook.

This segment also allows the operator to select the type of TRANSMIT Morse code practice desired. Code 1 = alphabet only. Code 2 = alphanumerics. Code 3 = alphanumerics + punctuation. Though the arrow symbols are illustrated as reminders, they can only be used during the transmit or receive modes.

The LEN and MID string functions of Level II BASIC are used for peeling off each letter, one at a time, for each prepared message. Each message is limited to a maximum of 255 bytes (string length), but by concatenating strings with appropriate software mods any message of any length can be transmitted.

One final noteworthy subcommand included in this segment is TEST. This function outputs the word PARIS with appropriate letter and word spacing standards so that the operator can time the number of words sent for 15 seconds, multiply by 4 and calibrate his words-per-minute code speed.

Code Practice is a unique subroutine that utilizes the random number generator to select a number between 1 and 26 in the Code 1 (alphabet only) practice mode. By adding 59 to the random number, the ASCII character code for the alphabet from A to Z is generated and output a letter at a time, in five letter code groups.

Code 2 (alphanumerics) is generated in much the same way by randomly generating a number from 1 to 47 and adding 48 to it to obtain the ASCII character code for both numbers and alphabet. Since ASCII character codes 60, 61, 62 and 64 (which equal < = > and @ respectively) have no Morse code equivalents, they are trapped and not output.

Code 3 (alphanumerics + punctuation) is generated this way also. For brevity, the Morse double dash is displayed on video as a single dash. (Purists can easily modify this.)

Also, the normal seven times dot length spacing after punctuation has been held to only three times, since it has been found in numerous Morse code training sessions that this convention speeds up the learning process. Spacing between each five letter group uses the international standard seven times dot length for word spacing.

Receive Morse Decoding

An algorithm derived by the MIT Radio Club many years ago and improved upon by Robert Kurtz and myself, is applied here. The method I developed to interface the TRS-80 with an ordinary speaker output does not require any ancillary/peripheral devices to work properly with Morse signals of S4 or stronger.

This subroutine makes the TRS-80 flip-flop Z-4 invisible to the approximately one volt peak to peak audio Morse signal coming from the station receiver's speaker terminals. This is done by re-setting flip-flop Z-4 every time the program measures a dot, dash or element space. With a good signal to noise ratio, incoming signal (S4 or better), it will copy well sent Morse up to 20 to 25 words per minute. This is about its upper limit because of BASIC's execution time.

A unique software solution renders the TRS-80 flip-flop Z-24 invisible to incoming signals.

For operators working stations with "swing fists" (odd-ball dot/dash timing ratios), the RECEIVE mode subroutine allows the operator to change ratios by pressing P on the keyboard. This takes a bit of experimenting and experience.

For operating convenience, the FILE (automatic logbook) can be called from both the transmit and receive modes.

The File and File Review function creates a semi-automatic logbook with auto-sequencing for each entry. During initialization, the program CLEARs 2550 bytes for this subroutine, which allows only 25 bytes per entry if all 100 log entries are used. By all means CLEAR as many bytes as your installed memory will allow.

This subroutine's most useful function is during CW (Morse code) amateur radio contests, which is the reason for the auto-sequencing aspect of the program, as time/speed are important.

The FILE subroutine can be called from both TRANSMIT and RECEIVE modes by pressing → on the keyboard. The subroutine automatically advances to the next unused file.

When the FILE REVIEW subroutine is called by pressing ↓ and ENTER, the program sequentially displays four files per page (16 lines maximum, if each of the four files is filled to capacity). You do not have to review all 25 file pages to return to the TRANSMIT mode, but can escape any time by pressing BREAK @ and ENTER. Here we deliberately induce an error and use the ON ERROR GOTO function to immediately put us back in the TRANSMIT mode.

At the end of a day's operation, or end of a contest, the file data may be saved on cassette or disk using PRINT# -1, described on page 3/10 (for cassette) of the Level II manual. If you plan to use this frequently, by all means add the following lines to this program:

```
5000 PRINT#-1,BA$:PRINT#-1,BB$:PRINT#
-1,BC$:PRINT#-1,BD$ (etc)
```

Remember that each print statement will handle only strings that TOTAL 255 bytes. This is why the PRINT#-1, is repeated for each string we wish to CSAVE.

Though one usually does not write instructions on how to use instructions, the five-page instruction summary is provided in part 3 of the program for the new user who does not wish to pick up a written instruction manual while operating. It is called from the TRANSMIT mode by pressing ←.

Hints and Kinks

Probably the most difficult problem this Morse Code System (or any TRS-80 Morse Code Program) is quieting the RFI (radio frequency interference) generated by the TRS-80 itself.

Every little digital gate in the TRS-80, plus the nominal 10.6445 MHz crystal oscillator

and all the clock dividers, are miniature spark coil transmitters or act like them. Do not let this overwhelm you.

Since July 1,1979 all new microcomputers have had to meet the FCC rules regarding spurious radiation levels. But, if your computer was manufactured before this time try these recipes to minimize the problem:

•Use Radio Shack #15-1106 line filters on each component's power line after cutting each power cord to minimum length.

•Separate the TRS-80 at least six feet from the station receiver.

•Run good quality, well-shielded RG8/U separately from the transmitter and receiver to your antenna.

•Your station antenna should be at least 60 feet away from the TRS-80. Most importantly, install a T/R relay and broadband preamplifier at the antenna.

•If all else fails, turn-off your expansion interface when operating and disconnect the keyboard/interface cable at the keyboard. When the operating day is finished, CSAVE your automatic logbook before powering up the interface and printing out the logbook data.

If the receive program works with your code oscillator but "NOT" with your station receiver, you still have an R.F.I. problem.

Shielding and grounding all the TRS-80 cables helps too.■

This article and program is from chapter 10 of the author's volume 2, *Disassembled Handbook for TRS-80.*

Program Listing

```
10 REM FN IS RESERVED FOR DISC BASIC
20 CLS:REM note 'GT' = GREATER THAN & 'LT' = LESS THAN
30 PRINTCHR$(23):PRINT:PRINT"  TRS-80 MORSE CODE SYSTEM":PRINT
40 PRINT"     TRANSMIT AND RECEIVE":PRINT
50 PRINT"          VERSION 2.2":PRINT
60 PRINT"NO ANCILLARY DEVICES REQUIRED":PRINT
70 PRINT"          BY  W4UCH/2":PRINT:PRINT:PRINT:PRINT
80 PRINT"     . COPYRIGHT 1979"
90 PRINT"CASSETTE & DISK RIGHTS RESERVED":INPUTR:CLS
100 CLEAR2550
110 DEFINTA-Z:CLS:INPUT"ALPHANUMERICS OR MORSE ON VIDEO DISPLAY
(A/M)";AA$:CLS:INPUT"CODE SPEED 5, 10, 15, 20, 25, 30, OR 35 W.P
.M.    ";S:CLS
120 IFS=35THENS=10ELSEIFS=30THENS=15ELSEIFS=25THENS=20ELSEIFS=20
THENS=30ELSEIFS=15THENS=40ELSEIFS=10THENS=80ELSEIFS=5THENS=140EL
SEGOTO110
130 PRINT@195,"REMEMBER ";CHR$(125);"-- FOR INSTRUCTION SUMMARY
IN TRANSMIT MODE":INPUTR:CLS
140 PRINT@195,"REMEMBER THE 'CLEAR' KEY IS YOUR T/R SWITCH";:INP
UTR:CLS
150 DIMA$(100)
160 ON ERROR GOTO 170
170 RESUME 180
180 PRINT"TRANSMIT MODE"
190 Z=100:M$=""
200 A$=INKEY$:IFA$=""THEN200
210 IFA$=" "ANDLEN(D$) LT  1THENPRINT" ";:GOTO190
220 IFA$="A"THENM$="12":GOTO740
230 IFA$="B"THENM$="2111":GOTO740
240 IFA$="C"THENM$="2121":GOTO740
250 IFA$="D"THENM$="211":GOTO740
260 IFA$="E"THENM$="1":GOTO740
270 IFA$="F"THENM$="1121":GOTO740
280 IFA$="G"THENM$="221":GOTO740
290 IFA$="H"THENM$="1111":GOTO740
300 IFA$="I"THENM$="11":GOTO740
310 IFA$="J"THENM$="1222":GOTO740
320 IFA$="K"THENM$="212":GOTO740
330 IFA$="L"THENM$="1211":GOTO740
340 IFA$="M"THENM$="22":GOTO740
350 IFA$="N"THENM$="21":GOTO740
360 IFA$="O"THENM$="222":GOTO740
370 IFA$="P"THENM$="1221":GOTO740
380 IFA$="Q"THENM$="2212":GOTO740
390 IFA$="R"THENM$="121":GOTO740
400 IFA$="S"THENM$="111":GOTO740
410 IFA$="T"THENM$="2":GOTO740
420 IFA$="U"THENM$="112":GOTO740
430 IFA$="W"THENM$="122":GOTO740
440 IFA$="V"THENM$="1112":GOTO740
450 IFA$="X"THENM$="2112":GOTO740
460 IFA$="Y"THENM$="2122":GOTO740
470 IFA$="Z"THENM$="2211":GOTO740
480 IFA$="/"THENM$="21121":GOTO740
490 IFA$="."THENM$="121212":GOTO740
500 IFA$="?"THENM$="112211":GOTO740
510 IFA$=","THENM$="221122":GOTO740
520 IFA$="Z"THENM$="11111111":GOTO740
530 IFA$="-"THENM$="21112":GOTO740
540 IFA$=":"THENM$="222111":GOTO740
550 IFA$=";"THENM$="212121":GOTO740
560 IFA$="#"THENM$="12121":GOTO740:REM "EOM"
570 IFA$="&"THENM$="111212":GOTO740:REM "Eo WORK"
580 IFA$=CHR$(91)THENGOTO780
590 IFA$="0"THENM$="22222":GOTO740
600 IFA$="1"THENM$="12222":GOTO740
```


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```
610 IFA$="2"THENM$="11222":GOTO740
620 IFA$="3"THENM$="11122":GOTO740
630 IFA$="4"THENM$="11112":GOTO740
640 IFA$="5"THENM$="11111":GOTO740
650 IFA$="6"THENM$="21111":GOTO740
660 IFA$="7"THENM$="22111":GOTO740
670 IFA$="8"THENM$="22211":GOTO740
680 IFA$="9"THENM$="22221":GOTO740
690 IFA$=CHR$(8)GOTO2690
700 IFA$=CHR$(31)GOTO1230
710 IFA$=CHR$(9)GOTO2620
720 IFA$=CHR$(10)GOTO1610
730 IFA$=""ORM$=""GOTO190
740 IFAA$="A"THENZ$=A$ELSEZ$=M$+" "
750 FORK=1TOLEN(M$):C$=MID$(M$,K,1):IFC$="2"THENC=S*3ELSEC=S
760 OUT255,4:FORA=1TOC:NEXT:OUT255,0:FORA=1TOS:NEXT:NEXTK:PRINTZ
$;:FORA=1TOC:NEXT
770 IFZ=0THENNEXTLANDGOTO1110ELSEIFZ=100GOTO190ELSEIFZ=1313GOTO1
170ELSEIFZ=1306GOTO1150ELSEIFZ=1310GOTO1160
780 CLS:PRINT    "  Q SIGNAL - MESSAGE - SUBCOMMANDS ":PRINT
790 PRINT"- CQ","- QTH","- QRZ","- QSL":PRINT
800 PRINT"- RST","- 73","- QRM","- QRN":PRINT
810 PRINT"- QRS","- QRQ","- QRX","- QRT":PRINT
820 PRINT"- QSB","- QSY","- QSY+","- QSY-":PRINT:PRINT"- CQSS","
- QRZSS","- SECT","- TEST":PRINT
830 PRINT"- CODE1 ","- CODE2 ","- CODE3 ","- SPEED":PRINT
840 PRINTCHR$(92);" FILE","-";CHR$(94); "REVIEW FILE",CHR$(91);"
 SUBCOMMAND",CHR$(93);"-";"INSTRUCTIONS"
850 PRINT@440,"";:INPUT"SIGNAL/MESSAGE";X$:Z=0:E=-1:CLS
860 IFX$="CQ"THEND$="CQ CQ CQ DE W4UCH/2 K "
870 IFX$="QTH"THEND$="QTH IS BOX 1065, CHAUTAUQUA LAKE, N.Y.   1
4722 "
880 IFX$="QRZ"THEND$="QRZ QRZ QRZ DE W4UCH/2 K "
890 IFX$="QSL"THEND$="QSL QSL GD LUK IN SS. DE W4UCH/2 K "
900 IFX$="RST"THEND$="RST 599 599 IN WNY WNY DE W4UCH/2 K "
910 IFX$="73"THEND$="73 TO U AND URS. HP TO WK U AGN SOON. DE W4
UCH/2 K "
920 IFX$="QRM"THEND$="QRM QRM PSE TRY AGN. DE W4UCH/2 K "
930 IFX$="QRN"THEND$="LOCAL QRN QRN PSE TRY AGN DE W4UCH/2 K "
940 IFX$="QRS"THEND$="QRS. PSE SLOW DOWN A BIT. DE W4UCH/2 K "
950 IFX$="QRQ"THEND$="QRQ. MAY I SPEED UP? DE W4UCH/2 K "
960 IFX$="QRX"THEND$="QRX. THE PHONE PSE STANDBY. "
970 IFX$="QRT"THEND$="MUST QRT NOW. 73, DE W4UCH/2 K "
980 IFX$="QSB"THEND$="QSB TERRIBLE PSE TRY AGN. DE W4UCH/2 K "
990 IFX$="QSY"THEND$="QRM WHERE U WISH TO MOVE? DE W4UCH/2 K "
1000 IFX$="QSY+"THEND$="QSY UP 3KHZ UP 3KHZ NOW. DE W4UCH/2 K "
1010 IFX$="QSY-"THEND$="QSY DOWN 3KHZ 3KHZ NOW. DE W4UCH/2 K "
1020 IFX$="CQSS"THEND$="CQSS CQSS CQSS DE W4UCH/2 K "
1030 IFX$="QRZSS"THEND$="QRZ SS QRZ SS QRZ SS DE W4UCH/2 K "
1040 IFX$="SECT"THEND$="WNY WNY WNY DE W4UCH/2 K "
1050 IFX$="TEST"THEND$="PARIS PARIS PARIS PARIS PARIS PARIS PARI
S PARIS PARIS PARIS PARIS "
1060 IFX$="CODE1"THENZ=1313:GOTO1170
1070 IFX$="CODE2"THENZ=1310:GOTO1160
1080 IFX$="CODE3"THENZ=1306:GOTO1150
1090 IFX$="SPEED"THENS=0:INPUT"NEW CODE SPEED FROM TABLE";S
1100 IFX$=CHR$(91)THEND$="AA":GOTO780
1110 FORL=1TOLEN(D$):A$=MID$(D$,L,1):IFL=LEN(D$)THEND$="":GOTO19
0
1120 IFA$=" "THENPRINT" ";:FORA=1TO7*S:NEXT:GOTO770
1130 GOTO220
1140 REM"CODE PRACTICE"
1150 D=RND(47)+43:IFD=60ORD=61ORD=62ORD=64GOTO1150ELSEGOTO1180
1160 D=RND(42)+47:IFD=58ORD=59ORD=60ORD=61ORD=62ORD=63ORD=64GOTO
1160ELSEGOTO1180
1170 D=RND(26)+64
1180 A$=CHR$(D):E=E+1:IFE GT  4GOTO1190ELSEGOTO220
1190 FORF=1TO7*S:NEXT:PRINT" ";:E=0:GOTO220
1200 REM "W4UCH/2 SPECIAL TRS-80 MORSE DECODER PGM LINES 2000 -
2150"
1210 INPUT"CHARACTER TIMING: 5 NOMINAL";CC
1220 INPUT"SPACE TIMING: 3 NOMINAL";SS:GOTO1250
1230 PRINT"RECEIVE MODE":RESTORE:CC=5:SS=3
1240 FORN=1TO100:READA$(N):NEXTN
1250 A=INP(255)
1260 C$=INKEY$:IFC$="P"THENGOTO1210
1270 IFC$=CHR$(31)GOTO180
1280 IFC$=CHR$(10)GOTO1610
1290 IFA=127THEN1250
1300 B=0
1310 IFA=255THENOUT255,0
1320 A=INP(255):B=B+10
1330 IFA=127THENC=((5*C)+(2*B))/6:DO=2*DO:DA=2*DA:DO=DO+1:GOTO14
00
1340 IFB LT  (.5*C)THEN1310
1350 DO=2*DO:DA=2*DA:DA=DA+1
1360 IFA=255THENOUT255,0
1370 A=INP(255):B=B+10
1380 IFA=255THENGOTO1360
1390 C=((4*C)+B)/5
1400 B=0
1410 IFA=255THENOUT255,0
1420 A=INP(255):B=B+CC
1430 IFA=255THENGOTO1300
1440 IFB LT  (.5*C)THENGOTO1410
1450 GOSUB1510
1460 A=INP(255):B=B+SS
1470 IFA=255THENGOTO1300
1480 IFB LT  (2*C)THENGOTO1460
1490 PRINT" ";
1500 GOTO1250
1510 DA=DA*2
1520 D=DA+DO
1530 IFD GT  100THEND=100
1540 PRINTA$(D);
1550 DA=0:DO=0
1560 RETURN
1570 DATAE,T,I,A,N,M,S,U,R,W,D,K,G,O,H,V,F,-,L,-,P,J,B,X,C
1580 DATAY,Z,Q,-,-,5,4,-,3,-,-,-,2,-,-,-,-,-,-,-,1,6,-,/,-
1590 DATA-,-,-,-,7,-,-,-,8,-,9,0,-,-,-,-,-,-,-,-,-,-,-,-,?
1600 DATA-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-
1610 PRINT"AUTOMATIC FILE SUBROUTINE - ENTER WILL RETURN TO TRAN
SMIT MODE. EACH FILE MAY CONTAIN UP TO 255 CHARACTERS.":PRINT
1620 IFBA$ LT  "1"INPUTBA$:CLS:GOTO180
1630 IFBB$ LT  "1"INPUTBB$:CLS:GOTO180
1640 IFBC$ LT  "1"INPUTBC$:CLS:GOTO180
1650 IFBD$ LT  "1"INPUTBD$:CLS:GOTO180
1660 IFBE$ LT  "1"INPUTBE$:CLS:GOTO180
1670 IFBF$ LT  "1"INPUTBF$:CLS:GOTO180
1680 IFBG$ LT  "1"INPUTBG$:CLS:GOTO180
1690 IFBH$ LT  "1"INPUTBH$:CLS:GOTO180
1700 IFBI$ LT  "1"INPUTBI$:CLS:GOTO180
1710 IFBJ$ LT  "1"INPUTBJ$:CLS:GOTO180
1720 IFBK$ LT  "1"INPUTBK$:CLS:GOTO180
1730 IFBL$ LT  "1"INPUTBL$:CLS:GOTO180
1740 IFBM$ LT  "1"INPUTBM$:CLS:GOTO180
1750 IFBN$ LT  "1"INPUTBN$:CLS:GOTO180
1760 IFBO$ LT  "1"INPUTBO$:CLS:GOTO180
1770 IFBP$ LT  "1"INPUTBP$:CLS:GOTO180
1780 IFBQ$ LT  "1"INPUTBQ$:CLS:GOTO180
1790 IFBR$ LT  "1"INPUTBR$:CLS:GOTO180
1800 IFBS$ LT  "1"INPUTBS$:CLS:GOTO180
1810 IFBT$ LT  "1"INPUTBT$:CLS:GOTO180
1820 IFBU$ LT  "1"INPUTBU$:CLS:GOTO180
1830 IFBV$ LT  "1"INPUTBV$:CLS:GOTO180
1840 IFBW$ LT  "1"INPUTBW$:CLS:GOTO180
1850 IFBX$ LT  "1"INPUTBX$:CLS:GOTO180
1860 IFBY$ LT  "1"INPUTBY$:CLS:GOTO180
1870 IFBZ$ LT  "1"INPUTBZ$:CLS:GOTO180
1880 IFCA$ LT  "1"INPUTCA$:CLS:GOTO180
1890 IFCB$ LT  "1"INPUTCB$:CLS:GOTO180
1900 IFCC$ LT  "1"INPUTCC$:CLS:GOTO180
1910 IFCD$ LT  "1"INPUTCD$:CLS:GOTO180
1920 IFCE$ LT  "1"INPUTCE$:CLS:GOTO180
1930 IFCF$ LT  "1"INPUTCF$:CLS:GOTO180
1940 IFCG$ LT  "1"INPUTCG$:CLS:GOTO180
1950 IFCH$ LT  "1"INPUTCH$:CLS:GOTO180
1960 IFCI$ LT  "1"INPUTCI$:CLS:GOTO180
1970 IFCJ$ LT  "1"INPUTCJ$:CLS:GOTO180
1980 IFCK$ LT  "1"INPUTCK$:CLS:GOTO180
1990 IFCL$ LT  "1"INPUTCL$:CLS:GOTO180
2000 IFCM$ LT  "1"INPUTCM$:CLS:GOTO180
2010 IFCN$ LT  "1"INPUTCN$:CLS:GOTO180
2020 IFCO$ LT  "1"INPUTCO$:CLS:GOTO180
2030 IFCP$ LT  "1"INPUTCP$:CLS:GOTO180
2040 IFCQ$ LT  "1"INPUTCQ$:CLS:GOTO180
2050 IFCR$ LT  "1"INPUTCR$:CLS:GOTO180
2060 IFCS$ LT  "1"INPUTCS$:CLS:GOTO180
2070 IFCT$ LT  "1"INPUTCT$:CLS:GOTO180
2080 IFCU$ LT  "1"INPUTCU$:CLS:GOTO180
2090 IFCV$ LT  "1"INPUTCV$:CLS:GOTO180
2100 IFCW$ LT  "1"INPUTCW$:CLS:GOTO180
2110 IFCX$ LT  "1"INPUTCX$:CLS:GOTO180
2120 IFCY$ LT  "1"INPUTCY$:CLS:GOTO180
2130 IFCZ$ LT  "1"INPUTCZ$:CLS:GOTO180
2140 IFDA$ LT  "1"INPUTDA$:CLS:GOTO180
2150 IFDB$ LT  "1"INPUTDB$:CLS:GOTO180
2160 IFDC$ LT  "1"INPUTDC$:CLS:GOTO180
2170 IFDD$ LT  "1"INPUTDD$:CLS:GOTO180
2180 IFDE$ LT  "1"INPUTDE$:CLS:GOTO180
2190 IFDF$ LT  "1"INPUTDF$:CLS:GOTO180
2200 IFDG$ LT  "1"INPUTDG$:CLS:GOTO180
2210 IFDH$ LT  "1"INPUTDH$:CLS:GOTO180
2220 IFDI$ LT  "1"INPUTDI$:CLS:GOTO180
2230 IFDJ$ LT  "1"INPUTDJ$:CLS:GOTO180
2240 IFDK$ LT  "1"INPUTDK$:CLS:GOTO180
2250 IFDL$ LT  "1"INPUTDL$:CLS:GOTO180
2260 IFDM$ LT  "1"INPUTDM$:CLS:GOTO180
2270 IFDN$ LT  "1"INPUTDN$:CLS:GOTO180
2280 IFDO$ LT  "1"INPUTDO$:CLS:GOTO180
2290 IFDP$ LT  "1"INPUTDP$:CLS:GOTO180
2300 IFDQ$ LT  "1"INPUTDQ$:CLS:GOTO180
2310 IFDR$ LT  "1"INPUTDR$:CLS:GOTO180
2320 IFDS$ LT  "1"INPUTDS$:CLS:GOTO180
2330 IFDT$ LT  "1"INPUTDT$:CLS:GOTO180
2340 IFDU$ LT  "1"INPUTDU$:CLS:GOTO180
2350 IFDV$ LT  "1"INPUTDV$:CLS:GOTO180
2360 IFDW$ LT  "1"INPUTDW$:CLS:GOTO180
2370 IFDX$ LT  "1"INPUTDX$:CLS:GOTO180
2380 IFDY$ LT  "1"INPUTDY$:CLS:GOTO180
2390 IFDZ$ LT  "1"INPUTDZ$:CLS:GOTO180
2400 IFEA$ LT  "1"INPUTEA$:CLS:GOTO180
2410 IFEB$ LT  "1"INPUTEB$:CLS:GOTO180
2420 IFEW$ LT  "1"INPUTEW$:CLS:GOTO180
2430 IFEX$ LT  "1"INPUTEX$:CLS:GOTO180
2440 IFEY$ LT  "1"INPUTEY$:CLS:GOTO180
2450 IFEZ$ LT  "1"INPUTEZ$:CLS:GOTO180
2460 IFFA$ LT  "1"INPUTFA$:CLS:GOTO180
2470 IFFB$ LT  "1"INPUTFB$:CLS:GOTO180
2480 IFFC$ LT  "1"INPUTFC$:CLS:GOTO180
2490 IFFD$ LT  "1"INPUTFD$:CLS:GOTO180
2500 IFFE$ LT  "1"INPUTFE$:CLS:GOTO180
2510 IFFF$ LT  "1"INPUTFF$:CLS:GOTO180
2520 IFFG$ LT  "1"INPUTFG$:CLS:GOTO180
2530 IFFH$ LT  "1"INPUTFH$:CLS:GOTO180
2540 IFFI$ LT  "1"INPUTFI$:CLS:GOTO180
2550 IFFJ$ LT  "1"INPUTFJ$:CLS:GOTO180
2560 IFFK$ LT  "1"INPUTFK$:CLS:GOTO180
2570 IFFL$ LT  "1"INPUTFL$:CLS:GOTO180
2580 IFFM$ LT  "1"INPUTFM$:CLS:GOTO180
2590 IFFO$ LT  "1"INPUTFO$:CLS:GOTO180
2600 IFFP$ LT  "1"INPUTFP$:CLS:GOTO180
2610 IFFQ$ LT  "1"INPUTFQ$:CLS:GOTO180
2620 PRINT"FILE REVIEW - FOUR FILES PER PAGE:";INPUTR:CLS
2630 PRINTBA$:PRINTBB$:PRINTBC$:PRINTBD$:INPUTR:CLS:PRINTBE$:PRI
NTBF$:PRINTBG$:PRINTBH$:INPUTR:CLS:PRINTBI$:PRINTBJ$:PRINTBK$:PR
INTBL$:INPUTR:CLS:PRINTBM$:PRINTBN$:PRINTBO$:PRINTBP$:INPUTR:CLS
:PRINTBQ$:PRINTBR$:PRINTBS$:PRINTBT$:INPUTR:CLS
2640 PRINTBU$:PRINTBV$:PRINTBW$:PRINTBX$:INPUTR:CLS:PRINTBY$:PRI
NT BZ$:PRINTCA$:PRINTCB$:INPUTR:CLS:PRINTCC$:PRINTCD$:PRINTCE$:P
RINTCF$:INPUTR:CLS:PRINTCG$:PRINTCH$:PRINTCI$:PRINTCJ$:INPUTR:CL
S:PRINTCK$:PRINTCL$:PRINTCM$:PRINTCN$:INPUTR:CLS
2650 PRINTCO$:PRINTCP$:PRINTCQ$:PRINTCR$:INPUTR:CLS:PRINTCS$:PRI
NTCT$:PRINTCU$:PRINTCV$:INPUTR:CLS:PRINTCW$:PRINTCX$:PRINTCY$:PR
INTCZ$:INPUTR:CLS:PRINTDA$:PRINTDB$:PRINTDC$:PRINTDD$:INPUTR:CLS
:PRINTDE$:PRINTDF$:PRINTDG$:PRINTDH$:INPUTR:CLS
2660 PRINTDI$:PRINTDJ$:PRINTDK$:PRINTDL$:INPUTR:CLS:PRINTDM$:PRI
NTDN$:PRINTDO$:PRINTDP$:INPUTR:CLS:PRINTDQ$:PRINTDR$:PRINTDS$:PR
INTDT$:INPUTR:CLS:PRINTDU$:PRINTDV$:PRINTDW$:PRINTDX$:INPUTR:CLS
:PRINTDY$:PRINTDZ$:PRINTEA$:PRINTEB$:INPUTR:CLS
2670 PRINTEW$:PRINTEX$:PRINTEY$:PRINTEZ$:INPUTR:CLS:PRINTFA$:PRI
NTFB$:PRINTFC$:PRINTFD$:INPUTR:CLS:PRINTFE$:PRINTFF$:PRINTFG$:PR
INTFH$:INPUTR:CLS:PRINTFI$:PRINTFJ$:PRINTFK$:PRINTFL$:INPUTR:CLS
:PRINTFM$:PRINTFO$:PRINTFP$:PRINTFQ$:INPUTR:CLS
2680 PRINT"END OF FILE - ENTER TO RETURN TO TRANSMIT MODE":INPUT
R:CLS:GOTO180
2690 CLS:PRINT"    I N S T R U C T I O N   S U M M A R Y ";CHR
$(125);"--":PRINT
```

```
2700 PRINT"-THE  SYMBOL CALLS SUBCOMMAND ROUTINES DURING TRANSM
IT MODE.":PRINT
2710 PRINT"-THE ";CHR$(92);" SYMBOL CALLS INPUT/FILE FUNCTION TH
AT IS YOUR LOGBOOK.":PRINT
2720 PRINT"-INPUT/FILE MAY BE CALLED FROM BOTH TRANSMIT AND RECE
IVE MODES.":PRINT
2730 PRINT"-THE -";CHR$(94);" SYMBOL CALLS THE REVIEW FILE FUNCT
ION.":PRINT
2740 PRINT"-CODE1=ALPHABET : CODE2=ALPHANUMERIC : CODE3=CODE2+PU
NCTUATION.":PRINT
2750 PRINT"-SPEED SUBCOMMAND CHANGES XMIT MORSE CODE SPEED AS DE
SIRED.":PRINT
2760 PRINT"-TEST SUBCOMMAND UTILIZES INTL. STD. CODE SPEED MEASU
REMENT.":PRINT@987," ";:INPUTR:CLS
2770 PRINT" INSTRUCTION SUMMARY-CONTINUED:";PRINT
2780 PRINT"-RECEIVE MODE SOFTWARE ADJUSTS SPEED AFTER 6 TO 10 CH
ARACTERS.":PRINT
2790 PRINT"-YOU MAY MODIFY RECEIVE CHARACTER & WORD SPACING BY P
RESSING P.":PRINT
2800 PRINT"-TRS 80 WILL COPY ITS OWN TAPED MORSE NEAR PERFECTLY
WITH LINES  2005 - CC=6 & SS=6 AND LINE 2045 B LT  (.3*C) CHANGE
D ACCORDINGLY.  "
2810 PRINT"-RELAY K1 ON LEFT EDGE OF Z-80 PCB IS USED FOR XMIT K
EYING.":PRINT
2820 PRINT"-IT IS NORMALLY THE CASSETTE MOTOR CONTROL RELAY 6VDC
 500 MA.":PRINT
2830 PRINT"-K1 IS UNFORTUNATELY UNRELIABLE WITH A POOR MTBF USED
 NORMALLY.":PRINT
2840 PRINT"-FOR RELIABILITY CHANGE K1 TO RADIO SHACK # 275-004 $
2.99 EA.";:INPUTR:CLS
2850 PRINT" INSTRUCTION SUMMARY - CONTINUED":PRINT
2860 PRINT"-AUTOMATIC CASSETTE 'RECORD' AND 'PLAYBACK' OF INPUT-
FILE DATA   OPTIONAL SOFTWARE PROGRAM IS IN INSTRUCTION MANUAL.
CONCEPT IS  TO CSAVE INPUT-FILE / LOGBOOK ENTRIES AT END OF OPER
ATING DAY.  "
2870 PRINT"-EQUIVALENT 'SPEED ' TABLE - WORDS PER MINUTE: (AUTON
ATIC 16K    MEM VERSION AND MANUAL, SLIGHTLY SLOWER, FOR 4K MEM
VERSION."
2880 PRINT" INPUT","WPM","INPUT","WPM"
2890 PRINT"  10","35"," 80","10"
2900 PRINT"  20","25"," 90"," 9"
2910 PRINT"  30","20","100"," 8"
2920 PRINT"  40","15","110"," 7"
2930 PRINT"  50","14","120"," 6"
2940 PRINT"  60","12","140"," 5"
2950 PRINT"  70","11","150"," 4     ";:INPUTR:CLS
2960 PRINT" INSTRUCTION SUMMARY - CONTD:"
2970 PRINT"-THOUGH ARROW COMMANDS ARE LISTED IN SUBCOMMAND TABLE
, THEY MAY  ONLY BE CALLED IN TRANSMIT AND/OR RECEIVE  OPERATING
 MODES.     "
2980 PRINT"-ANY NEW SYSTEM REQUIRES PRACTICE AND EXPERIENCE TO U
TILIZE ITS  CAPABILITES FULLY.  IT IS SUGGESTED THAT YOU GAIN EX
PERIENCE    WITH THE TRS-80 MORSE CODE SYSTEM USING THE RADIO SH
ACK MODEL  ";
2990 PRINT" # 20-005 CODE PRACTICE OSCILLATOR FOR TRS-80 INPUT A
ND OUTPUT,  USING YOUR OWN KEY TO SEND.  ADJUST VOLUME FOR ACCUR
ATE COPY.  "
3000 PRINT"-IN THE FUTURE, A CASSETTE LOGBOOK MAY BECOME A WORLD
 STANDA .  FOR TRS-80 OWNERS AND OPERATORS, THE 'FUTURE ' IS NO
W
3010 PRINT"-LINE 50 'CLEARS 2550 ' BYTES FOR THE 100 EACH AUTO-F
ILES.  IF   YOU HAVE ADEQUATE MEMORY, INCREASE THIS UP TO 25500
TO FULLY    UTILIZE EACH FILE'S CAPABILITY OF 255 BYTES CAPACITY
.  ";:INPUTR:CLS
3020 PRINT"-TO ESCAPE FROM: SUBCOMMAND, FILE, FILE-REVIEW, OR IN
STRUCTION   SUMMARY, PRESS 'BREAK', THEN '@', AND THEN 'ENTER' F
OR NEAR     IMMEDIATE RETURN TO THE 'TRANSMIT-MODE'":PRINT
3030 PRINT"-PROGRAM SUGGESTIONS AND IMPROVEMENTS ARE ALWAYS WELC
OME.":PRINT
3040 PRINT"-PLEASE SEND TO:":PRINT
3050 PRINT"                  RICHCRAFT  ENGINEERING
3060 PRINT"                  DRAWER 1065"
3070 PRINT"                  CHAUTAUQUA, N.Y. 14722
3080 PRINT:PRINT:PRINT"          'ENTER ' WILL RETURN TO TRANSMI
T MODE    ";:INPUTR:CLS:GOTO180
3090 END
```

Instruction Summary

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 GENERAL:
-"CONGRATULATIONS": YOU NOW HAVE THE FINEST TRS-80 MORSE SYSTEM
   PROGRAM THAT REQUIRES NO ANCILLARY EXPENSIVE INTERFACES.

-IT OPERATES SIMPLY FROM THE CASSETTE INPUT AND OUTPUT PORTS,
 THUS REQUIRING ONLY A TRANSMITTER/RECEIVER OR CODE PRACTICE
 KEYER/OSCILLATOR FOR OPERATION.

-FOR RECEIVE OPERATION ONLY A JACK IN PARALLEL WITH RECEIVER
 SPEAKER OUTPUT IS REQUIRED WHICH CONNECTS TO CASSETTE EARPHONE
 PLUG. JACK IS RADIO SHACK # 274-251 SET OF 3 FOR $ .99 PER PAK.

-FOR TRANSMIT MODE, THIS PROGRAM UTILIZES THE TRS-80 CASSETTE
 MOTOR ON-OFF CONTROL RELAY AS A KEYING RELAY. RECOMMENDED MAX.
 IS 6VDC AT 500 MA. OR BETTER YET USE R/S # 275-004 RELAY. PRICE
 $ 2.99 EACH.   ? _


 GENERAL CONTD.
-THE TRS-80 CASSETTE MOTOR CONTROL PLUG MATES WITH SUBMINIATURE
 JACK, RADIO SHACK # 275-004 AT $ .99 FOR 2 EACH.  AS MENTIONED
 ON THE 1ST PAGE, WE STRONGLY RECOMMEND YOU USE A BUFFER RELAY
 OR TTL CHIP

 TO PROTECT RELAY K1, WHOSE CONTACTS ARE UNRELIABLE AT BEST!
 SEE INSTRUCTIONS FOR THIS SIMPLE AND INEXPENSIVE INSURANCE.

-THERE ARE FOUR COMMONLY USED METHODS OF SENDING AND RECEIVING
 MORSE CODE. THE FIRST, INVENTED BY SAMUEL MORSE OVER 100 YEARS
 AGO USING A KEY & SOUNDER IS STILL IN USE TODAY BUT VIA RADIO.

-THE SECOND METHOD USES DEDICATED TTL LOGIC I.C. CHIPS TO BOTH
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GENERATE AND DECODE MORSE.  THE ATRONICS # CR-101 CODE READER
AND CW KEYBOARD ARE TYPICAL AND PRICED AT $ 450. TOTAL.? _

GENERAL CONTD:

-THE THIRD METHOD USES A DEDICATED MICROCOMPUTER TO GENERATE AND
 DECODE BOTH MORSE AND TELETYPE. THE HAL COMMUNICATIONS CORP'S.
 DS3000 KSR-3 IS TYPICAL AT $ 1575. PLUS $595. RTTY DEMODULATOR.
 IT IS A SUPERB SYSTEM, AS WELL IT SHOULD BE, CONSIDERING PRICE.

-THE FOURTH METHOD UTILIZES A GENERAL PURPOSE MICROCOMPUTER SUCH
 AS THE TRS-80 OR PET AND USES A COMBINATION MACHINE LANGUAGE
 AND BASIC SOFTWARE PROGRAM THAT GENERATES AND DECODES MORSE AS
 WELL AS TELETYPE.  IT REQUIRES A 9 I.C. PRINTED CIRCUIT BOARD
 TO INTERFACE THE TRS-80 DATA BUS TO THE OUTSIDE REAL WORLD.

-AN OUTSTANDING EXAMPLE OF THIS APPROACH IS THE MACROTRONICS M-
 80 INTERFACE SYSTEM DESIGNED BY DR. RON LODEWYCK N6EE, WHO ALSO
 WAS CO-AUTHOR OF THE TRS-80 LEVEL I & PET BASIC TUTORIALS.  ? _

GENERAL CONTD:

-THE MACROTRONICS M-80 IS AN OUTSTANDING EXAMPLE OF EXCELLENT
 SOFTWARE AND ENGINEERING DESIGN. IT IS PRICED AT $129 POSTPAID.

-THE NEWEST APPROACH TO TRS-80 MORSE GENERATION AND DECODING HAS
 BEEN DEVELOPED BY RICHCRAFT ENGINEERING AFTER EXTENSIVE R & D
 EFFORT.  THIS NEW SYSTEM REQUIRES NO INTERFACES WHATSOEVER.

-THESE INSTRUCTIONS WILL AUTO-LOAD AND AUTO-DELETE WHEN APPRO-
 PRIATE IF YOU WILL KINDLY FOLLOW INSTRUCTIONS.

GENERAL CONTD.

-THE TRS-80 MORSE CODE SYSTEM, BOTH TRANSMIT AND RECEIVE MODES,
 ARE ELEGANT IN THEIR SIMPLICITY.  MORSE CODE SPEEDS OF UP TO
 30 - 35 WORDS PER MINUTE ARE EASILY ATTAINABLE WITH THIS PGM.

-THE PROGRAM IS WRITTEN ENTIRELY IN TRS-80 LEVEL II MICROSOFT
 BASIC IN TWO VERSIONS.  VERSION 2.0 FOR 4K MEMORY TRS-80S AND
 VERSION 2.2 FOR 16K MEMORY TRS-80S.  BASIC DIFFERENCE IS THE
 AUTO-LOG, INSTR., & NO. OF Q-SIGNALS.

-THE ADVANTAGES OF A BASIC PROGRAM OVER ONE IN Z-80 MACHINE
 LANGUAGE ARE MULTIFOLD; I.E., THE USER MAY EASILY MODIFY THE
 PROGRAM, AS DESIRED.  THE USER CAN EASILY UNDERSTAND THE PGM.
 AND IMPROVE THEIR SKILLS.? _

THEORY OF THE SYSTEM:

-IN THE TRANSMIT MODE THE PROGRAM USES THE 'IF-THEN' FUNCTION
 WITH A 'LOOK-UP' TABLE TO FIND THE MORSE CHARACTER DESIRED.
 THE CHARACTER HAS 1 = DOT & 2 = DASH. FIRST THE CHARACTER IS
 OUTPUT VIA MID$.

-TIMING IS ALWAYS 1 DASH=3 DOT LENGTHS; SPACE BETWEEN DOTS AND
 DASHES ALWAYS = 1 DOT LENGTH. SPACE BETWEEN WORDS ALWAYS  = 7
 DOT LENGTHS.  WORDS AND SENTENCES ARE SEQUENTIALLY OUTPUT VIA
 THE MID$ FUNCTION.

-CODE SPEED IS INTIALLY INPUT BY THE USER DURING INITIALIZATION
 AND MAY BE CHANGED DURING TRANSMISSION BY THE 'SPEED' COMMAND
 THAT IS CALLED ALONG WITH 20 OTHER SUBCOMMANDS BY THE  CALL.
? _

THEORY CONTD:

-IN THE RECEIVE MODE THE 1200-2000 CYCLE CW SIGNAL IS TAKEN FROM
 THE RECEIVER'S 3-8 OHM SPEAKER IN PARALLEL. APPROXIMATELY ONE
 VOLT OF AUDIO A/C IS ADEQUATE. THIS IS INPUT TO THE TRS-80 VIA
 CASSETTE EAR PLUG.

-THE CASSIN AUDIO INPUT IS FIRST PROCESSED BY Z4 QUAD OP AMP AND
 OUTPUT TO Z24 SCHMITT TRIGGERS IN FLIP-FLOP CONFIGURATION.
 NORMALLY THIS WOULD BE THE 'END' OF THE GAME, BUT A UNIQUE PGM.
 RENDERS Z24 INVISIBLE. 0

-AFTER PASSING Z44 THE PROCESSED CW SIGNAL IS PLACED ON THE TRS-
 80 D7 DATA LINE AS A DIGITAL 0 OR 1 WHERE ITS LENGTH IS THEN
 MEASURED BY THE SOFTWARE PROGRAM AND A SIMPLE ALGORITHM DECODES
 THE SYMBOL.? _

THEORY CONTD:

-
 THE KEYBOARD 'CLEAR' KEY AUTOMATICALLY SWITCHES THE TRS-80 FROM
 TRANSMIT TO RECEIVE AND VICE VERSA. THE 4 ARROW KEYBOARD KEYS
 CALL SUBCOMMAND, FILE, FILE-REVIEW, AND INSTRUCTION SUMMARY.

-DURING TRANSMIT  MODE ALL FOUR ARROWS ARE OPERABLE. DURING THE
 RECEIVE MODE ONLY  AUTO-FILE AND 'CLEAR' MAY BE USED.

-AUTO-FILE CONSISTS OF 100 AUTOMATICALLY SEQUENCED FILES, EACH
 CAPABLE OF HOLDING UP TO 255 CHARACTERS. IT'S DESIGNED TO SERVE
 THE USER AS A LOGBOOK AND MAY BE RECORDED ON CASSETTE ANY TIME.

-FILE REVIEW, -- PRINTS OUT ALL 100 AUTO-FILE ENTRIES IN GROUPS
 OF 4 AT A TIME.
? _


        NOW PRESS 'ENTER' FOR MAIN PROGRAM
THEN TYPE 'RUN' AND ENTER TO AUTOMATICALLY CLEAR OUT
MEMORY FOR MAIN PROGRAM USE.  THERE IS AN INSTRUCTION
SUMMARY IN MAIN PGM.? _
```

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.

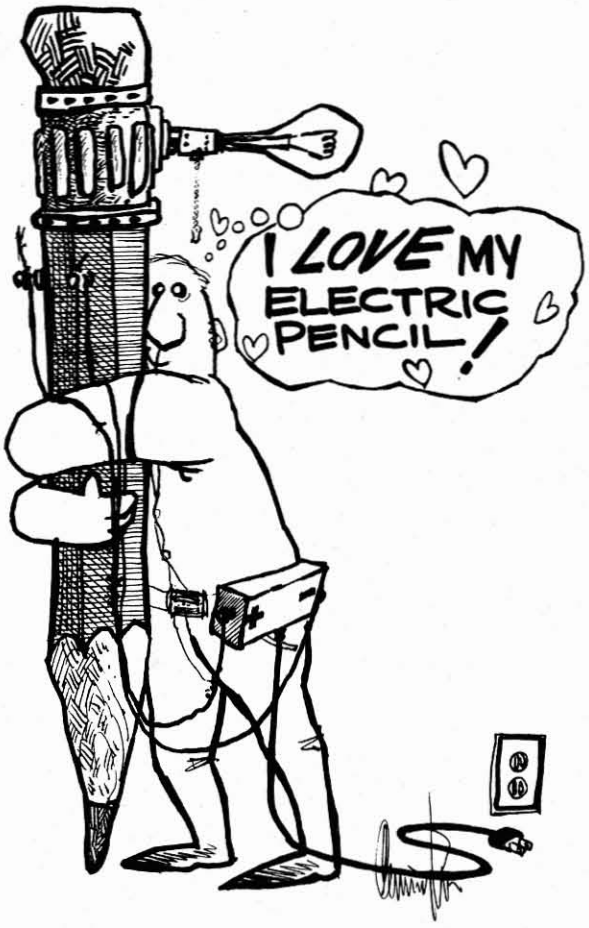
Our CP/M versions are the same as we have been distributing for several years and allow the CP/M user to edit CP/M files with the addition of our CONVERT utility for an additional $35.00. CONVERT is not required if only quick and easy word processing is required. A keyboard buffer permits fast typing 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

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mss

MICHAEL SHRAYER SOFTWARE, INC.
1198 Los Robles Dr.
Palm Springs, CA. 92262
(714) 323-1400

✓Reader Service—see page 178

Put graphics in their place.

Beginners' Formatting

Ms. Wynne Keller
RD 1, Box 507
Solon ME 04979

Much is left unsaid by Radio Shack's Level II manual. By trial and error and studying the programs of others, one can learn how to arrange input on the screen, so that a great deal of information can be displayed at one time in a visually pleasing format. To do this admittedly takes more time than a simple PRINT command, but the results are well worth the effort.

Before you begin any screen format, I recommend using programming paper to help you avoid awkward word divisions.

Try a Screen Chart

A screen chart for input is a desirable programming tool. To create one, input locations must be controlled. I prefer to locate input at line 768 in most cases. (Avoid the bottom line, as scrolling will occur.) To position the cursor, simply type:

```
PRINT @ 768,"";
```

The "" means null string. In other words, PRINT@768, nothing. The trailing semi-colon leaves the cursor there, and the input can then be placed exactly where you want it.

It might seem ridiculous to allow four lines for input (768,832,896,960), but this is necessary if any errors are anticipated. If the user types a letter when numeric input is expected, the computer prints "REDO" on the next line (832) and a question mark on line 896 for the corrected input.

After the data is entered, it must be moved to its proper place in the chart. If the chart title is to be on the first line (0) and column headings on the second line (64), the data can be printed, starting on line 128. This is handled with a FOR-NEXT loop and an array.

Since each line is 64 spaces, multiply 64 times a variable (B). This variable is incremented by one each time through the loop. Add to this the number of the line above where you wish to start (in this case 64):

```
15 B=1
20 FOR N=1 TO 60: PRINT@768,"YOUR
   ANSWER IS ";
25 INPUT A(N)
30 PRINT@B*64+64,N;A(N);: B=B+1 :
   NEXT N
```

Notice that B is set at 1 outside the loop, while it is incremented inside the loop.

To keep everything neat, the input line and answer should be erased each time through the loop. If this is not done, the previous answer still shows at the bottom of the screen when the user is ready to type in a new answer. To fix this, type:

```
PRINT@768,CHR$(30);"YOUR ANSWER IS
";: INPUT A(N).
```

CHR$(30) erases the line, then the question is reprinted.

A trailing semi-colon is usually used in these PRINT@ statements, and this is a good habit. You are placing the cursor all over the screen at your command, but, at the same time, the semi-colon protects data from unplanned deletions.

With this program, the screen fills after ten answers. The program can, however, be expanded to start a new column:

```
35 IF B>10 PRINT@(B-10)*64+96,N;A(N);
```

This starts a new column in the middle of the screen (64 + 32 = 96).

Improving Appearance

Separating N from A(N) improves the appearance of the chart. You might use a blank space between quote marks (N;" ";A(N);), however, this causes some problems. In the first column, when N = 10, the extra digit makes the A(N) column off line. There are several solutions. One is to use tab, thus:

```
30 PRINT@ B*64+64,N;TAB(5)A(N);
```

Alternatively, you could omit the tab and use a comma instead of a semi-colon after N, thereby spacing A(N) to the next column. This works, if you aren't planning many columns on the screen.

Perhaps the best solution is a PRINT USING statement. Because we are dealing with only numeric input, all we require is P$ = "## ##". Place this line near the beginning of the program. The "#" indicates where a number is to go, and the columns are neatly justified on the right side. When ready to use it, simply type:

```
30 PRINT@B*64+64,USING P$;N;A(N);
```

Note the punctuation and the fact that you type only USING, because print has already been stated before the @. If you had input a string instead of numbers, the print using string would be P$ = "## % %". The % sign indicates the beginning and end of the string input.

If there are more than 20 answers in the program, you again run out of room, so an additional line is needed to clear the screen and start a new chart:

```
40 IF B=20,PRINT@768,CHR$(30);"PRESS
   ENTER TO CONTINUE TO NEXT PAGE";
   :INPUT A$: GOSUB 1000: B=0
```

GOSUB 1000 gives the chart headings. B must be reset so that the PRINT@ lines that format the screen still work. It must be set at 0, because the B = B + 1 line is further along in the loop and will be encountered before the next input.

One more point deserves consideration. You must stop the input when you are finished. You could enter a value that would never occur logically, such as 99 in a program counting the daily output from 50 chickens in our sample listing. A line must instruct you to enter a number, or word, if you are entering string values, to end the program. This

can go on line 960 or at the top of the screen. Further, you need a line within the FOR-NEXT loop looking for 99:

```
25 IF A(N) = 99 GOTO 55
```

The Sample Listing shows the final version of our egg production program. Of course, it must be expanded to manipulate or record data. Several more columns could be added, if desired, using the same format.

Using INKEY$

If all the values you planned to enter were one digit, the INKEY$ function could be used. This saves you the trouble of pushing enter. Furthermore, INKEY$ does not cause scrolling, even if placed on the bottom line.

You would, however, need an error-correcting routine, since the user does not have time to change his entry if he hits the wrong key. To use INKEY$ for the sample program, make the following changes:

```
25 A$ = INKEY$:IF A$ = "" GOTO 25
27 IF A$ = CHR$(47) GOTO 55
28 A(N) = VAL (A$)
1010 PRINT@960, "HIT / TO QUIT";
```

Since '99' cannot be entered to stop the program, being 2 digits, the / key is used, CHR$(47). INPUT A was also changed to a string for INKEY$, so that a null condition could be searched. However, before A(N) is printed, it is changed back to a number in line 28 and assigned a position in the array.

Using the above statements, you can pack a lot of information on the screen. Of course, many other commands are useful, but these few keep the cursor under your control, and your programs look more professional. ■

```
10 DIM A(60)
12 P$="##      ##"
15 B=1:GOSUB1000
20 FOR N=1 TO 60: PRINT @ 768,CHR$(30);"NUMBER OF EGGS DAY";N;
25 INPUT A(N): IF A(N)=99 GOTO55
30 IF B<=10 PRINT@ B*64+64,USING P$;N;A(N);
35 IF B>10 PRINT@ (B-10)*64+96,USING P$;N;A(N);
40 IFB=20PRINT@768,CHR$(30);"HIT ENTER FOR NEXT PAGE";:INPUTA$:
GOSUB1000:B=0
45 B=B+1
50 NEXT N
55 END
1000 CLS: PRINTTAB(20)"EGG PRODUCTION"
1005 PRINT@64,"DAY      EGGS";:PRINT@96,"DAY      EGGS";
1010 PRINT@960,"ENTER '99' TO QUIT";
1015 RETURN
```

Sample Listing.

✓Reader Service—see page 178

The high cost of saving money.

Saving Money

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My TRS-80 and myself had come through some rough times but together we were working them out—at least I thought we were. Looking back now, I think the real problems began when I brought home the Percom TFD-200—a 77-track disk drive that provided over twice the storage of a Radio Shack drive. The same storage capacity as two Radio Shack drives for $675 just seemed like a smart move.

The first problem was that the Radio Shack disk cable wasn't long enough for the way the Percom drive hooks up. It cost me 40 bucks for a new one from Percom. Then my TRS-80 had to be "brainwashed," as Percom refers to "patching the operating system" to format and backup a 77-track drive.

Departing the Radio Shack Family

Next, I lost the Radio Shack printer that was nicely compatible with my 80. It's owner, the person for whom I'd been developing software, needed it back. I went shopping for another printer, but $1600 seemed like a steep price to pay for a noisy, relatively slow Radio Shack product. Since I was very satisfied with that first venture outside the Radio Shack family, I decided to try a Microtek printer. At $750 it promised to be fast, versatile and quiet.

It was late October when I ordered the Microtek printer and delivery was quoted as late November. Three weeks without a printer to save $850 was a good trade-off for anyone in my tax bracket.

But Microtek didn't deliver on time. They were back-ordered and their printer mechanism supplier was behind on his shipments.

Finally, in late December, the printer arrived. I hooked it up, using a standard Centronics type cable from Radio Shack. It was time for a trial run. First, I loaded a program listing into memory, pressed LLIST and out came a neat, easy to read listing at 125 characters per second.

Next, I tried running a program. The program, an inventory system for furniture stores, was supposed to access disk, print out some information, then go back to disk again. For some reason though it didn't work properly.

My TRS-80 reset to DOS, locked up, showed syntax errors—did anything but run properly. I was furious. I was certain that the problem was with the 80.

"Crack! I looked up to see smoke pouring from the TFD-200 cabinet . . . . CRACK! More smoke."

A moment later, I reached to pick up a pencil that I had hurled onto the floor in frustration, and my foot caught the power cable to the Percom TFD-100 knocking it halfway out of the wall socket.

Crack! I looked up to see smoke pouring from the TFD-200 cabinet. When I saw the TFD-200 cord partially unplugged, I—in what has to be in contention for the dumbest move of the year—plugged it back in. CRACK! More smoke. I quickly unplugged everything.

I was certain this was the 80's work. In retaliation for the foreign equipment I had bought, it had killed the TFD-200.

The Post-mortem

Removing the injured disk drive from the system, I plugged everything in and powered up. Nothing. Next, I took off the two Radio Shack drives and tried again. Nothing. I unhooked the printer—nothing. The expansion interface was removed—nothing!

I got out my voltmeter and examined the equipment piece by piece. The TFD-200 was first. When I picked it up to remove the screws holding its cover, I heard it rattle. While removing the cover, several pieces of black plastic fell out—pieces of integrated circuits! Looking at the PC board, I could see that several chips had exploded and there were several black marks where whole PC traces had vaporized.

I looked inside the two Radio Shack disk drives, and, while they showed no visible signs of damage, a voltage check on each of them showed 0.56 volts where 5 volts should have been. The expansion interface and keyboard showed similar low voltages. Finally, I measured the printer power supply. It wasn't much better at 0.85 volts.

I could not imagine what had happened.

The printer was the only thing

that was new. It had to be related to the disaster. I began reading the Microtek manual searching for a clue. (I hadn't bothered reading it before.) The interfacing section contained some interesting facts. It seems that Microtek uses a chassis ground separate from the logic signal ground. Microtek further suggest that these two be kept separate.

I got out the TRS-80 expansion interface service manual and sure enough, the chassis ground (pin 17 of the Microtek printer connector) was connected to signal ground inside the expansion interface. Things were starting to make sense.

Looking at the TFD-200, I realized it and the Microtek printer had 3-prong power plugs. The Radio Shack equipment had no ground pins on their power plugs. Ground pins are longer than the two power pins on AC cords. When I kicked the TFD-200 power cord, only that longer ground pin stayed in its socket.

Somehow a ground loop was created, when I kicked out the plug, causing 120 volts (or some fraction thereof) to get onto the signal ground. This theory was borne out by examination of the Microtek PC board. The trace going to pin 17 (chassis ground) was vaporized.

Realizing how grave the injuries were, I decided to consult the experts. With notes of explanation I returned the printer and TFD-200 to their manufacturers for repair. I took the expansion interface and Radio Shack drives to the computer center for treatment.

I kept the keyboard at home to repair myself. Thirteen chips, $21 and 16 hours later, the TRS-80 had recovered. The expansion interface repair bill was $72. The Radio Shack disk drives cost $45 each. The Microtek printer repairs were $166.52. The Percom drive is not back yet, but will cost around $90-$110.

I was without a computer for 4 weeks. Worse, the repaired Microtek printer does not function as it should. It gets lost while printing and prints only partial lines or forgets to do line feeds. According to Microtek, even some of their new printers do it, but they have no cure for it at present. I am returning the printer for a refund.

Saving Money

For me then, the high cost of saving money was about $485 counting shipping charges, the loss of a system for over a month, and I still don't have a printer.

I'm not saying that foreign equipment on a TRS-80 isn't a good idea. Nor am I saying that there is anyone to blame but myself for my tragedy. I do suggest though that anyone using computer equipment give consideration to these points:

1. Make certain your AC power is wired properly. I don't just mean a properly wired 3-prong outlet either. If you're like most people, you never have enough places to plug things in. I used an extension cable with a faulty ground—and I paid for it.

2. When hooking one manufacturer's piece of equipment to anothers, pay close attention to detail. Phrases like "Centronics compatible" don't necessarily mean complete compatibility. Read the manual carefully to be sure.

3. Don't move equipment around while it is still turned on. Turn off everything before unplugging a single component.

4. If you do make a mistake—don't hide it. Write about it. Others can learn from what you did wrong, and you can recoup a few bucks to boot.

5. If you're in a hurry to get a job done, don't try something brand new. Computer equipment is complex and manufacturers are under economic pressure to get equipment out into the field. I lost a lot of valuable time trying to get Microtek's printer to work. Let someone else be the guinea pig. Remember, advertising claims are almost always optimistic.■

✓Reader Service—see page 178

Your 80 got the hang up blues? Use this simple circuit to take some of the load from it.

Relay Assistant

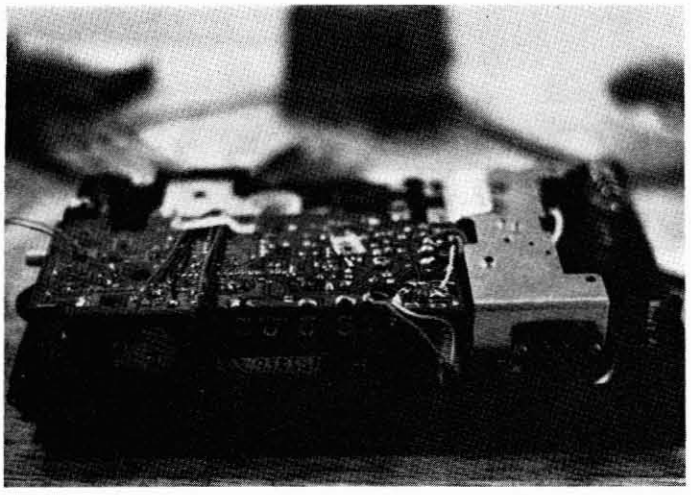
Karl K Jahns
PO Box 434
Allyn WA 98524

As an owner of a TRS-80, wanted to get full use out of the machine by using data files and other programs that required repeated on-off control of the recorder by the computer. I was concerned, however, for I had heard several complaints by others that the relay that did this had become mini-welded in the closed position. When this happens, you can either forget about that feature of the TRS-80 or send it in to be repaired, which means downtime and repair costs. Neither prospect appealed to me. After witnessing a friend's computer undergo this tragic transformation, I decided some preventative surgery was needed to correct the design flaw.

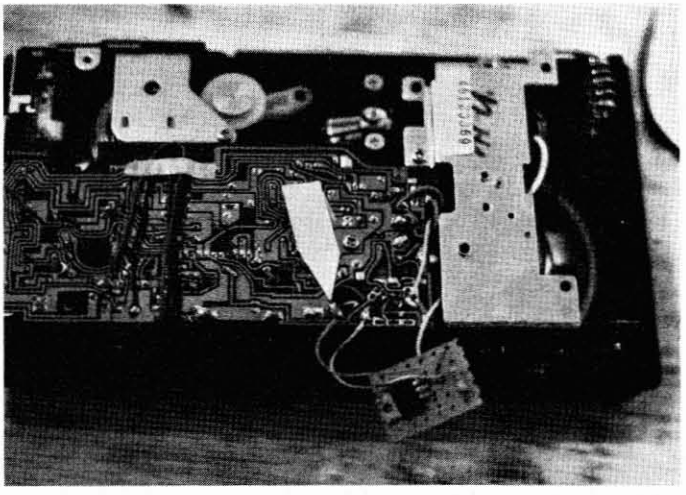
The solution is quite simple: Reduce the amount of current being switched by the relay so that arcing will not occur. You can purchase a device to do this that costs from $10 to $25, but this adds to the entanglement of cords and is unnecessarily expensive. I found that a 3055 NPN transistor mounted inside the tape recorder is the best solution. The transistor acts as a switch. Its base is turned on by the computer's relay. The current across that relay is reduced from 100 mA to .5 mA. (See Fig. 1.)

I mounted the 3055 (TO-220 case) and the resistor on a small piece of perfboard, wrapped it with tape and slipped it into a nice bit of unused space in the recorder. It could also be built in a small case and set beside the recorder.

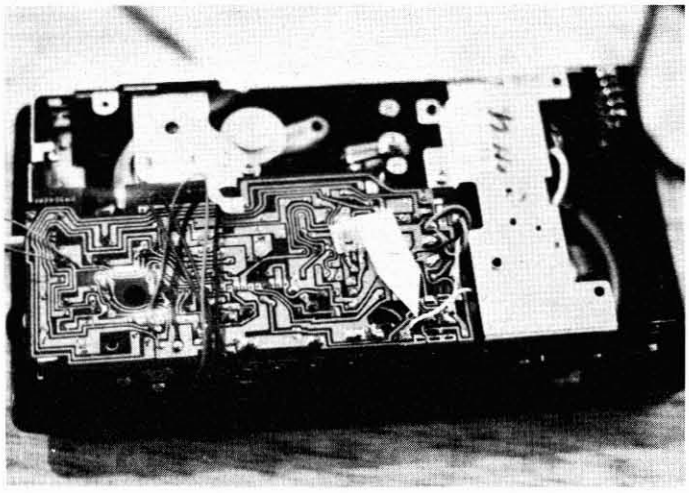
For internal construction, the



Perfboard with circuit tucked in just in front of battery holder.



Position of connection from collector to recorder.



Negative power supply wire, which is desoldered at this point

negative wire of the recorder's power supply needs to go directly to the circuit. The wire from the transistor's base is then soldered to the spot you unsoldered the negative wire from. The wire from the collector goes to the other side of the plug receptacle, which is conveniently located (on the Radio Shack recorder) a few millimeters from the connections previously made.

That's all there is to it. After a few minutes of soldering and some careful positioning, you'll never again have to worry about getting hung up in the middle of a program—well, at least not by a relay.■

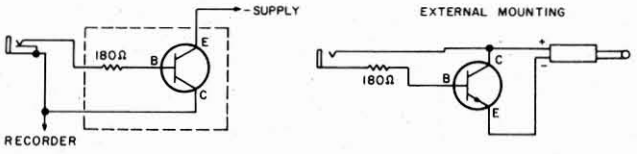


Fig. 1.

✓Reader Service—see page 178

Increase the speed of your H14 printer with software changes.

Heathkit Interface

Larry Kunk
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Speedway, IN 46224

After using a microcomputer for only a short time, it became apparent that some type of hard copy device would be a great help, especially in debugging programs.

After looking at various printers, both serial and parallel, the Heathkit H14 line printer at $625.00 looked like a good buy. The H14 prints upper and lowercase letters with 80, 96 or 132 characters per line. Vertical line spacing is 6 or 8 lines per inch and all of these parameters are controlled by software.

The H14

In addition, 80 or 132 character lines can be selected by a front panel switch. The baud rate is adjustable between 110 and 4800 and is easily set with three DIP switches. Unless handshaking is established, 110 baud is recommended. The H14 uses 9½-inch paper with sprocket holes on both sides. The perforated edges are easily removed to yield an 8½ by 11 page.

After acquiring the Heath printer, I tried to interface it, using the RS232 sold by Radio Shack. Both the printer cable and the RS232 cable from the computer have male plugs, so I mounted two female DB25 connectors on a small box, wired them together and connected the two pieces of equipment.

The printer worked well at low baud rates, but printed only part of the text at higher ones.

Handshaking between the printer and the computer did not occur.Request To Send (pin 4 on the DB25 connector) on the Heath printer goes high when the buffer in the printer is full. The computer is supposed to wait until Request To Send goes low before sending more data.

Request To Send from the computer RS232 is also on pin 4 of the DB25 connector, but it is an output. To provide handshaking it would have to be an input.

According to the RS232 manual, the Clear To Send input (pin 5 on the DB25) is unused. Request To Send from the printer (pin 4) was wired to pin 5 on the female socket, used by the RS232 cable from the computer.

The signal on pin 5 of the printer is also unused.

Software

I altered the Radio Shack driver program, supplied with the RS232, in order to establish handshaking. I inserted the patch seen in Example 1 in the driver software between lines 510 and 520 of the source program.

With these changes the Heath printer operates at 4800 baud without losing any text. There is an impressive difference between 300 baud and 4800 baud.

When the machine-language driver produced by this assembly language program is loaded from disk, the entry address must be placed in the printer Device Control Block before it is used. This can be done with POKE statements from BASIC or by adding the patch in Example 2. The Device Control Block is changed automatically when the program is loaded.

If you are using TRSDOS 2.2, one last patch eliminates the need to protect the driver with the memory size routine when entering Disk BASIC (Example 3).

This feature of TRSDOS 2.2 is mentioned in the documentation.

Interfacing with the TRS232

When a 300 baud modem is used with the RS232, changing back and forth between 300 and 4800 baud for the printer is inconvenient. For that reason I tried the Small Systems Software TRS232.

This device attaches at the cassette port and claims to be able to drive an RS232 compatible printer at baud rates up to 9600. The Electric Pencil and RSM-2 also support this device, but only to 1200 baud.

Hooking it up is very simple. Plug the tape recorder cable into the cassette port with the other end in the TRS232. Plug the printer cable into the TRS232 and plug the power supply into an outlet.

The TRS232 from Small Systems Software comes with a BASIC program. The baud rate, number of nulls to be sent after a carriage return and other specifics are fed in as the BASIC program asks for them. The program then creates a machine-language driver at the address you specify and makes the necessary entries in the printer Device Control Block.

```
512   IN    A,(RESURT)   ;CHECK HEATH RTS
514   BIT   7,A          ;IF HIGH BUFFER FULL
516   JR    Z,STATIN     ;LOOP UNTIL PRINTER
518                      ;IS READY
```

Example 1.

```
30    ORG   4025H        ;START OF PRINTER DCB
40    DEFB  02H          ;TYPE I OR O
50    DEFB  XXH          ;DRIVER ADDRESS LSB
60    DEFB  XXH          ;DRIVER ADDRESS MSB
```

Example 2.

With this device the Heath printer works fine up to 1200 baud. Operating faster than this is not possible because handshaking has not been established, and the text is lost when the buffer becomes full.

Letters typed with the shift key held down are printed as lowercase, just as with the Radio Shack Quick Printer.

To print lowercase normally, I recommend the excellent disk version of Electric Pencil that contains a driver for the Radio Shack RS232 as well as the Small Systems TRS232.

Other software, such as KVP and DOS 3.0, also provides typewriter action with upper and lowercase, but lowercase letters will not appear on the video display unless a hardware modification is made.

Software Compatibility

The Small Systems Software driver program is not compatible with the NEWDOS version of the EDITOR/ASSEMBLER, the NEWDOS DISASSEMBLER and several other programs. The Radio Shack RS232 and modified driver program have worked with all software I've tried, with the exception of the tape version of Electric Pencil.

Maximum software compatibility with the Heath H14 or any other serial printer will not be achieved until a hardware solution is applied. The serial printer must be made to appear like a parallel printer. Then, the only driver program that will be needed is in the Level II ROM.■

```
70    ORG    4049AH    ;MEMORY SIZE STORAGE
80    DEFB   XXH       ;DRIVER ADDRESS LSB
90    DEFB   XXH       ;DRIVER ADDRESS MSB
```

Example 3.

✓Reader Service—see page 178

Analog to digital conversion via the AD570 and AD582 chips.

Two Different Worlds

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Syracuse, NY 13211

Since a computer is digital in nature (numbers exist inside the machine in discrete values), we must change the continuous quantity into a digital form in order to represent it inside our computers. This is called an analog-to-digital (A/D) conversion.

Many of the signals we see every day are continuous in nature. By continuous I mean a quantity which can take on any possible value. Examples of continuous quantities are very easy to find around us. The temperature of the air is a continuous quantity which can take on any of an infinite number of values, although we may not be able to measure or detect all of these values.

Digital Quantities

Examples of discrete or digital quantities are also plentiful. If you are like me, you probably have at least one digital clock around the house. The time increments, whatever they are—minutes, seconds, or even tenths of a second—are discrete steps of time. Another example of a discrete quantity is the speed of a push-button blender. The blades of the blender can take on only a finite number of different speeds. When you push a different button, the blades change to another discrete value of speed.

There are many methods that could be used to accomplish A/D conversion. The method I will discuss is called successive approximation. This is the method used in Analog Devices' A/D converter chip, the AD570. This chip contains all the circuitry needed to convert a 0 to 10 volt or −5 to +5 volt signal to an 8-bit digital value in approximately 25 microseconds.

Fig. 1 is a block diagram of the AD570 A/D converter. It will serve as a good aid to describe the operation. Upon receiving the negative edge of the $\overline{\text{CONVERT}}$ pulse, the internal 8-bit current output digital-to-analog converter (DAC) is fed binary values from the successive approximation register (SAR),starting with the most significant bit first. This produces a current which is injected into the summing junction of the comparator. The other current input is from the input signal.

The comparator determines whether the addition of each successively weighted bit current causes the DAC current sum to be greater or less than the input current. If the sum is less, the bit is left on; if more, the bit is turned off. The decision is made by the SAR based on the input to it from the comparator.

The clock is also contained in the SAR. When the final bit is checked, the SAR contains a 8-bit binary number that represents the input signal to within ± ½ LSB. Upon completion of this sequence, the SAR sends a $\overline{\text{DATA READY}}$ ($\overline{\text{DR}}$) signal (active low), which also places the three-state buffers into their active states.

Level II BASIC	Z-80 Machine Language		Comments
A = INP(126)	IN A,7E	DB 7E	Reads binary value from converter into accumulator.
OUT 126,C	OUT 7E	D3 7E	Loads analog channel number into flip-flop U6 (0-7). Channel number must be in accumulator before executing this Z-80 instruction. For BASIC, variable C must be the channel number.
OUT 127,x	OUT 7F	D3 7F	Starts A/D conversion process. Contents of accumulator not important as only the pulse generated by the address decoder (U9) is used to trigger one-shot. For BASIC, x can be any integer 0 to 255.

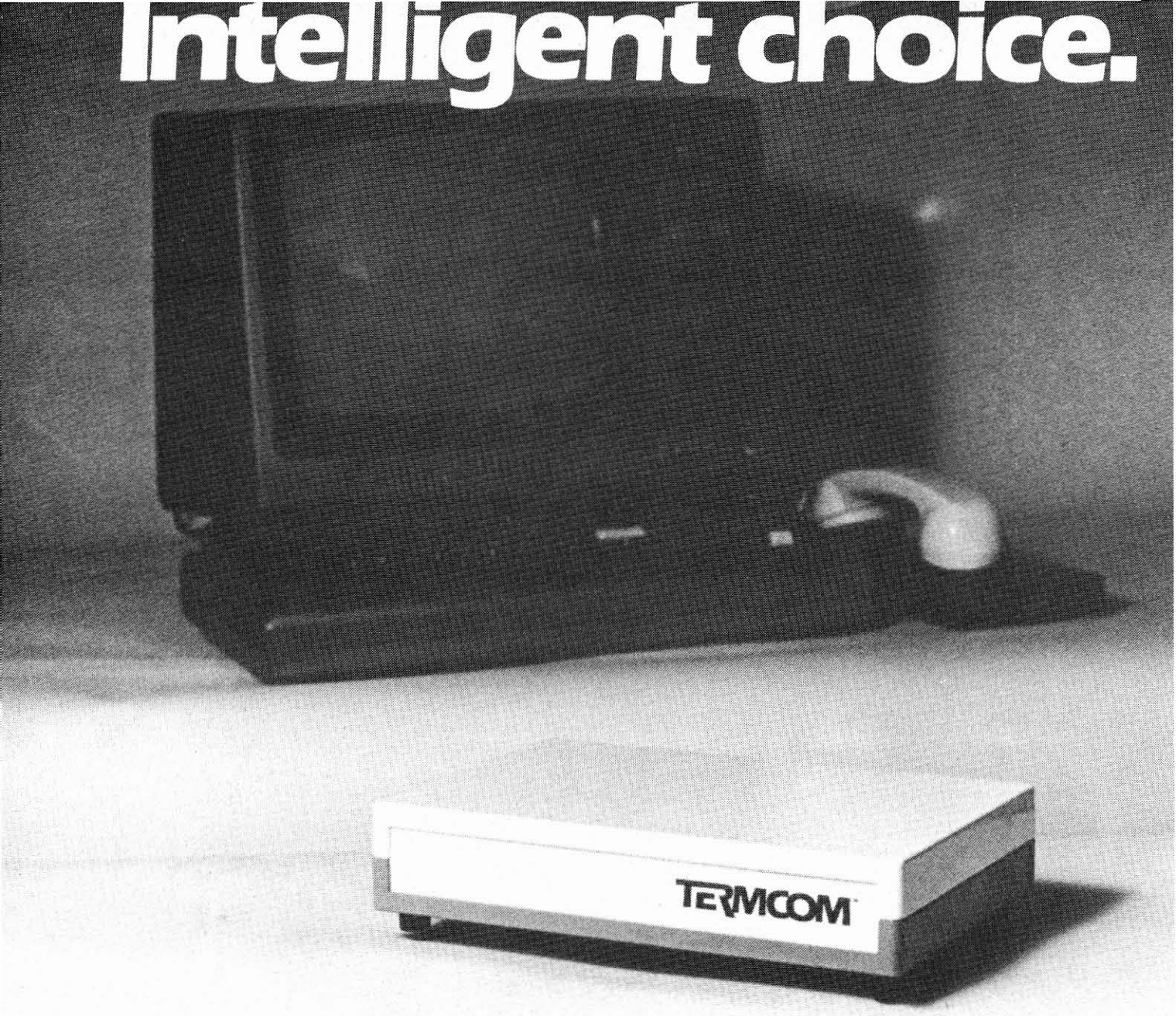
Table 1. Instructions in Z-80 machine language and Level II BASIC for addressing the A/D converter board.

Integrated Circuits and Diodes Parts List—A/D Converter

Ref. #	Type	+5V	Com	−12V	+7.5V	−7.5V
U1,2,3,4	LM1458				8	4
U5	CD4051		8		16	7
U6	74LS175	16	8			
U7	7416	14	7			
U8	7430	14	7			
U9	74LS139	16	8			
U10	74123	16	8			
U11	AD570	10	16	12		
U12	74LS244	20	10			
U13	7805					
U14	LM1458				8	4
D1,D2	1N755A	7.5V	Zener	±5% 400mW		

Parts List

Intelligent choice.



Timesharing and intelligent terminal functions for the TRS-80.

With the Termcom package from Statcom you get the software and the hardware you need to turn the TRS-80* into an intelligent terminal — ready for timesharing. And if you already have an Expansion Interface, all you need is the Termcom software.

The Termcom package includes the hardware Level II users need for timesharing, and the software for these features:

- **Full paging capability** — allowing storage of several screens of data in the computer, ready to be called to the screen.
- **Scrolling** — with the information stored for instant callback.
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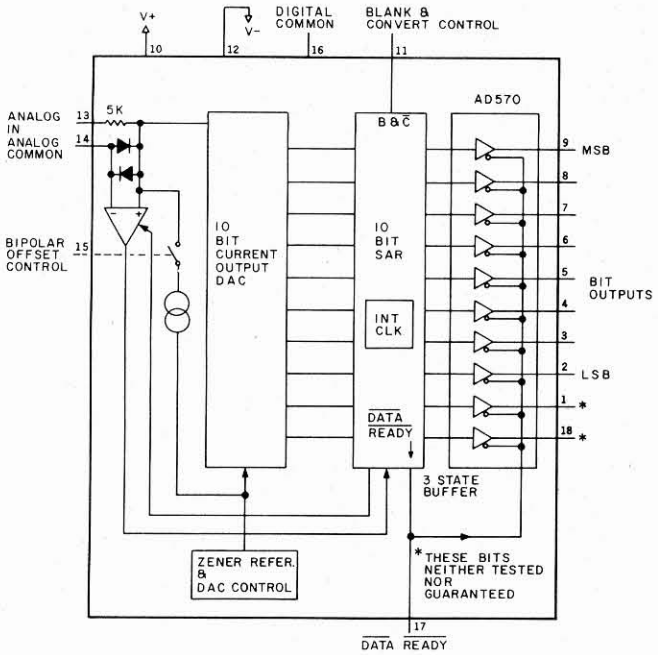


Fig. 1. The AD570.

In the simplest mode of operation, the convert pulse mode (see Fig. 2), the B & $\overline{C}$ input is normally low, enabling the three-state devices. When the B & $\overline{C}$ input goes high, it causes the three-state devices to turn off by sending ($\overline{DR}$) high.

When the B & $\overline{C}$ input goes low, this starts the conversion process. Typically, 25 microseconds later, the $\overline{DR}$ line returns low to signal the end of the conversion. This signal also enables the three-state buffers to allow the binary number to be read. This is only one of the many configurations available to operate the AD570. The AD570 data sheet contains details of the other possible configurations.

The Design

This 18-pin DIP integrated circuit can greatly simplify the design of an eight-channel A/D converter board. The signal designations are from a TRS-80 computer system, which uses a Z-80 microprocessor. I chose to use the IN and OUT Z-80 instructions, which require only the lower eight address lines to specify the Input/Output (I/O) port number. I could have used memory-mapped I/O, but this normally requires using more than just eight address lines.

The $\overline{IN}$ and $\overline{OUT}$ signals used in Fig. 5 are generated in the TRS-80 by combining the Z-80 signals $\overline{RD}$ and IORQ to produce $\overline{IN}$, and $\overline{WR}$ and IORQ to produce $\overline{OUT}$ (see Fig. 3). The port numbers for this board are 7EH and 7FH.

An OUT instruction outputs the contents of the accumulator on the data bus and the port number on the lower eight address lines as above. The data on the data bus is loaded into the accumulator. See Table 1 for instructions to address the A/D board. A flow chart for writing a program to perform the conversion is given in Fig. 4.

The A/D Converter

The desired channel number is first loaded into the channel register (U6 in Fig. 5) with the appropriate instruction. This number is fed to the select inputs of a CD4051 analog multiplexer. This device can accept up to eight analog inputs and send the one specified by the select lines to the output.

The analog inputs are all buffered with op amps wired as unity gain amplifiers. These buffers provide a gain of one with a very large input impedance and a low output impedance. These are both desirable properties of a buffer. The high input impedance prevents loading of the signal source. The low output impedance allows the full signal swing to be applied to the desired point.

The output of the CD4051 is also buffered with a unity gain buffer. This output goes directly to the only adjustment on the entire board, the full scale calibration resistor.

There is a bipolar control, pin 15, which is used to select the range of allowable input to the converter. If this pin is high, the converter is in the unipolar range (0 to 10 volts full scale). A low at this pin places the converter in the bipolar range (−5 to +5 volts full scale).

On my system this pin is wired to provide the bipolar range at all times. This could be made software selectable to provide more flexibility.

When it is desired to start a conversion process, the appropriate instruction is executed. This instruction places a port number of 7FH on the lower address lines. The decoder (U8 and U9 in Fig. 5) generates a negative-going pulse that triggers a one-shot multivibrator (U10). This pulse from U10 is approximately 2.5 microseconds wide. The trailing edge of this pulse initiates the conversion process (B & $\overline{C}$ pulse in Fig. 2).

Since I do not use the $\overline{DR}$ signal to flag the processor when the conversion is complete, I simply wait 40 microseconds (worst case conversion time) and then read the converter with the appropriate input instruction.

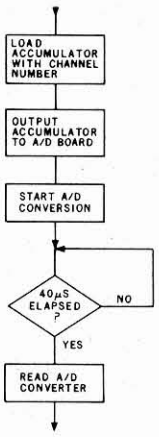


Fig. 4. Flowchart for an A/D conversion without a flag.

If you are using BASIC, nothing is lost because by the time the BASIC interpreter reads the next line of your program, the conversion is complete. When using machine language in a Z-80 based system, you must choose a few time-wasting instructions to execute while the conversion is taking place.

When the read instruction is executed, the decoder detects port number 7EH in conjunction with the $\overline{IN}$ line going low and enables the three-state buffer (U12), which allows the data to be placed on the data bus. The

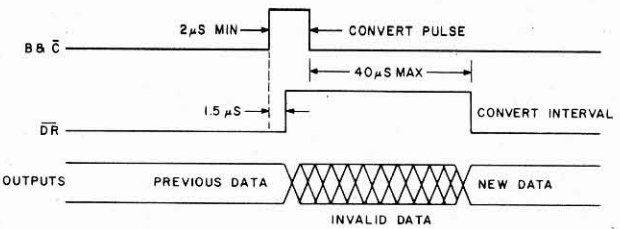
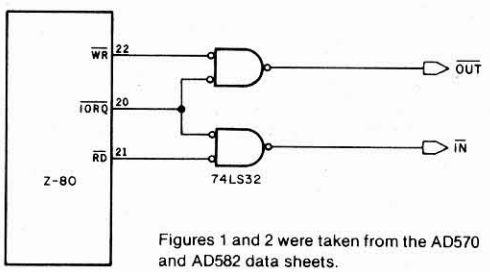


Fig. 2. Timing diagram of the AD570. Diagram from AD570 data sheet.



Figures 1 and 2 were taken from the AD570 and AD582 data sheets.

Fig. 3. Generation of the $\overline{OUT}$ and $\overline{IN}$ signals in the TRS-80.

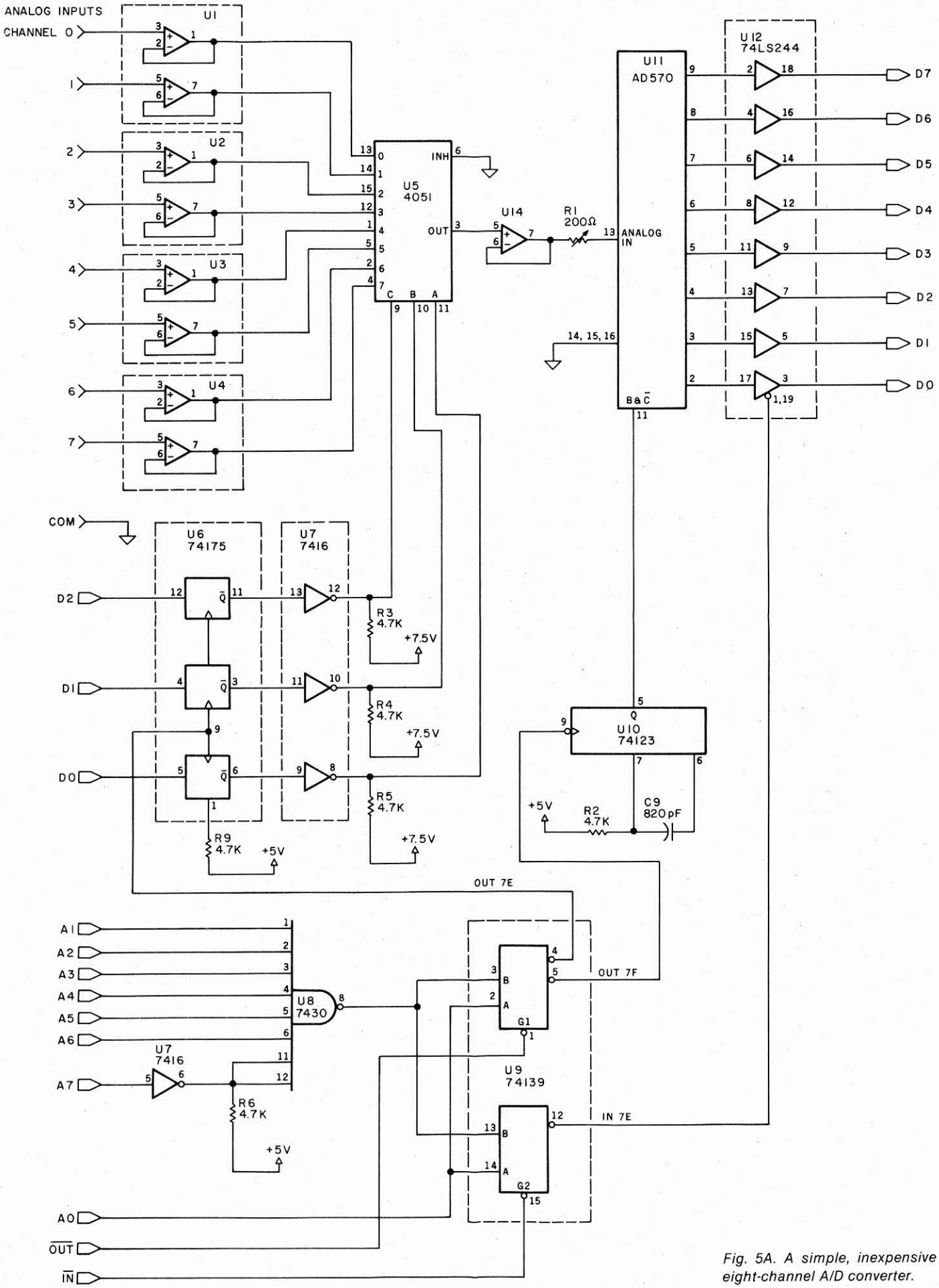


Fig. 5A. A simple, inexpensive eight-channel A/D converter.

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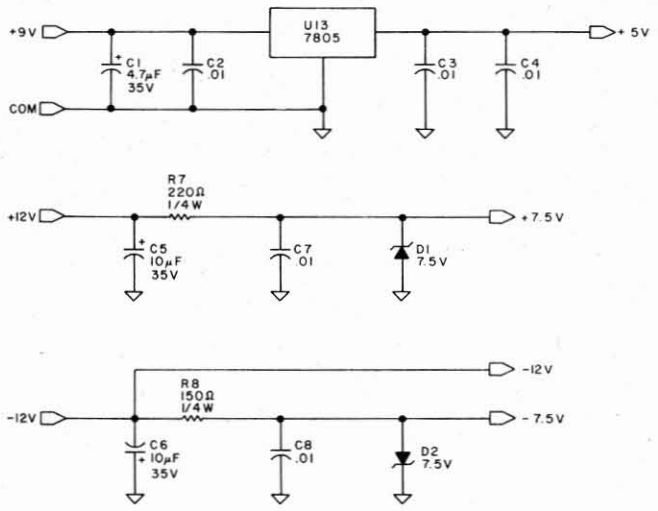

Fig. 5B. Circuitry for 5A.

accumulator will then contain the eight-bit representation of the analog signal at the input to the converter board.

A Word of Caution

No provision has been made to account for rapidly changing input signals. If an input has a value at the beginning of the conversion period and it changes drastically during the process, this will confuse the converter.

If input variation is excessive, a circuit known as a sample-and-hold must be inserted, somewhere before the AD570, in order to hold the input steady during the conversion process. This circuit typically is some sort of gated switch which charges a capacitor and maintains this charge during the conversion period. However, don't be too alarmed. This converter completes its cycle in less than 40 microseconds and most applications using this converter will work fine.

If it is desired to add a sample-and-hold circuit, Analog Devices makes one on a single chip, the AD582, sample-hold amplifier (SHA). A block diagram of this SHA and how it fits into the converter board is shown in Fig. 7. Notice that the buffer (U14 in Fig. 5) can be deleted because the AD582 SHA performs the buffer function as well as sample-and-hold.

When pin 12 of the AD582 is low (refer to Fig. 2), the SHA is in the sample mode. The output follows the input on pin 1 of the SHA. After the convert pulse is received by the AD570, the $\overline{DR}$ lines goes high within 1.5 microseconds causing the AD582 to go into the hold mode.

The time constant of one-shot U10 (Fig. 5) must be lengthened to about six to eight microseconds to give the SHA time to stabilize before the negative-going edge of the convert pulse, which starts the conversion in the AD570.

The 300pf hold capacitor should be a high quality polystyrene or Teflon type with low dielectric absorption. There is also an optional null circuit shown in Fig. 7 to eliminate any D.C. offset during the hold period. However, this offset will then appear at the output during the sample period.

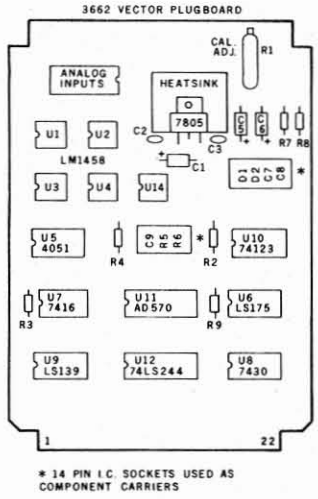

Fig. 6. Components mounted on a Vector 3662 plugboard.

Conclusion

The AD570 A/D converter chip makes easy work out of designing a fast, accurate A/D converter board. All of the critical components of the A/D converter are contained in the chip. Only address decoding, latching the channel number, and triggering the one-shots to initiate the conversion process need be added if desired.

If you desire to construct this A/D converter, first consult the data sheet supplied with the AD570 and AD582. These can normally be obtained through your local Analog Devices distributor. The data sheets contain a lot of useful information that I have not discussed, and also give additional information on other modes of operation which may be more suited for your particular application. ■

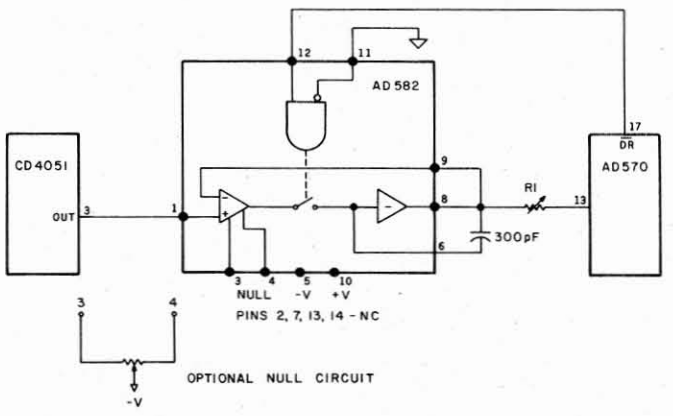

Fig. 7. A/D converter with AD582 SHA added.

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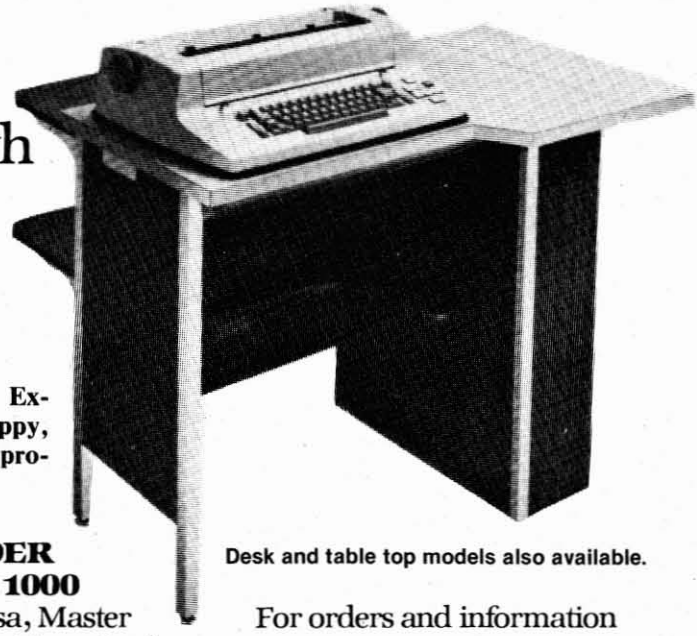

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Interested in a printer that handles the full 96-character ASCII upper and lowercase character set at 31 lines per minute, takes pin-feed, single sheets or cheap roll paper, comes in parallel or serial interface versions and weighs less than 10 pounds? If you are, then this new offer from Centronics may be just what you're looking for.

For a year I put up with an enormous old Model 15 Baudot Teletype but just could not resign myself to its impossibly slow speed and lack of many common ASCII symbols.

Since I also wanted lowercase, I originally intended to wait until I could afford a converted IBM Selectric, but the more I listened to that ". . chunk . . chunk . . chunk . . ," the more I realized that 15 characters per second would never do; it had to be faster.

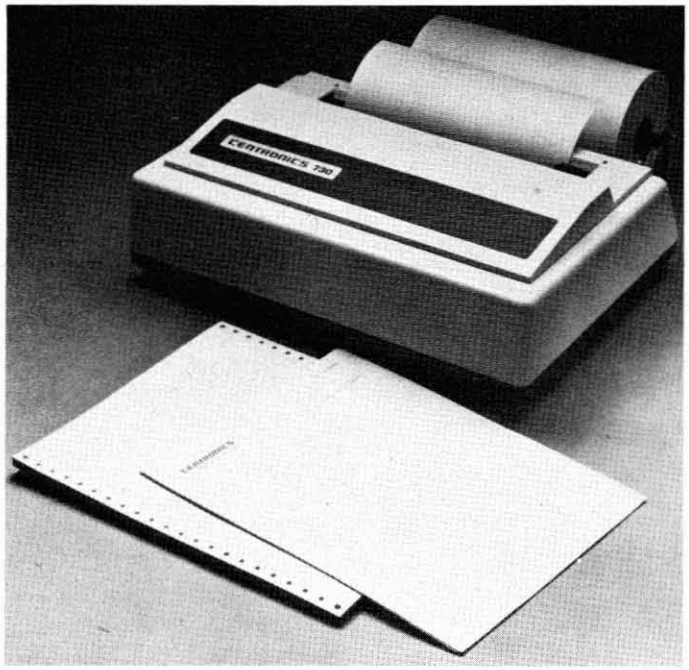

Photo 1. Centronics 730 Printer.

The new thermal printers didn't appeal to me at all, because they need special paper. Tractor or pin feed was a must, too—I was fed up with stopping the printer in order to adjust crooked paper. When Radio Shack started advertising the Line Printer II, I was ready to buy.

In my opinion, ordering anything from Radio Shack has two major disadvantages: They are notoriously slow on deliveries of new products, and their prices are outrageous. In this case they were asking $979 for the printer, plus $29 for the cable, so I decided to see what a Centronics dealer could do for me instead. A Centronics marketing manager told me that all the 730's were being held up by Centronics so that their 50 CPS speed could be increased. Even more interesting, he offered to sell me the speedier version, without the cable, for a considerably lower price! That did it: I ordered the printer and placed a separate order with Radio Shack for the cable.

Three weeks later my 730 arrived, carefully packed in foam and plastic in a little carton—in fact, so little that it was difficult to believe that I was holding the whole thing. It looked pretty, but, of course, the Radio Shack cable I had ordered hadn't arrived.

Another three weeks passed and still no cable. After a completely unsuccessful search in the local area for one of the connectors listed in the manual, I attended the Philadelphia Microcomputer Fair and returned with a $35 cable that I had been assured was just right for Centronics printers. Alas, the 730 uses a different connector from the 779 and its ilk, and I still couldn't hook it up!

Finally, my Centronics dealer did a little digging in his manuals, located yet another compatible connector and mailed it to me without charge.

What you Get

The original advertisements all state a speed of 50 characters per second for the 730, but this is instantaneous print speed and does not include the carriage return. The printer is unidirectional, and the carriage takes almost as long to return as it does to print a line. The converted printers like mine operate at 31 full lines per minute. The

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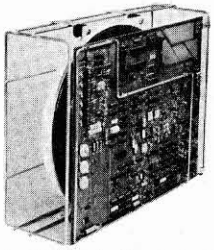

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DISKOS 2050 (8")	20 Mbytes	4.62" × 8.55" × 14.25"	20 lbs.	$2995
DISKOS 3450 (8")	34 Mbytes	4.62" × 8.55" × 14.25"	20 lbs.	$3745
DISKOS 570	5.3 Mbytes	floppy-size	(low)	(low)
DISKOS 1070	10.6 Mbytes	floppy-size	(low)	(low)

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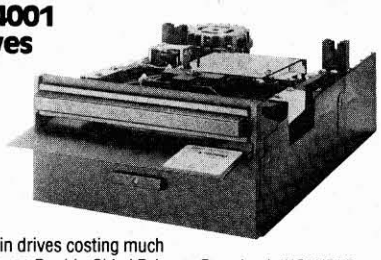

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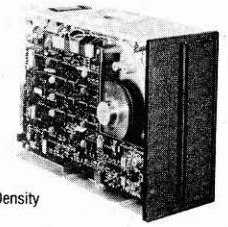

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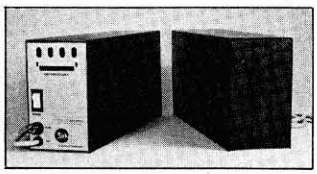

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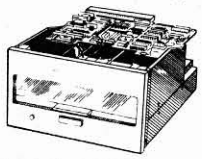

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```
10 'PRINTING DOUBLE-WIDTH CHARACTERS
20 LPRINT CHR$(27);CHR$(14)              :'TURN ON WIDE
30 LPRINT "ABCDEFG"; X; "HIJK"           :'ALL WIDE
40 LPRINT "LMNOP"                        :'NARROW
50 LPRINT CHR$(27);CHR$(14)              :'TURN ON WIDE
60 LPRINT "QRS "; LPRINT "TUV"           :'QRS WIDE, TUV NARROW
70 'USING STRINGS TO ALTERNATE WIDTHS
80 A$=CHR$(27)+CHR$(14)                  :'A$=WIDE
90 B$=CHR$(27)+CHR$(15)                  :'B$=NARROW
100 LPRINT A$;"ABC ";B$;"DEF ";A$;"GHI ";B$;"JKL"   :'ALTERNATE

ABCDEFG  0  HIJK
LMNOP
QRS
TUV
ABC  DEF GHI  JKL
```

Program Listing 1. Printing Double-Width Characters on a TRS-80.

new 100 CPS instantaneous print speed works out to an average of 41.33 characters per second of actual printing.

Characters are formed by a 7×7 dot-matrix impact print head and can also be printed in double width.

The printer circuitry contains an 80-character print buffer which allows a maximum printed line of 80 characters, printed 10 characters to the inch (six lines per vertical inch).

The manual implies that if more than 80 characters are entered before a carriage return, the line will be truncated and the last characters lost; but that isn't so unless you are using double-width characters, where the maximum 8-inch line width could be exceeded in under 80 characters. As soon as 80 characters have been received they are printed, the next 80 go into the buffer and are printed, etc.

An additional separate line feed buffer can store up to 255 line feeds, each of which moves the paper 1/6 of an inch. My model (730-1) also has a built-in automatic carriage return and line feed, so no extra control characters need be sent to get proper listings.

While on the subject of line feeds, there is one quirk. You cannot skip an extra line on the printer by typing LPRINT alone as you do on the screen. Instead you must print a blank (LPRINT " ") or LPRINT CHR$(138), which is the control character 10 (line feed) plus a necessary 128. There are only two control switches on the printer! One is the usual ON-OFF switch, and the other is a RESET switch which allows the printer to receive characters only in the ON position. RESET OFF stops the printing, clears the print buffer and returns the print head to the leftmost position. Unfortunately, there is no self-test mechanism built in, so the printer cannot be tried out without hooking it up to a computer.

Three Different Papers

The printer accepts three different kinds of paper: ordinary single sheets, eight and one-half-inch wide roll paper with five-inch diameter and a one-inch core (sold by Radio Shack for their 779 printer), or standard nine and one-half-inch fanfold paper with one-half-inch hole spacing that tears down to 8½ × 11-inch sheets. A holder is included for roll paper. The pins for fanfold paper are molded onto the plastic platen and cannot be adjusted for other widths.

A lever in the back can be turned to a vertical position for pin-feed or horizontal for friction-feed. Large thumb wheels at each end of the platen are easily accessible for manual paper adjustments. There is no waste when tearing off sheets.

The plastic printer cover lifts off easily to get at the print head and ribbon. In comparison to the light plastic construction of the rest of the printer, the print head itself is quite a surprise: It's the same one as used in the much more expensive 700 series printers and should last through many years of service.

There is a little plastic swivel near the print head that can be turned to point to 1, 2, 3 or LOAD. The manual is pretty sketchy on use of this lever, other than saying it should be turned to "LOAD" (the most counter-clockwise position) whenever new paper is loaded. Since the head is closest to the paper on 1, I assume that the numbers are meant to stand for the number of sheets of paper being printed simultaneously. (You can supposedly print an original and two carbons, although I haven't tried it.)

The ribbon is a nightmare on first sight—yards and yards of ribbon (20 to be exact) lying loose in a tray. No reels! There is a Mobius twist in the ribbon, so that both sides will be used. A small drive roller pulls the ribbon and can be twisted manually counterclockwise to remove slack. Ribbon tensioners are little foam pads glued to the inside of the case.

Ribbon replacements come in a zip-pack which is placed in the compartment and pulled off the ribbon in a sort of "yank the tablecloth out from under the plates" routine. I understand later ribbons will come in an easier-to-use cartridge. Ribbons are available inexpensively from Radio Shack.

The Manual

The 18-page manual, definitely a rush job, is supposed to be replaced by a better one. The main text and drawings are legible, but the schematic is not. Most of the manual consists of set-up instructions and drawings showing how to load various types of paper, change the ribbon and use the few controls. A pin diagram is included for the card-edge connector. There is no exploded diagram with accompanying part numbers, so if something goes wrong, it will be difficult to repair. A technical manual is also supposed to be in the works.

Double-Width Characters

All the manual says about double-width characters is that the two hex bytes 1B and 14 turn on the double-width function, while 1B and 15 turn it off again. It took a bit of experimentation to figure out how to use it with a TRS-80.

First let me mention some of the approaches that do not work! LPRINT CHR$(23) or LPRINT CHR$(151) accomplishes nothing. Since the line printer address is 37E8H (14312D) it would seem logical to POKE 14312,27:POKE 14312,14, but that only works if the POKEs are

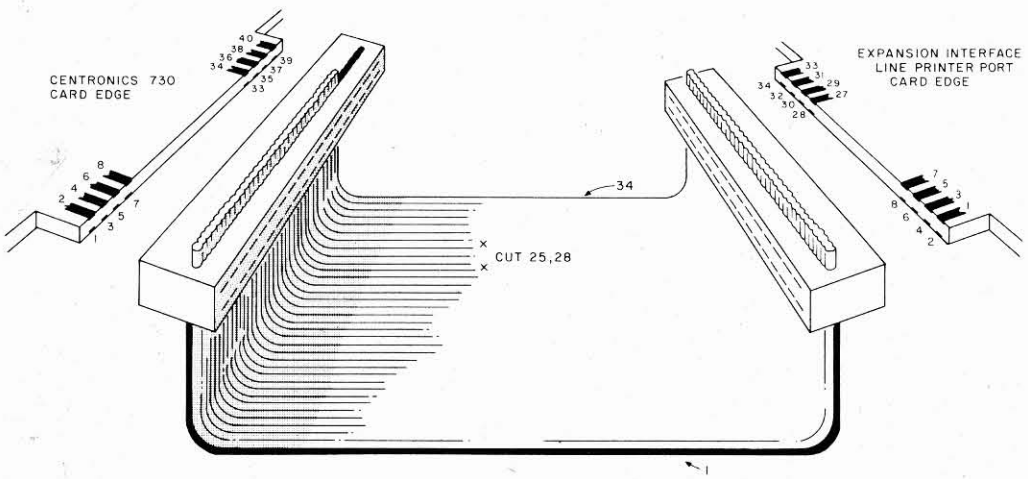

Fig. 1. Cable connections for the TRS-80.

the very first statement in the program and only for the first LPRINT following the POKEs; if you loop back to the POKEs, it won't work the second time around.

These three methods do work:

1. If you only want to LPRINT an occasional double-width character, you can LPRINT CHR$(160) through CHR$(255); these are the ASCII double-width characters corresponding to the normal ASCII characters 32–127.

Methods two and three are illustrated in Listing 1. Either method requires that the double-width function be invoked separately for each LPRINT statement requiring it.

2. Type LPRINT CHR$(27); CHR$(14) as in statements 20 and 50. Anything in the first LPRINT statement following will come out wide, while a second LPRINT in the same line will be narrow.

3. Set up a string containing the two bytes, and LPRINT the string whenever you want wide characters. You don't need to bother turning off the wide print function, unless you want a combination of wide and narrow in the same LPRINT statement. In that case you would make a separate string for "off." This method is illustrated in statements 80–100.

If you've read this far, you've probably gotten the impression that I'm sold on my new printer, and you're right. I think it's a darn good buy for the money. The 730 is available in both parallel (730-1) and serial (730-3) versions. Be sure to order parallel for a TRS-80.

Making Your Cable

The cable required is a standard 34-conductor ribbon with 20 conductors to the inch. The connector for the line printer port of the expansion interface is a 34-pin female edge-card connector, similar to the one for the CPU, except for the number of conductors.

The printer requires a 40-pin female edge-card connector with the same one-tenth-inch center-to-center pin spacing. Any one of the following connectors will work: Centronics #3123003Z, 3M #3464-0001, T&B Ansley #609-4015M, or Winchester #53-40-0. The connector used for the CPU interface cable is also correct.

The diagram in Fig. 1 shows how to make up a cable for the TRS-80. Usually there is a blue coating on one edge of the ribbon: Use this to keep track of your number-one wire. The connectors come in two parts, with indentations to hold the individual conductors in the correct places.

When looking at the side of the expansion interface, pin #1 will be at the top right. Insert the cable into the expansion interface connector, hold the two parts together while you put it in a vice and squeeze. No soldering is required.

When looking at the back of the printer, pin #1 will be on the bottom left: Be sure you install the cable in the connector as far on the left as possible, leaving unused pins on the right. Use the same vice-squeeze routine.

After the connectors are installed, count over very carefully from wire #1 (marked in Fig. 1) on the cable near one of the connectors, make slits through the insulation surrounding wire #25 and #28 and cut out a small piece of each of these wires. An Exacto knife is good for this.

That's all there is to it—much faster than waiting for Radio Shack's cable. ■

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
32		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
64	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	↑	←
96	↓	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{	|	}	→	▮
160		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
192	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	↑	←
224	↓	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	{	|	}	→	▮

Fig. 2. Centronics 730 Character Set. Row + column = ASCII value.

Got any axis to grind?

Scatterplot

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It is often useful in business or science to examine one variable as a function of another. Many methods are available to measure the strength of the relationship of these variables. One of the most common measures is the Pearson Product-Moment correlation coefficient (*r* correlation).

Calculating this measure is relatively simple, and the TRS-80 can perform the task with only a few Level II BASIC instructions.

```
10 CLS: PRINT"********************  S C A T T E R P L O T  ********
    ************"
15 REM INPUT HEADING & SCALE INFORMATION
20 PRINT: PRINT: PRINT: INPUT "TOTAL NUMBER OF X,Y PAIRS"; N
30 PRINT: INPUT "TITLE AND SCALE UNITS OF X (30 CHAR. MAX.)"; A$
40 PRINT: INPUT "TITLE OF Y (15 CHAR. MAX.)"; B$
50 PRINT: INPUT "SCALE UNITS OF Y (15 CHAR. MAX.)"; C$
60 PRINT: INPUT "ENTER MIN. & MAX. VALUES  OF X (USE ,)"; X1,X2
70 PRINT: INPUT "ENTER MIN. & MAX. VALUES OF Y (USE ,)"; Y1,Y2
80 DIM XP(N),YP(N),XC(N),YC(N): CLS
85 REM INPUT DATA AND CONVERT TO GRAPHICS POINTS
90 FOR Z=1 TO N: PRINT Z: INPUT "ENTER X & Y (USE ,)"; X,Y
100 XC(Z)=X: YC(Z)=Y
110 CLS: XP(Z)=(85/(X2-X1))*(X-X1)+34: XP(Z)=INT(XP(Z))
120 IF XP(Z)=0 THEN XP(Z)=34
130 YP(Z)=37-(36/(Y2-Y1))*(Y-Y1): YP(Z)=INT(YP(Z))
140 NEXT Z: PRINT "*** W O R K I N G ***": GOSUB250: CLS
145 REM PRINT AXIS TITLES & SCALES
150 PRINT @128,B$: PRINT @192,C$: PRINT @640,"N=";N: PRINT @704,
    "R=";R
160 PRINT @11,Y2: PRINT @523,INT(((Y2-Y1)/3)+Y1): PRINT @267,INT(
    (((Y2-Y1)/3)*2)+Y1): PRINT @779,Y1
170 PRINT @847,X1: PRINT @861,INT((((X2-X1)/3)+X1)): PRINT @875,I
    NT((((X2-X1)/3)*2)+X1): PRINT @889,X2
180 PRINT @928,A$
185 REM PRINT AXIS AND SET DATA  POINTS
190 FOR Y=0 TO 38: SET (34,Y): SET (35,Y): NEXT Y
200 FOR X=32 TO 121: SET (X,37): NEXT X
210 FOR Y=1 TO 31 STEP 6: SET (32,Y): SET (33,Y): NEXT Y
220 FOR X=48 TO 118 STEP 14: SET (X,38): SET (X+1,38): NEXT X
230 FOR W=1 TO N: SET (XP(W),YP(W)): NEXT W
240 GOTO 240
245 REM SUBROUTINE TO COMPUTE CORRELATION
250 FOR W=1 TO N
260 XT=XT+XC(W): XS=XS+XC(W)[2: YT=YT+YC(W): YS=YS+YC(W)[2
270 CP=CP+XC(W)*YC(W): NEXT W
280 MX=XT/N: MY=YT/N
290 VX=SQR((XS/N)-(MX[2)): VY=SQR((YS/N)-(MY[2))
300 R=((CP/N)-(MX*MY))/(VX*VY): RETURN
```

Program Listing

The Scatterplot

Statistics are only numbers, and it is often more desirable to examine a graph of the data. Such a graph is known as a scatterplot.

Formerly, machine-generated scatterplots were reserved for individuals having access to one of the larger computers, but microcomputers have changed that. The graphics capabilities of the TRS-80 are limited, but they are adequate for this task.

The following program inputs values for two variables and outputs a graph of the data as a function of the variables. The total number of pairs of data and the value of the *r* correlation are displayed. The routine can be condensed to less than thirty lines. The method is straightforward and easily modified to conform to individual specifications.

The program begins by prompting the user to label and scale the axes of the graph. Since the procedure is simplified, numerical scale values are limited to integers. The output is designed to center two and three-digit scale values, but should be easy to alter.

A counter is provided to assist with long data entries. Using a conversion procedure, proportional values corresponding to the X and Y function set are generated. After allowing for peripheral printing, the resulting graph is often smaller than the field from which the data originated, but in most cases this limitation is tolerable.

Following data input, the correlation statistic is computed. For those not interested in this information, simply delete the subroutine and the reference to it.

Once these steps are completed, output begins. Because the PRINT @ format is used for labels, scale values and statistics, these statements must appear before the set commands (trailing blanks of a PRINT @ can interfere with a previously executed set command). The axes and data points are then printed, using the set command.

Because the Y side of the set coordinates are larger units than the X side, the data points appear as rectangles, rather than squares, though this, too, can be altered. ■

Even if you don't know an asteroid from a hypocloid, have fun with these programs.

Curve Plotter

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How would you like to use the computer to create string art type figures? Or how about a constantly changing display of curves to fascinate and delight the kids on the block?

Here are six simple programs for video screen displays. The names and equations of several exotic looking curves are included. The curves are in polar form, parametric equations, and in circles or lines.

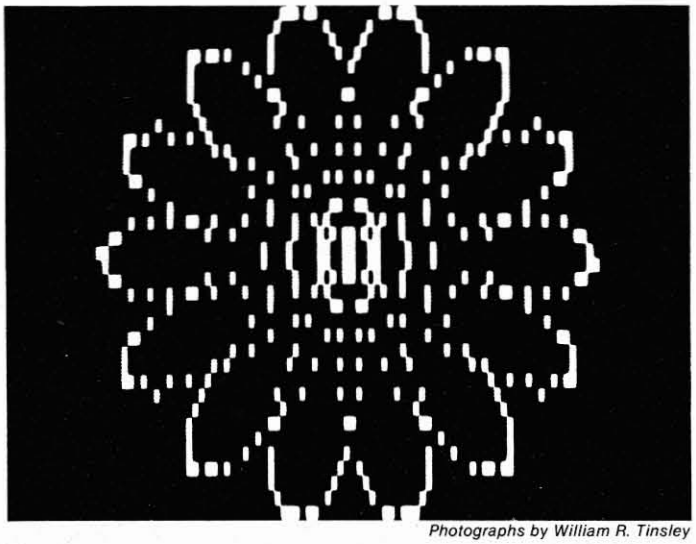
A scale factor must be input to determine the figure size (some suggested scale factors are included for experimentation).

The programs are written for the TRS-80's display area of 128 by 48. The origin of the curves is near the center of the screen (at 65, 23), the x-axis is horizontal and the y-axis is vertical (the two axes are not displayed). To simplify the programs and allow the visible creation of the curves as the angle parameter changes, BASIC has been used for the curve generation instead of assembly.

Polar Curves

The polar coordinate curves are plotted as if the screen were a sheet of polar coordinate paper with the pole at the center and the polar axis horizontal. This axis is not displayed with the programs given here.

Program 1 is to be used for curve equations, in polar form, with bounded extent.



Photographs by William R. Tinsley

Photo 1. A many-leaved rose using Program 1 with S = 8, A = 3.5 and line 30 having 0 TO 4•PI STEP 2•PI/180.

```
10 ON ERROR GOTO 120
20 PI=3.14159
30 INPUT "SCALE FACTOR =";S:
   INPUT "CONSTANT = ";A
40 CLS
50 FOR I=0 TO 2•PI STEP 2•PI/180
60 R=COS(A•I): REM THIS LINE IS
   CHANGED FOR OTHER POLAR
   CURVES
70 X=65+4.9•S•R•COS(I)
80 Y=23-2.3•S•R•SIN(I)
90 SET(X,Y)
100 NEXT I
110 GOTO 110
120 RESUME NEXT
```

Program 1.

Enter the program and type RUN. When the input prompt, ?, appears use 10, and then 2 for the second input prompt. A four-leaved rose (rhodonea) is sketched. To terminate the display, press the BREAK key.

To obtain other rhodonea, with different numbers of leaves, try the following choices for the scale factor S and the constant A.

S	9	9	5	10	10	8
A	3	4	4	6	5	3.5

Be sure to use the BREAK key for every new curve. Note that the larger the S, the larger the figure; also that when A is an integer, there are A leaves for A odd, but 2A leaves for A even.

For non-integer A, the leaves overlap considerably and the figure appears incomplete. To complete the figure a larger number than 2•PI in line 50 is needed (try 4•PI, or some other multiple of 2•PI).

Now use R=1+A•COS(I) for line 60. If A = 1 (and S of perhaps 5), the figure is heart-shaped (a cardioid), if A = 2 we have a trisectrix (let S be 4); for A < 1 there is one loop, and for A > 1 there are two loops. The curves are called limacons of Pascal.

Here are some other curves created by changing line 60, and by increasing 2•PI to 4•PI in line 50. Freeth's nephroid has R = 1 + 2•SIN(1/2 + A) for its equation (try S = 3,A =). Folia are given by R = COS(I)•(A•SIN(I)↑2 − 1)(try S = 10,A = 3); and the equation for Cayley's sextic is R = COS(I/3 + A)↑3 (try S = 11, A = 3 and see where the loop is located).

Changing the constant A in either Freeth's nephroid or Cayley's sextic rotates the figure. Experiment by observing the orientation of the loop in Cayley's sextic for the following S, A combinations.

S	10	9	9
A	1.7	2.4	0

These combinations have bounded values for the parameter I (such as 0 to 2π, or 0 to 4π). For interesting figures that have unbounded parameters for I use Program 2.

```
10 ON ERROR GOTO 130
20 PI=3.14159: W=2•PI/60: I=W
30 INPUT "SCALE FACTOR =";S:
   INPUT "CONSTANT =";A
40 CLS
50 R=A/I: REM THIS LINE IS
   CHANGED FOR OTHER POLAR
   CURVES
60 FOR J=1 TO 2:1=-1
70 X=65+4.9•S•R•COS(I)
80 Y=23-2.3•S•R•SIN(I)
90 SET(X,Y)
100 NEXT J
110 I=I+W
120 GOTO 50
130 RESUME NEXT
```

Program 2.

QUALITY TRS-80 SOFTWARE

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A series of programs that will create a data file on disc, build an index of all occurrences of "Keywords" in the text of the data file and allow inquiries or searches into the file using the indexed keywords. The system features:

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Program 2 creates a hyperbolic spiral (try S = 15, A = 1). A cross curve has R = A*SQR(1/COS(I)↑2) + (1/SIN(I)↑2) for line 50 (try S = 1,A = 3). You can increase the number of plotted points by changing the 60 in line 20 to 120.

A folium of Descartes is plotted if line 50 is R = A*SIN(I)*COS(I)/(SIN(I)↑3) + COS(I)↑3). This has an interesting shape for S = 2, A = 5. Many other curves with polar equation forms can be handled with Programs 1 and 2. Some of these curves will be presented in terms of parametric equations.

Parametric Equation Curves

Program 3 modifies Program 1 to allow parametric equations. The program is designed to simulate plotting in the Cartesian plane with usual graph paper.

```
10 ON ERROR GOTO 130
20 PI = 3.14159
30 INPUT "SCALE FACTOR = "; S:
   INPUT "CONSTANTS A, B"; A, B
40 CLS
50 FOR I = 0 TO B*2*PI STEP
   2*PI/90
60 X1 = (A - B)/B*COS(I) + COS
   ((A - B)/B*I)
70 Y1 = (A - B)/B*SIN(I) - SIN
   ((A - B)/B*I)
80 X = 65 + 4.9*S*X1
90 Y = 23 - 2.3*S*Y1
100 SET(X,Y)
110 NEXT I
120 GOTO 120
130 RESUME NEXT
```

Program 3.

The parametric equations for the curves are in lines 60 and 70 with the x-coordinate called X1, the y-coordinate Y1 and I for the parameter.

The equations already listed in lines 50 and 60 represent the roulettes called hypocycloids, and give the curve traced by a point on the circumference of a circle rolling on the inside of a larger fixed circle. You might want to start experimenting using the following choices.

S	2	2	3	2.8	3	6
A	5	9	10	7	9	7.2
B	1	2	3	2	3	4.6

Did you notice that if (A – B)/B is an integer, there are A/B cusps (vertices)? Also if A – B is larger than B and if A – B and B are relatively prime (no common factors except ±1), you see A cusps in B revolutions? Finally, did you note that when A and B are not integers, the figure is not completed symmetrically?

If you would like to see the larger fixed circle, add the following to Program 3. Try this with some of the choices for S, A and B suggested above.

```
52 FOR J = 1 TO 2
54 IF J = 1 THEN 60
56 X1 = A/B*COS(I)
58 Y1 = A/B*SIN(I)
59 GOTO 80
105 NEXT J
```

Epicycloids are obtained by tracing a point on the circumference of a circle rolling on the outside of a larger fixed circle. To sketch these you need only change the + in line 60 to a – and change the A/B in lines 56 and 58 to (A – 2*B)/B. Some interesting patterns are obtained with the following choices.

S	2	2	1	3
A	5	9	16	9
B	1	2	2	3

Epicycloids have (A – 2* B)/B cusps when this number is an integer, and A – 2*B cusps (lying on the fixed circle) in B revolutions when A – 2*B and B are relatively prime with A – 2*B>B.

If you delete lines 52 through 59 and line 105, and change lines 60 and 70 to read:

```
60 X1 = COS(I)/(1 + SIN(I)↑2)
70 Y1 = X1*SIN(I)
```

the resulting figure is called a lemniscate of Bernoulli. A nice sized sketch is obtained with S = 9. (Note the constants A and B are not used here, but you can input A = 1 and B = 1 when asked by the program or delete the last half of line 30.)

Some very interesting curves, called Lissajous figures, or Bowditch curves, can be obtained using parametric equations. Make the following changes in Program 3.

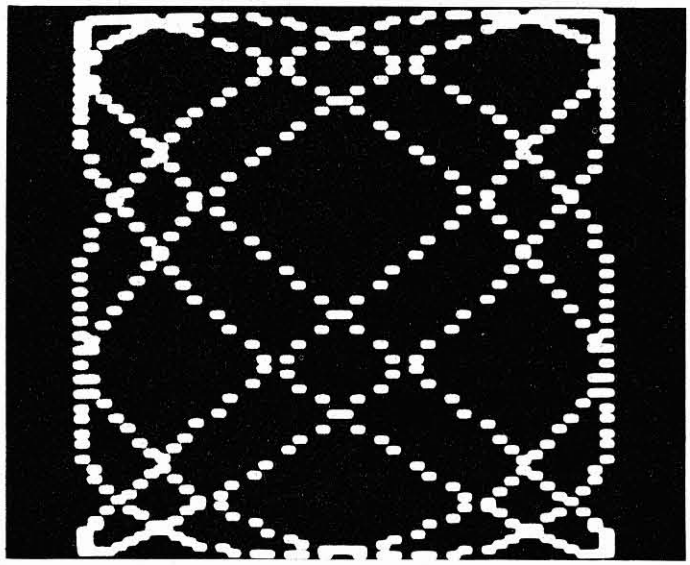

Photo 2. Hypocycloid using program 3 with S = 2, A = 9, B = 2 and with lines 52 through 59 and line 105 added.

```
30 INPUT "SCALE FACTOR = ";
   S: INPUT "CONSTANTS
   A,B,C"; A,B,C
50 FOR I = 0 TO 10* PI STEP
   2*PI/90
60 X1 = SIN(A*I + B)
70 Y1 = C*SIN(I)
```

Here are some choices you might want to try.

S	12	10	11	12
A	.75	.4	.8	.67
B	0	.75	2	2.8
C	.8	1	.9	.7

String Art on the Computer

Constructing curves with the computer is done in much the same way that string art figures are made. To illustrate the possibilities let's construct a cardioid (the heart-shaped figure mentioned earlier) and an astroid (a four-pointed star, or hypocycloid of four cusps).

For the cardioid begin with a fixed circle C and a fixed point PF (use the point on the circum-

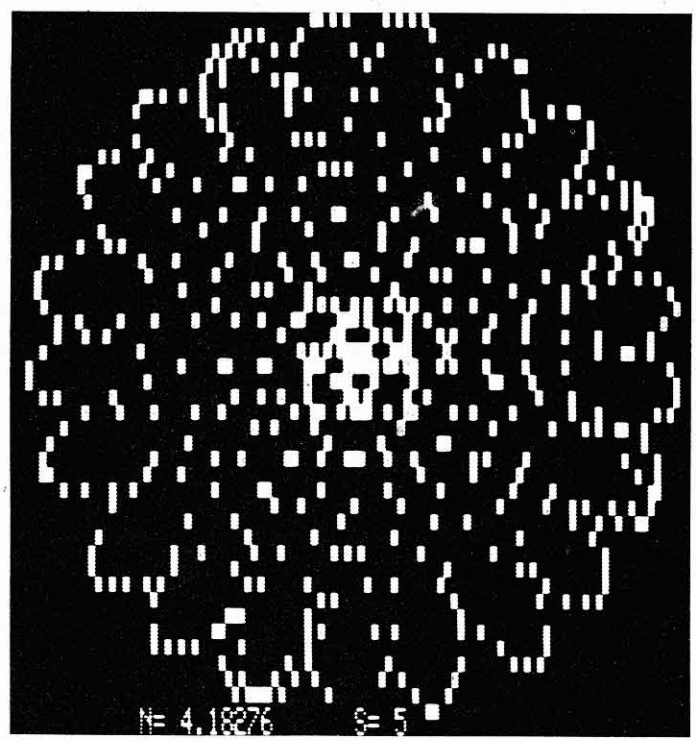

Photo 3. Cardioid using Program 4 with a fixed circle size of 9.

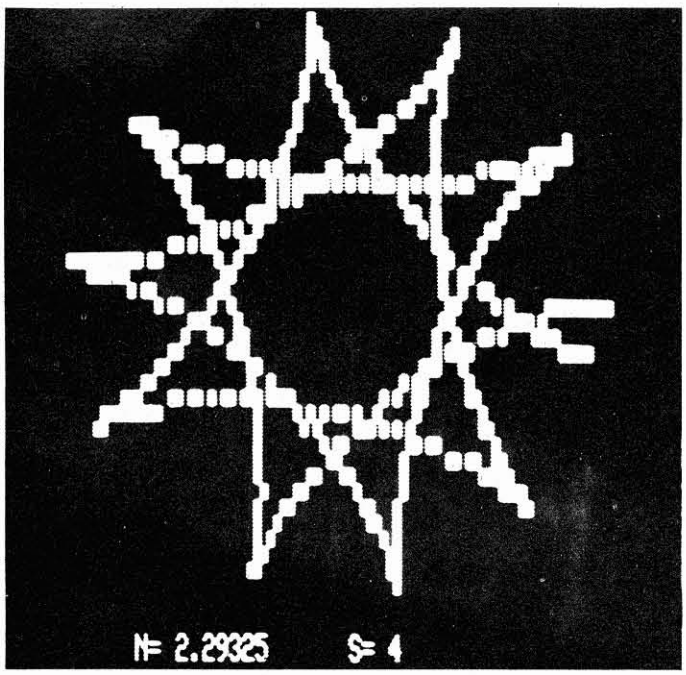

Photo 4. Astroid using Program 5 with A-value of 5.

ference at the extreme left of the circle for PF). Then choose a number of points (XO, YO) on C and draw circles with centers at (XO, YO) and with radii equal to the distance between PF and (XO, YO). The curve generated by these circles is the desired cardioid. Program 4 creates the circles and the cardioid.


```
10 ON ERROR GOTO 170
20 INPUT "SIZE OF FIXED
   CIRCLE"; A
30 CLS
40 PI = 3.14159
50 FOR I = – PI TO PI STEP 2•PI/180
60 X1 = A•COS(I): Y1 = A•SIN(I)
70 SET(63 + 2.2•X1, 23 + Y1)
80 NEXT I
90 FOR J = – PI TO PI STEP 2•PI/20
100 XO = A•COS(J): YO = A•SIN(J)
110 R = SQR((XO + A)↑2 + YO↑2)
120 FOR K = – PI TO PI STEP 2•PI/90
130 X = XO + R•COS(K):
    Y = YO + R•SIN(K)
140 SET(63 + 2.2•X, 23 + Y)
150 NEXT K,J
160 GOTO 160
170 RESUME NEXT
```

Program 4.

You might try an A of 8 or 9 for a nice sized display. If XO + A in line 110 is changed to XO – A, the cardioid is turned 180° since the point PF is now on the extreme right of the circle.

Lines instead of circles will generate the four-pointed astroid star. With x- and y-axes positioned so the origin is at the center of the screen, and a line RS of fixed length 4•A, we draw several copies of the line with R always on the x-axis and S always on the y-axis.

Program 5 allows different choices for A (values between 4 and 7 give nice displays) and draws the RS lines two at a time, one above and one below the x-axis.

```
10 ON ERROR GOTO 120
20 INPUT "A-VALUE"; A
30 CLS
40 Q = 4•A•19/20
50 FOR X = – Q TO Q STEP 4•A/20
60 FOR XX = X TO 0 STEP – X/10
70 Y = (1 – XX/X)•SQR(16•A↑2 – X↑2)
80 SET(63 + 2.4•XX, 23 + Y)
90 SET(63 + 2.4•XX, 23 – Y)
100 NEXT XX, X
110 GOTO 110
120 RESUME NEXT
```

Program 5.

The astroid can also be generated using ellipses since the envelope of the ellipses X = A•COS(I), Y = (1 – A)•SIN(I) is the astroid X = ¼•(3•COS(I) + COS(3•I)), Y = ¼•(3•SIN(I) – SIN(3•I).

Computer Spirograph

The last program presents a panorama of hypocycloids, epicycloids and rhodonea (roses) generated in random order and sizes. If the curve suddenly disappears, the random size is too big for the screen, but don't worry! The curve will reappear in a smaller size.

```
10 ERROR GOTO 210
20 RANDOM
30 N = 7•RND(0): T = RND(4)
40 S = RND(6)
50 CLS
60 PI = 3.14159
70 FOR I = 0 TO 6•PI STEP 2•PI/180
80 ON T GOTO 90, 100, 120, 130
90 X1 = N•COS(I) + COS(N•I): GOTO 110
100 X1 = N•COS(I) – COS(N•I)
110 Y1 = N•SIN(I) – SIN(N•I):GOTO 150
120 R = 3 + 2•COS(N•I): GOTO 140
130 R = 5•SIN(N•I)
140 X1 = R•COS(I): Y1 = R•SIN(I)
150 X = 65 + 49/S•X1:Y = 23 + 23/S•Y1
160 SET(X,Y)
170 NEXT I
180 PRINT @960, "T = "; T, "N = "; N,
    "S = "; S;
190 FOR J = 1 TO 1250: NEXT J
200 GOTO 30
210 S = S + 1: RESUME 50
```

Program 6.

After each curve is constructed the values for T, N and S are displayed for a short period at the bottom of the screen. If you don't want these values shown, delete line 180. If you prefer fewer points drawn, change the step size in line 70 to 2•PI/90, or 2•PI/60, etc.; more points may be obtained with 2•PI/360.

In line 70 the parameter I makes three revolutions (0 to 6π). If more (fewer) revolutions are desired, change the 6•PI to 10•PI(4•PI), etc. ■

References

A Book of Curves by E. H. Lockwood, Cambridge University Press, 1961.

A Catalog of Special Plane Curves by J. Dennis Lawrence, Dover Publications, 1972.

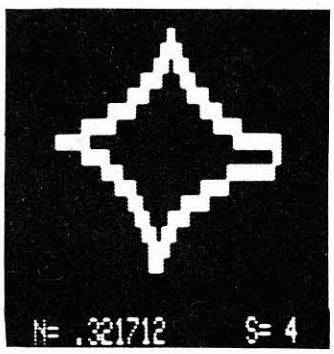

Photo 5. Random pattern using Program 6. The value of N and S is displayed.

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Sound X

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Sound can add a lot to any game program, but it's not nearly as widely used as it could be. The main problem is that the TRS-80 does not have a built-in speaker, and Radio Shack has never marketed a speaker/amplifier as a peripheral.

But, it isn't difficult to get sound from the TRS-80 cassette port. The hardware is very simple. Just take the large gray plug that normally plugs into the recorder's auxiliary input and connect it to an amplifier and speaker instead. Or purchase Radio Shack's Microsonic box that includes amp and speaker.

```
10 REM        >>>>>>  SOUND X  <<<<<<
20 REM
30 CLS
40 DEFINT J,K,L
50 INPUT"WHAT MEM SIZE DID YOU SET ";DS
60 REM  SOUND X WILL START AT MEM SIZE PLUS ONE
70 MS=DS
80 IF MS>32767 THEN MS=MS-65536
90 REM  POKE THE 72 BYTES IN
100 FOR J=1 TO 72
110 READ K
120 POKE MS+J,K
130 NEXT J
140 REM  NOW SEE IF WE'RE IN LEVEL II OR DISK BASIC
150 IF PEEK(16433) = 0 THEN 200
160 REM       MUST BE DISK
170 CMD"T"
180 DEFUSR=MS+1
190 GOTO 290
200 REM      IT'S LEVEL II
210 N=DS+1
220 REM  CHANGE N FROM DEC TO HEX FOR USR ENTRY POINT POKE
230 FOR I=1 TO 4
240 D(I)=INT(N/16[(4-I))
250 N=N-D(I)*16[(4-I)
260 NEXT I
270 POKE 16527, 16*D(1)+D(2)
280 POKE 16526, 16*D(3)+D(4)
290 REM  CHOOSE SQUARE WAVE FOR DEMO
300 POKE 16672,102
310 REM  THIS IS THE BIG DEMO . . .
320 X=USR(-100)
330 FORL=65TO1STEP-1:X=USR(L):NEXT
340 FORL=1TO70STEP2:X=USR(L):NEXT
350 REM
360 REM  THESE FIVE DATA STATEMENTS CONTAIN THE RELOCATABLE
370 REM  CODE OF SOUND X:
380 REM
390 DATA 205,127,10,203,124,40,4,34,28,65,201,34,30,65
400 DATA 219,255,31,31,31,47,230,248,95,58,57,65,254,4,32,2
410 DATA 171,95,58,32,65,87,237,75,28,65,43,124,181,40,6
420 DATA 221,227,221,227,24,12,42,30,65,122,7,7,87,230,3,179
430 DATA 211,255,3,120,177,32,228,123,211,255,201
```

Note: Left bracket [is up arrow ↑ in line 240.

Fig. 1. Program to POKE Sound X into memory.

Software

As for software, BASIC is too slow to generate sound. Machine language is required in the form of a driver program that can be called from BASIC. Such programs have been described before and some are available for a price. Sound X is the equal of most of these and combines the following features:

- It is easily called from BASIC via the USR command.
- It works edentically under Level II or Disk BASIC.
- It is completely relocatable, and thus can be POKEd anywhere in memory without reassembly.
- It offers a wide range of frequencies (0 to 8 KHz).
- It offers a number of different "sounds," both loud and soft.
- It is suitable for imbedding into string space or REM statements (no need for memory protect).
- It is short (72 bytes).

Using Sound X

Once the sound driver has been put in memory (as described later), calling it from BASIC is simple. The user must first specify the tone duration, which is done by writing:

```
X = USR ( dd )
```

X is a dummy variable. The value dd must be a number between −1 and −32767. The smaller this number is, the longer the tone will be. The range is 0 to 2 seconds. Once a duration has been specified, it will control all subsequent tones until a new duration is specified.

To actually generate a tone, the user writes:

```
X = USR ( pp )
```

The value pp can be any number between 1 and 32767; it defines the pitch. The larger the value for pp, the lower the pitch will be. Actually, only values for pp in the range of 1 to 100 are useful. A silent duration is generated by using a value of 0 for pp.

The following calls in a BASIC program would put out two tones. The first tone would be long and low-pitched, the second tone short and high-pitched:

```
10 X = USR( − 20000)
20 X = USR(50)
30 X = USR( − 2000)
40 X = USR(2)
```

If line 30 is deleted, both tones will be long.

The USR calls are simple

enough, and often they are all that will be used. There are a few preliminaries and options. First, the user must select a "voice" or type of sound by POKEing a value into address 16672. Only 10 values give distinct voices. These are: 1, 5, 6, 17, 18, 22, 25, 86, 90, 102.

Some of these do not give different types of sound; they give a tone of twice the normal pitch. Just as with tone duration, the voice need not be re-specified until a different one is desired.

Near the beginning of a program you might write:

```
POKE 16672,18
```

All tones generated after this would be fairly smooth sine wave approximations. For a noticeably softer sound, write POKE 16672,5. For a thin, reedy sound use POKE 16672,25.

In Disk BASIC, the user should disable interrupts with CMD T to avoid tones which pop, sounding like radio static.

By working with a combination of tone duration, pitch, voice, and speed of call from BASIC, one can eventually arrive at a suitable sound effect for almost any application.

Under BASIC it is possible to use OUT 255,4 or OUT 255,12 to turn the cassette motor on. Sound X will normally turn off the cassette motor whenever it is called. Should the user wish to run the cassette during his program (possibly even during the generation of sound), he should inform Sound X of this fact with a POKE 16697,4. To go back to having the cassette motor disabled, POKE 16697,0.

Of course, you must begin by defining the USR entry point. This is discussed in the Level II and Disk BASIC manuals. Sound X achieves its relocatability by using the six bytes in low memory—the reserved section of RAM—for temporary data storage. These bytes are hex 411C-4120 and 4139.

Creating the Sound X Code

There are many ways to get the 72 bytes of code into memory. Using the assembly-language source listing in Fig. 2, Sound X can be assembled into any location and SAVEd as a tape or disk object file. This can then be loaded under DOS or using the SYSTEM command from BASIC. This technique requires memory protection via MEM SIZE. As listed, the code resides at the very top of 48K; this can be changed with a new ORG address.

A BASIC program can POKE the code into memory. If high memory is to be used (the usual approach), then MEM SIZE must be answered to protect the code from BASIC. Since Sound X does not contain any zero bytes, it is feasible to POKE the code into a dummy REM statement instead. This avoids having to protect memory, since Sound X is an integral part of the BASIC program itself. Both of these techniques will be presented.

The BASIC program listed in Fig. 1 will POKE Sound X into memory. The program may look complicated, because it has been set up to handle different combinations of BASIC level and memory size. Any single application will really require only the READ, DATA and POKE statements; these can be extracted and used as needed in the user's program.

For example, you might want sound in a 16K Level II game. Memory size is then set at 32695, assuming there are no other high-memory machine language routines to be used. If there are, Sound X would have to be loaded below them.

Once into BASIC, the program of Fig. 1 is loaded and run. On completion, a demo sound plays. The Sound X code can then be SAVEd as a SYSTEM tape using T-BUG.

A more convenient alternative incorporates the data statements into your own program, and POKEs them into (protected) high memory, starting at 32696.

Once either code is in memory, you will define the USR entry point (32696) to BASIC with:

```
POKE 16526,184 : POKE 16527,127
```


✓Reader Service—see page 178

as explained in the Level II manual.

Storing Sound X in a REM Statement

A dummy REM statement is used as line 1 in a BASIC program. The Sound X code is then POKEd by the BASIC program itself. The REM statement must have at least as many dummy characters in it as there are bytes in the machine code. Finally, the USR entry point is defined to point at the string of code now in the REM line.

The POKE can be done by the target program every time it is run, or it can be done just once after which the DATA, READ, and POKE statements can be deleted and the target program SAVEd. The advantage of the former is that the program remains entirely listable and readable.

If the program is SAVEd after the code has been POKEd into line 1, that line will not list properly; nor can it be SAVEd later as an ASCII file, meaning that some renumbering utilities will not work with it.

On the other hand, with the code imbedded, the program is shorter and requires no initialization time. I prefer the latter.

Either way, the first line of the

```
01260 ;
01270 ;     BY ROXTON BAKER   -
01280 ;
01290               ORG   0FFB8H        ;FOR 48K.  72 BYTES.
01300   PORT        EQU   0FFH          ;CASSETTE PORT
01310   GETARG      EQU   0A7FH         ;PASSES USR VALUE IN HL
01320   CASSOP      EQU   4139H         ;WILL HAVE 04 IN IT IF
01330                                   ;USER WANTS CASSETTE ON.
01340   LENGTH      EQU   411CH         ;STORAGE FOR 'LENGTH'
01350   FREQ        EQU   411EH         ;STORAGE FOR 'FREQ'
01360   WAVBYT      EQU   4120H         ;THE FOUR PAIRS OF BITS
01370                                   ;POKED INTO THIS BYTE
01380                                   ;DEFINE THE SOUND WAVE-
01390                                   ;FORM.
01400               CALL  GETARG        ;GET USR ARGUMENT
01410               BIT   7,H           ;IS THE ARG NEG?
01420               JR    Z,CONT1       ;NO - IT'S A FREQ.
01430               LD    (LENGTH),HL   ;YES - STORE AS LENGTH
01440               RET                 ;AND RETURN TO BASIC.
01450 ;
01460   CONT1       LD    (FREQ),HL     ;ARG IS NON-NEG. STORE
01470                                   ;AS FREQUENCY VALUE.
01480 ;
01490               IN    A,(PORT)      ;IF BIT 6 IS SET (64
01500               RRA                 ;CHAR/LINE) THEN WE WANT
01510               RRA                 ;BIT 3 TO BE ZERO WHEN
01520               RRA                 ;WE OUTPUT LATER.
01530               CPL
01540               AND   0F8H          ;ALWAYS WANT THREE LSB'S
01550               LD    E,A           ;TO BE ZERO -
01560               LD    A,(CASSOP)    ;UNLESS USER WANTS BIT 2
01570               CP    04            ;HIGH TO USE CASSETTE.
01580               JR    NZ,CONT2      ;IN WHICH CASE THIS IS 4
01590               XOR   E             ;AND MODIFIES PORTWORD.
01600               LD    E,A           ;EITHER WAY, THE
PORTWORD
01610                                   ;ENDS UP IN E.
01620   CONT2       LD    A,(WAVBYT)    ;PUT WAVEFORM IN D.
01630               LD    D,A
01640               LD    BC,(LENGTH)   ;INITIALIZE OUR LOOP
01650 ;
01660   MNLOOP      DEC   HL            ;START COUNTING DOWN THE
01670               LD    A,H           ;FREQ COUNTER.  WHEN IT
01680               OR    L             ;REACHES ZERO, GO CHANGE
01690               JR    Z,SNDOUT      ;PORT TO MAKE SOUND.
01700 ;
01710               EX    (SP),IX       ;ELSE DELAY TO EQUALIZE
01720               EX    (SP),IX       ;SOUND AND NO-SOUND
PATHS
01730               JR    LENCHK        ;AND GO CHECK DURATION.
01740 ;
01750   SNDOUT      LD    HL,(FREQ)     ;RESTORE FREQ COUNT FOR
01760                                   ;NEXT CYCLE.
01770 ;
01780               LD    A,D           ;PUT WAVEFORM IN A.
01790               RLCA                ;BRING NEXT TWO BITS
01800               RLCA                ;OF WAVEFORM INTO ACTION
01810               LD    D,A           ;FOR NEXT CYCLE.
01820               AND   03H           ;DROP ALL BUT 2 LSB'S.
01830               OR    E             ;MERGE IN 6 LSB'S OF
01840                                   ;PORTWORD -
01850               OUT   (PORT),A      ;AND SEND THE 2 LSB'S TO
01860                                   ;THE SPEAKER.
01870 ;
01880   LENCHK      INC   BC            ;HAS THE TONE BEEN LONG
01890               LD    A,B           ;ENOUGH YET?
01900               OR    C
01910               JR    NZ,MNLOOP     ;NO - DO ANOTHER CYCLE.
01920 ;
01930               LD    A,E           ;DONE.  PUT KNOWN VALUE
01940               OUT   (PORT),A      ;OUT TO SPEAKER TO AVOID
01950                                   ;TRANSIENTS NEXT TIME.
```

Fig. 2. Source Listing for Sound X.

user's BASIC program should be:

```
1REM********** (continue for 72 *'s total)
*****...
```

Next, it is necessary to locate the address of the first asterisk so that Sound X POKE can begin there. This address is fixed in the sense that we are always using the first line, but Level II, TRSDOS and NEWDOS all put the first line at a different place. However, they all point to it the same way—its address is kept at locations 16548, 16549. The first * is always the fifth byte in the first line (even if it doesn't look like it). So its address is simply:

```
PEEK(16548)+256*PEEK(16549)+5
```

Putting all this together, the following lines, placed at the beginning of the user's Disk BASIC program, imbed the Sound X routine. After running the program once the user could delete lines four through 12 and save the program with the machine language now permanently integrated into it.

```
1REM********** (72 *'s total) ****...
2 S=PEEK(16548) + 256*PEEK(16549)
+ 5
3 DEFUSR = S
4 FOR J = 1 TO 72
5 READ X
6 POKE S+J-1,X
7 NEXT J
8 DATA .....
9 DATA .....
10 DATA .....
11 DATA .....
12 DATA .....
13 etc. user's program from here on.
```

For Level II BASIC line 3 has to be changed. An example of how to convert a decimal memory address into the correct POKE statements for a Level II USR entry address, is given in lines 200-280 of Fig. 1.

Program sound is being used more every day. I hope that Sound X causes more people to realize the possibilities of sound and to take advantage of them. ■

✓Reader Service—see page 178

A very short BASIC program that allows you to investigate your graphic capabilities.

Basic Drawing

Buzz Gorsky, K8BG
2449 Derbyshire Road
Cleveland, OH 44106

Though graphics features are available in the Level II TRS-80 many users do not use them because of all of the typing required to do any drawing.

This short and simple BASIC program permits anyone to draw on the screen and save the drawings on tape by using the SET, RESET and POINT commands.

The screen is divided into a number of boxes, each of which can be identified by two integers – one indicating the location along the horizontal or X axis, and the other showing the location on the vertical or Y axis.

The upper left corner of the screen is indicated by the pair (0,0). Moving across the screen the X value can be any integer between 0 and 127; moving down the screen the Y value can be any integer between 0 and 47. Thus (127,47) indicates the block in the lower right corner of the screen.

SET(X,Y) turns on the graphic block indicated by the value of X and Y, RESET(X,Y), turns off the block and POINT(X,Y) will be 0 if a graphic block is off and – 1 if it is on.

How the Program Works

The program uses these commands and INKEY$, which scans the keyboard without requiring that the ENTER key be used, to draw, or turn on blocks, erase, or turn off blocks, and to move around the screen without permanently changing the status of the blocks.

Statements 30 to 45 give directions for the use of the program. These directions do not appear again since the screen will be used for drawing. Statement 50 takes care of the required housekeeping; establishing fields for subscripted variables and defining some as integers and B as a string. X and Y are also set to zero.

Lines 200 to 230 compose the drawing routine. The keyboard is first strobed and the value obtained given to B. We then test to see if (X,Y) is turned on. If it is, we turn it off and then on again. If (X,Y) is not on, we turn it on, then off again. This sequence leaves the block in its original status, but creates a blinking effect so the user can see what is happening on the screen.

If the letter X is depressed, the program branches to the executive routine at 3000. If it was not depressed, control goes to the subroutine beginning at 2000.

This subroutine is central to the program. The user can de-

Program Listing

```
30 CLS:PRINT"THIS PROGRAM WILL LET YOU DRAW ON THE TRS80 SCREEN":
     PRINT"A GRAPHICS BLOCK BLINKING ON AND OFF LETS YOU KNOW THE
      PROGRAM  IS RUNNING"
40 PRINT"THE X KEY LETS YOU CHANGE MODES":PRINT "AFTER HITTING X
     YOU CAN HIT ONE OF THE FOLLOWING":PRINT"D TO DRAW, E TO ERAS
     E, M TO MOVE THE CURSOR, R TO RECORD A PICTURE, AND P TO PRI
     NT A":PRINT"PICTURE FROM TAPE."
45 PRINT"IN DRAW,ERASE, AND MOVE MODES A U MOVES CURSOR UP, D MOV
     ES IT":PRINT"DOWN, L IS FOR LEFT AND R FOR RIGHT.":INPUT "HI
     T ENTER TO START THE PROGRAM.";X$
50 DEFSTR B:DEFINT X,Y,I,N:DIM X(1000),Y(1000):X=0:Y=0:CLS
200 REM DRAW ROUTINE
210 B=INKEY$:IF POINT(X,Y)=0 THEN SET(X,Y):RESET(X,Y) ELSE RESET(
     X,Y):SET (X,Y)
220 IF B="X" THEN 3000
230 GOSUB 2000:SET(X,Y):GOTO 210
300 REM ERASE ROUTINE
310 B=INKEY$:IF POINT (X,Y)=0 THEN SET(X,Y):RESET(X,Y) ELSE RESET
     (X,Y):SET(X,Y)
320 IF B="X" THEN 3000
330 GOSUB 2000:RESET(X,Y):GOTO310
400 REM MOVE ROUTINE
410 B=INKEY$:IF POINT(X,Y)=0 THEN SET(X,Y):RESET(X,Y) ELSE RESET(
     X,Y):SET(X,Y)
420 IF B="X" THEN 3000
430 GOSUB 2000:GOTO 410
500 REM RECORD ROUTINE
510 N=0:FOR X=0 TO 127
520 FOR Y=0 TO 47
530 IF POINT(X,Y)=-1 THEN X(N)=X:Y(N)=Y:N=N+1
540 NEXT:NEXT:INPUT"HIT ENTER WHEN RECORDER READY";X$
550 PRINT#-1,N:FOR I=0 TO N STEP 5:PRINT#-1,X(I),Y(I),X(I+1),Y(I+
     1),X(I+2),Y(I+2),X(I+3),Y(I+3),X(I+4),Y(I+4):NEXT
600 INPUT"PREPARE RECORDER TO ENTER DATA";X$:REM PRINT ROUTINE
610 INPUT#-1,N
620 FOR I=0 TO N STEP 5:INPUT#-1,X(I),Y(I),X(I+1),Y(I+1),X(I+2),Y
     (I+2),X(I+3),Y(I+3),X(I+4),Y(I+4):NEXT
630 CLS:FOR I=0 TO N:SET(X(I),Y(I)):NEXT
640 GOTO 200
2000 IF B="U" THEN Y=Y-1  :REM UP
2010 IF B="D" THEN Y=Y+1  :REM DN
2020 IF B="R" THEN X=X+1  :REM RIGHT
2030 IF B="L" THEN X=X-1        :REM LEFT
2040 IF X<0 THEN X=0:RETURN
2050 IF X>127 THEN X=127:RETURN
2060 IF Y<0 THEN Y=0:RETURN
2070 IF Y>47 THEN Y=47
2080 RETURN
3000 REM EXECUTIVE ROUTINE
3010 B=INKEY$
3020 IF B="D" THEN 200:REM DRAW ROUTINE
3030 IF B="E" THEN 300:REM ERASE ROUTINE
3040 IF B="M" THEN 400:REM MOVE
3050 IF B="R" THEN 500:REM RECORD
3060 IF B="P" THEN 600:REM PRINT
3070 GOTO3010
```

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  - input/output file key specifiers

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press U (Up), D (Down), L (Left), or R (Right) while using the draw, erase, or move parts of the program. In this instance we have entered the subroutine from the draw routine. We now look to see if B equals any of the four control letters.

If a U was depressed, one is subtracted from the value of Y, indicating a graphic block one higher than the one currently indicated by the value of X and Y. If a D had been depressed, one would be added to Y. Similarly, if L is depressed, one is subtracted from X, while one is added to X if R was depressed.

In statements 2040 through 2070, if X or Y has been assigned unacceptable (off the screen) values, a value is reassigned for the appropriate screen edge. Even if you keep hitting L after the block has moved all the way to the left the program will not crash.

When control returns from the subroutine, the graphic block for the new value of X and Y is turned on and we go to line 210 to do it all over again. We can now turn on graphics blocks or draw until an X is depressed.

Five Routines

Whenever an X is hit the program branches to 3000. B is again set equal to INKEY$ and the user can hit D, E, M, R or P to indicate which routine is desired. This causes branching to the draw, erase, move, record, or print routines.

The erase routine is in statements 300-330 and is identical to the draw routine except when returning from the subroutine the graphic block is turned off rather than on. This is also true of the move routine except that when returning from the subroutine, the graphic block is not turned on *or* off, but the blinking block is moved.

The record routine (500-550) scans the entire screen and where a block is turned on, the values of X and Y are saved as pairs in a series of X(N), and Y(N). The user is told to set up the tape recorder and the Xs and Ys are recorded. I have arbitrarily written the PRINT$-1 statement to record five pairs at a time. If you write it to print 10 or 20, the recording and subsequent reading from the tape is much faster.

The print routine reads values of X and Y from tape, turns on the corresponding graphic blocks and branches to statement 200 for more drawing.

After the program is loaded and run you will see a small blinking block at the upper left of the screen. If you want to begin drawing there, just hit D or R and a line is drawn down or to the right. Use D, L, R and U to direct this blinking block of light.

If you decide to erase something just hit X and the blinking will stop. Hit E and the blinking resumes, but now when you use U, D, L and R, your lines disappear as the blinking block moves over them.

If you want to move to another part of the screen, just hit X. When the blinking stops, hit M and the blinking resumes. Now as you use the direction letters the blinking block moves but nothing will be drawn or erased.

You can experiment, correct mistakes and go back and try again until you have the drawing you want. Hit R. There will be a long pause while the screen is scanned and X and Y values are saved. Then you will get a prompt to set up the recorder to record values. When you hit enter, recording begins. The program will continue—allowing you to enter what you have from tape.

While this program is quite simple, it provides a lot of fun drawing on the screen, and you will probably find yourself amazed at its versatility. When you have a figure that you would like to use, you can break from the program after recording values on tape and get a printout in the immediate mode of the existing X-Y pairs. These values can then be used in another program to draw the image you desire. ■

Use an old TTY for hard copy with this mixture of hardware and software.

TTY Interface

Robin Rumbolt
1134 Glade Hill Dr.
Knoxville TN 37919

After a few weeks of familiarization with my TRS-80 and Radio Shack's Level II BASIC, I found my programs getting longer than the 16 lines that the CRT would accommodate at one time. Listing and relisting to see various parts of the program during debugging became tedious. I soon found myself making repeated trips to the neighborhood Radio Shack store to get my programs listed on their line printer.

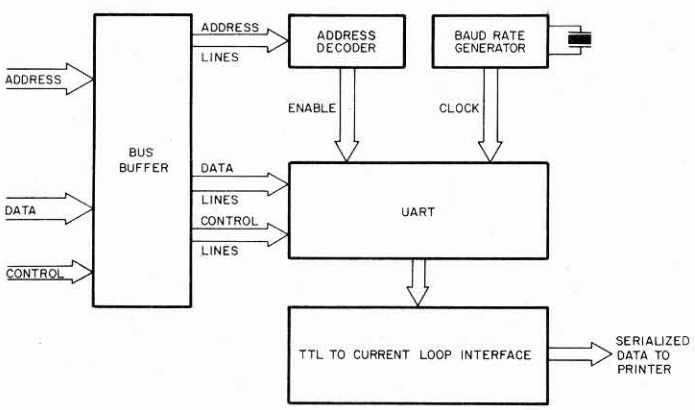

Fig. 1. Hardware printer interface block diagram.

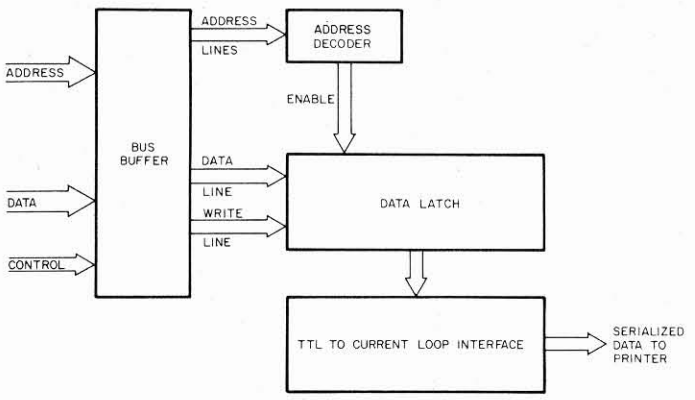

Fig. 2. Alternate interface block diagram.

This couldn't go on. After all, I did have that model 33 Teletype out in the garage if I could figure out how to hook it up. I found several Teletype interface kits on the market in the $75-$120 price range, but having barely squeaked the TRS-80 into the family budget and being an avid home-brewer, I decided to build my own interface. The resulting circuit required only five parts.

Interfacing Techniques

The usual method of interfacing a Teletype to the TRS-80 is shown in Fig. 1. This method requires a UART that accepts data in parallel form from the CPU data bus, adds the proper start and stop bits and sends the data out in serial form at a rate determined by an external baud rate generator. This method is fast and efficient and, if interrupt driven, can even let the processor do something else while the UART is serializing the data. For parts, it requires an address decoder circuit, a UART, bus buffers, a baud rate generator IC and some form of TTL-to-current-loop interface circuit. Also, a software routine is required to set up the internal functions of the UART and then continuously route data to the UART.

Another method, shown in Fig. 2, merely writes a bit at a time out to a location at a decoded I/O port. This method requires hardware only for decoding the port address and interfacing to the current loop of the printer. While this method requires less hardware than the first method, it does require more software. In addition, the processor is tied up the whole time doing the actual output of bits. The software routine must take the data, add the proper start and stop bits and then write the bits out to the I/O port one at a time at a rate determined by a software timing loop.

Since the LPRINT routine in the TRS-80 ROM is non-interrupt driven, and since I had enough half-finished construction projects in process already, it was obvious that the simplest hardware interface was the best.

Remembering that the CPU decodes port FF for cassette input/output and motor control, I studied the schematic for any unused bits I might use in that port. Eureka! . . . there were several. I decided to use bit D5 for my serial output line. Since the port was already decoded, the need for external address

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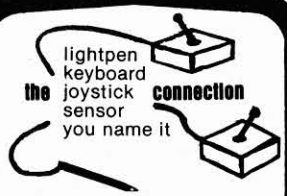

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Each of these programs (except PPLOT) is available in either of two forms:
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2) Commented source listing using Z-80 mnemonics. PPLOT tape or listing is in LEVEL II BASIC, 16K.

decoding and bus-buffering hardware was eliminated. Now all I had to provide was a data latch to store the bit and a current loop interface.

Fig. 3 shows how I accomplished this task with only five parts. The 74LS175, which I will refer to as Z59A, serves as the data latch. Although it is capable of latching four bits, I used only one section to latch bit D5. Resistors R1 and R2 and transistor Q1 are used to buffer the output of the latch and provide approximately 20 mA of drive current for the optical isolator.

The 4N35 optical isolator provides about 2500 volt isolation between the outside world current loop and my precious CPU —a nice thing to have when you accidentally hook the loop supply up wrong! The outputs of the 4N35 are connected to two unused pins on the video output connector. These pins then connect to the 20 mA printer loop.

Software

Now that I had the hardware capability to enable or disable current flow in an external loop, I needed a program to turn this current flow on and off according to the ASCII bit pattern required by the printer. The flowchart of such a program is shown in Fig. 4.

Since the normal logic state of the bits in port FF is 0, I used the logic 0 to represent the MARK, or current-flowing condition, in the loop. A logical 1 written to the output port represents the SPACE condition and disables current flow in the loop. The flowchart describes the program fairly well, so I will only touch on a few of the high points.

The LPRINT and LLIST routines in ROM never output a line-feed code since they assume the printer to have automatic line feed on the carriage return. Since my machine does not have that feature, I included a routine to output a line feed whenever a carriage return was output by the ROM.

Also included is a character-counter routine set to limit line length to approximately 70 characters. Memory location 16424 is used as the counter. Every time a character is output, this memory location is incremented. When it reaches 70, a carriage return and line feed are printed. The character counter is set to zero initially and also every time a carriage return-line feed is output.

Because the LPRINT and LLIST routines were written to operate with Centronics printers, they examine the line printer address, memory location 14312, for a READY bit to be set before they output the next character. Therefore, the Teletype program writes a fake READY bit to this address to

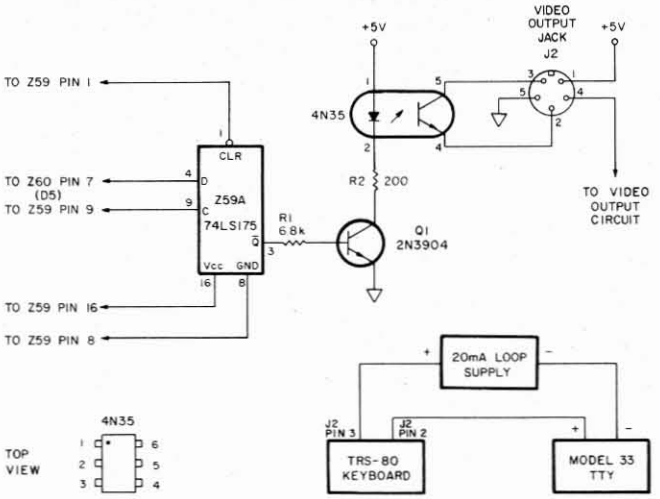
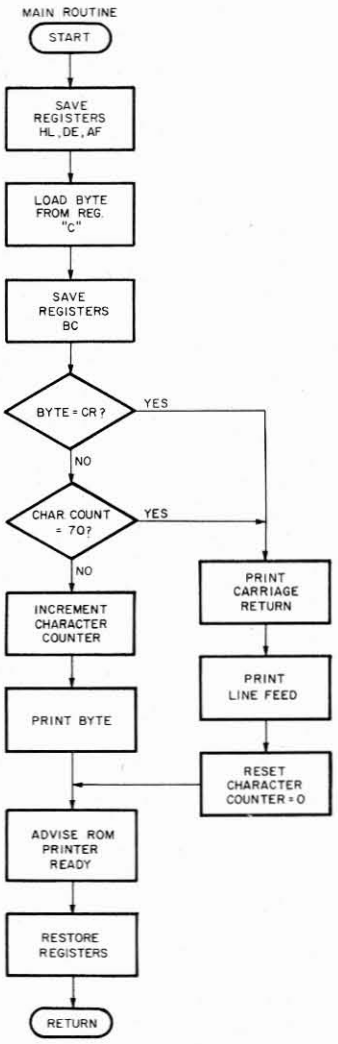


Fig. 3. TTY interface schematic.



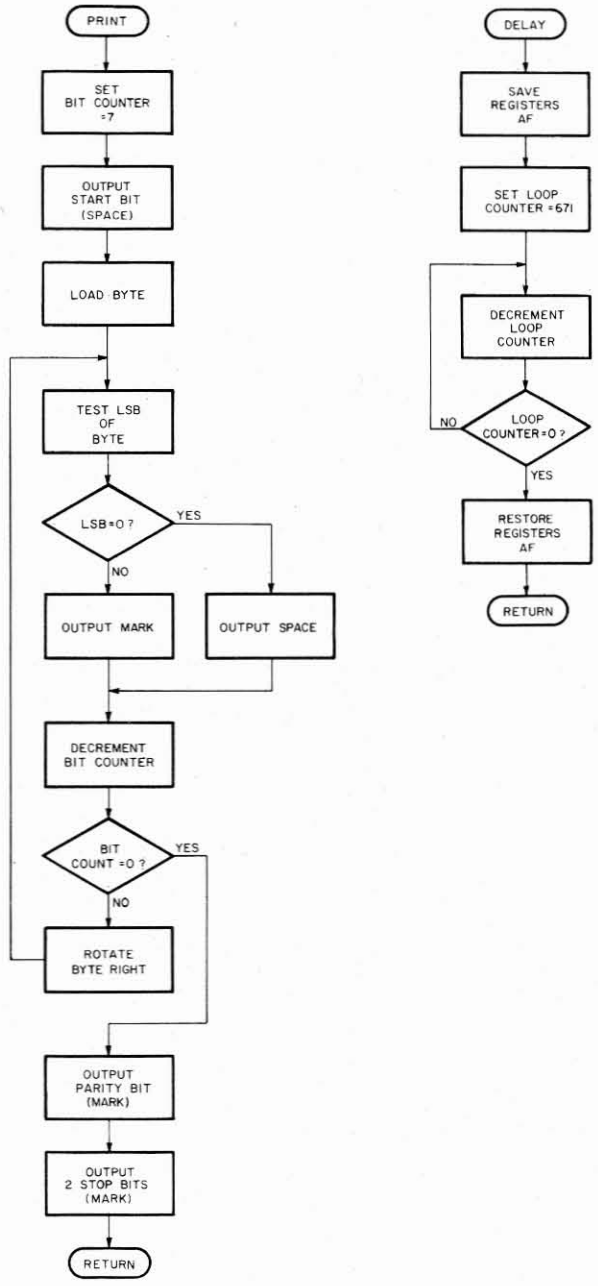


Fig. 4. Software flowchart.

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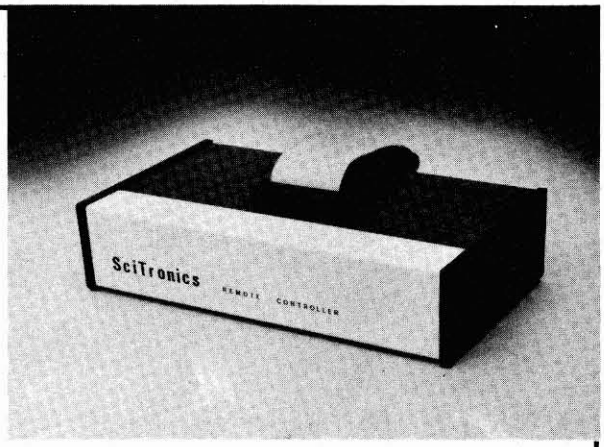

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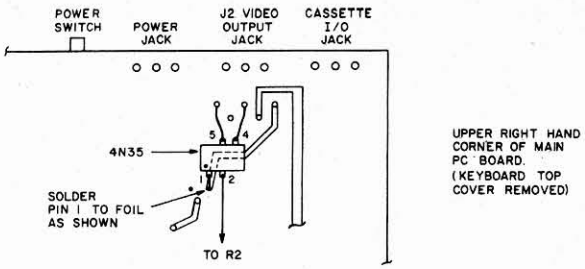

Fig. 5. 4N35 installation on main PC board.

enable a character output by the ROM routines.

The section of code labeled PRINT in Fig. 4 is a part of the program that serializes the data to be output. It first holds the output in SPACE condition for one bit time to simulate the start bit. Then the program samples each bit in register H and outputs a logic 0 (MARK) or a logic 1 (SPACE) to bit D5 of port FF, depending on the bit status of the byte being printed. After all bits have been sampled, the program holds the output in MARK condition for three bit times—one for an even parity bit and two for two stop bits—before executing a RETURN to ROM.

The part of the program labeled DELAY determines the baud rate of the output. The DELAY loop furnishes approximately 13.56 microseconds' delay each time it is executed. Therefore, for the 9.1 ms bit time required for a 110 baud printer this delay loop is executed 671 times.

Installation

To make the required modifications, first place the keyboard face down on a soft surface and remove the six Phillips-head screws holding the case together. Note that there are three different sizes, so note where each size goes. Next, holding the case together with your hands, place the keyboard right side up on your work surface and gently lift off the top cover.

Notice that the keyboard is connected to the main PC board by a delicate, white, flat ribbon cable located on the lower left edge of the keyboard PC board. Trying not to flex this cable too much, pull the keyboard away from the main PC board and hold it vertically while removing the five little white-plastic spacers that are on the PC board and lift the entire assembly out of the bottom half of the case. Holding the keyboard against the main PC, turn the whole assembly over and place it so the IC numbers can be read with the keyboard face down.

Locate Z59 in the lower left area. Take a new 74LS175 IC and bend all but the four corner pins outward. Place this IC, Z59A, piggyback style on top of Z59. Solder the four corner pins of Z59A to their counterparts on Z59. Use as little heat and solder as possible to avoid overheating the ICs or causing shorts.

Now cut one of the leads of both R1 and R2 and the base and collector leads of Q1 to a length of about ¼ inch. Solder the short lead of R1 to the base lead of Q1. Similarly, solder the short lead of R2 to the collector of Q1.

Now turn Q1 upside down and solder its emitter lead to Z59, pin 8. Run a short piece of insulated wire from Z59A, pin 4, to Z60, pin 7. Make sure that all unconnected leads of Z59A are bent away from Z59 and are not touching anything else. Solder one end of a long piece of insulated wire to the unconnected lead of R2.

Now take a good look at what you have done so far. Make sure that the transistor and resistors are secure and that their leads are not touching anything that they are not supposed to touch.

Once satisfied, turn the PC boards over and mount them back in the lower half of the case. Before putting the top cover back on, do the following: Take a 4N35 IC and cut off pins 3 and 6. Then, referring to Fig. 5, solder pin 1 of the 4N35 to the trace shown. Solder the end of the hookup wire still dangling to pin 2 of the 4N35. Solder pins 4 and 5 of the 4N35 to short pieces of hookup wire, which should then be soldered to the video connector pins shown.

The modification is now complete. Reassemble the rest of the case. Connect the Teletype and loop supply as shown. Upon power-up, set MEMORY SIZE to 32566 for a 16K machine or 20277 for a 4K model.

Enter and run the TTY program. When run is typed, the BASIC program will poke the TTY program into high memory and then destroy itself. From then on, the LLIST and LPRINT statements should work using the Teletype as a line printer.

Conclusion

For those who are not afraid to modify their prized equipment, this modification is convenient and works well with any program utilizing the line printer control block set up in RAM by the Level II ROM. Since

```
---------- TTY PROGRAM FOR 4K LEVEL II ----------
                SET MEMORY SIZE TO  20277
10 CLS:INPUT"DO YOU WANT CRT ECHO ON LPRINT ";A$: IF A$="Y" OR A$="N" THEN IF
   A$="Y" THEN POKE 16422,54 ELSE POKE 16422,58 ELSE 10
20 POKE 16423,79: POKE 16424,0 : FOR I= 20278 TO 20423
30 READ BYTE
40 POKE I,BYTE
50 NEXT
60 DATA 121,205,51,0,229,213,245,97,197,124,87,254,13,194,86,79,205,136,79,38
65 DATA 10,205,136,79,62,0,50,40,64,195,126,79,58,40,64,254,70,194,115,79,205
70 DATA 136,79,38,13,205,136,79,38,10,205,136,79,62,0,50,40,64,195,126,79,58
75 DATA 40,64,60,50,40,64,98,205,136,79,62,63,50,232,55,193,241,209,225,201,6
80 DATA 7,62,48,211,255,205,188,79,124,103,203,71,202,157,79,62,16,195,159,79
85 DATA 62,48,211,255,205,188,79,5,202,174,79,124,203,31,195,146,79,62,16,211
90 DATA 255,205,188,79,205,188,79,205,180,79,201,245,17,159,2,27,122,179,194
95 DATA 192,79,241,201
97 NEW
99 END


---------- TTY PROGRAM FOR 16K LEVEL II ----------
                SET MEMORY SIZE TO 32566
10 CLS:INPUT"DO YOU WANT CRT ECHO ON LPRINT ";A$: IF A$="Y" OR A$="N" THEN IF
   A$="Y" THEN POKE 16422,55 ELSE POKE 16422,59 ELSE 10
20 POKE 16423,127: POKE 16424,0: FOR I = 32567 TO 32712
30 READ BYTE
40 POKE I,BYTE
50 NEXT
60 DATA 121,205,51,0,229,213,245,97,197,124,87,254,13,194,87,127,205,137,127,38
65 DATA 10,205,137,127,62,0,50,40,64,195,127,127,58,40,64,254,70,194,116,127,205
70 DATA 137,127,38,13,205,137,127,38,10,205,137,127,62,0,50,40,64,195,127,127,58
75 DATA 40,64,60,50,40,64,98,205,137,127,62,63,50,232,55,193,241,209,225,201,6,7
80 DATA 62,48,211,255,205,189,127,124,103,203,71,202,158,127,62,16,195,160,127,62
85 DATA 48,211,255,205,189,127,5,202,175,127,124,203,31,195,147,127,62,16,211,255
90 DATA 205,189,127,205,189,127,205,189,127,201,245,17,159,2,27,122,179,194,193
95 DATA 127,241,201
97 NEW
99 END
```

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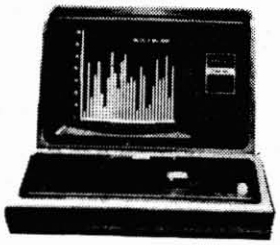

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Radio Shack's Editor/Assembler does not use this control block, the printer will not operate while using the Editor/Assembler. This is the only shortcoming I have found.

A final note: As I was going over the program for the 50th time in preparation for this article, I noticed that by adding four more bytes to the beginning of the program I could have the CRT echo what was being LPRINTed. I have included them in the TTY programs. These bytes are a call to a subroutine located in ROM at hex location 0033, which displays the character on the CRT. ■

References

"TRS-80 Machine-Language Programmer's Handbook," Tahl Milburn.

"Radio Shack TRS-80 Editor/Assembler Operation and Reference Manual," Radio Shack, 1978.

"TRS-80 Technical Manual," Radio Shack, 1978.


```
7F3B E5                 PUSH    HL
7F3C D5                 PUSH    DE
7F3D F5                 PUSH    AF
7F3E 61                 LD      H,C
7F3F C5                 PUSH    BC
7F40 7C                 LD      A,H
7F41 57                 LD      D,A
7F42 FE0D               CP      0DH
7F44 C2577F             JP      NZ,EOL
7F47 CD897F             CALL    PRINT
7F4A 260A               LD      H,0AH
7F4C CD897F             CALL    PRINT
7F4F 3E00               LD      A,0
7F51 322840             LD      (4028H),A
7F54 C37F7F             JP      EXIT
7F57 3A2840     EOL     LD      A,(4028H)
7F5A FE46               CP      70D
7F5C C2747F             JP      NZ,MIN
7F5F CD897F             CALL    PRINT
7F62 260D               LD      H,0DH
7F64 CD897F             CALL    PRINT
7F67 260A               LD      H,0AH
7F69 CD897F             CALL    PRINT
7F6C 3E00               LD      A,0
7F6E 322840             LD      (4028H),A
7F71 C37F7F             JP      EXIT
7F74 3A2840     MIN     LD      A,(4028H)
7F77 3C                 INC     A
7F78 322840             LD      (4028H),A
7F7B 62                 LD      H,D
7F7C CD897F     OUT     CALL    PRINT
7F7F 3E3F       EXIT    LD      A,63D
7F81 32E837             LD      (37E8H),A
7F84 C1                 POP     BC
7F85 F1                 POP     AF
7F86 D1                 POP     DE
7F87 E1                 POP     HL
7F88 C9                 RET
7F89 0607       PRINT   LD      B,7D
7F8B 3E20               LD      A,32D
7F8D D3FF               OUT     (0FFH),A
7F8F CDBD7F             CALL    DELAY
7F92 7C                 LD      A,H
7F93 67         LOOP    LD      H,A
7F94 CB47               BIT     0,A
7F96 CA9E7F             JP      Z,SPACE
7F99 3E00               LD      A,0
7F9B C3A07F             JP      BIT
7F9E 3E20       SPACE   LD      A,32
7FA0 D3FF       BIT     OUT     (0FFH),A
7FA2 CDBD7F             CALL    DELAY
7FA5 05                 DEC     B
7FA6 CAAF7F             JP      Z,DONE
7FA9 7C                 LD      A,H
7FAA CB1F               RR      A
7FAC C3937F             JP      LOOP
7FAF 3E00       DONE    LD      A,0
7FB1 D3FF               OUT     (0FFH),A
7FB3 CDBD7F             CALL    DELAY
7FB6 CDBD7F             CALL    DELAY
7FB9 CDBD7F             CALL    DELAY
7FBC C9                 RET
7FBD F5         DELAY   PUSH    AF
7FBE 119F02             LD      DE,671D
7FC1 1B         DLOOP   DEC     DE
7FC2 7A                 LD      A,D
7FC3 B3                 OR      E
7FC4 C2C17F             JP      NZ,DLOOP
7FC7 F1                 POP     AF
7FC8 C9                 RET
0000                    END
00000 TOTAL ERRORS
DLOOP   7FC1
DONE    7FAF
BIT     7FA0
SPACE   7F9E
LOOP    7F93
DELAY   7FBD
OUT     7F7C
MIN     7F74
EXIT    7F7F
PRINT   7F89
EOL     7F57
TTY     7F3B
```

Assembled program.

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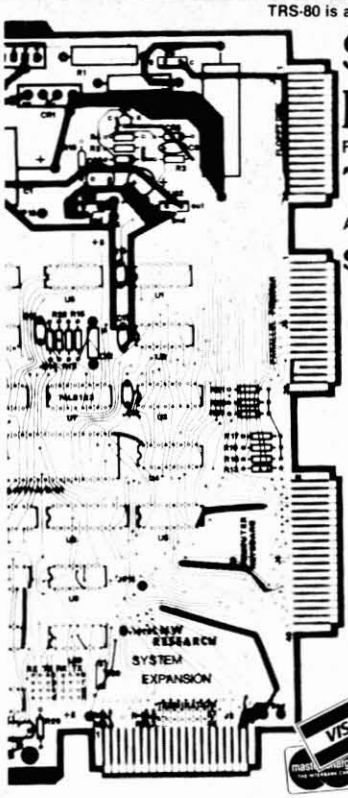

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Going through my back issues of *Kilobaud*, I reread the article in the April, 1978 issue on 3D Tic-Tac-Toe for the North Star BASIC. I decided to convert it for the TRS-80.

It was immediately apparent that the conversion would mean changing the graphics format to a 16 line screen. Since it is annoying to have the computer blank the screen to redraw the board while you are trying to analyze a complex arrangement, I decided to draw a new layout.

Using X and O gave me a chance to try POKEing instructions for graphics. Fortunately, the TRS-80 graphic characters enabled me to form a very acceptable X and O with only two POKE statements each.

Drawing the Board

I laid out the four boards on a TRS-80 graphics worksheet. When I thought I had a nice balance, with room for responses and playing aids, I was ready to write the display portion of the program.

Since I would only draw the boards one time for each game and the symmetrical nature of the boards was so obvious, I chose a simple FOR-NEXT routine to draw the boards. The top of the screen was used for information, and the bottom for alterable text describing moves.

I used the edit mode to change lines in the graphic portion of the resident program and gave it a run. I liked the looks of the presentation, so I turned my attention to making the game run.

The array used to set up the possible winning combinations was two dimensional with 304 elements. After deciphering the intent of the listed statements, it was fairly easy to edit the lines so the TRS-80 could construct the required array.

After a few false starts, I managed to get the game to run. The computer took just over four minutes to make its first move, but it did place its O correctly. I was grateful for that. I continued play and about 45 minutes later, while on the verge of making an excellent move, I was rudely jolted by an "I WON WITH BOARD 3, POSITION 11". In checking carefully the supposed winning combination, I found that I had been truly "snookered".

That hooked me. I knew I was in for a prolonged altercation with this crafty machine. Furthermore, I didn't want each game to be over an hour long, so I set to work increasing its speed.

Increasing the Speed

There are 64 squares on the four boards and you need four-in-a-row for a win. This results in 76 possible combinations for a win. When you make a move, the computer has to check all possible combinations to determine if you won, and, if not, what the board now contains as threats to win. The computer then sorts through all 76 possible combinations of wins for each of the 64 squares resulting in 19,456 comparisons before it can go on with its move.

This is in addition to the evaluation for your move. With close to 20,000 comparisons to be made, it is not surprising that the computer moves slowly.

Since there are only seven combinations that involve square (1,1) and only four combinations that involve square (1,2), it seemed like a waste of time to have to look through all 76 combinations just to find the seven or four combinations required.

There are sixteen squares that are involved in seven winning combinations and 48 squares that are involved in four winning combinations. By allowing the computer to access only the small set of winning combinations for each box, the number of comparisons could be reduced to only 294.

Another array was added to the program calling all 294 winning combinations which the computer searched in order. With this modification, the run time for the computer to move was reduced to less than 25 seconds.

I added some instructions and a score keeping function and converted the appropriate variables to integer form to reduce memory requirements. I

Program Listing.

```
5 CLS
6 GOSUB 4000
7 DEFINT A-Z
9 CLS:PRINT@520,"PLEASE WAIT A SECOND WHILE I GET READY
    "
10 DIM S(64),W(3,76),V(76),D1(64,7),K(64)
20 FOR A=1 TO 10:FOR A1=0 TO 3 :READ W(A1,A):NEXTA1,A
30 FOR A=1 TO 3:A1=A*10:FOR A2=1 TO 10:FOR A3=0 TO 3
40 W(A3,A1+A2)=W(A3,A2)+(16*A):NEXTA3,A2,A
50 FOR A=41 TO 56:FOR A1=0 TO 3
60 W(A1,A)=(A1*16)+A-40:NEXT A1,A
70 FOR A=57 TO 76: FOR A1=0 TO 3: READ W(A1,A):NEXT A1,
    A
72 DATA1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,1,5,9,13,
    2,6,10,14
74 DATA3,7,11,15,4,8,12,16,1,6,11,16,4,7,10,13,1,22,43,
    64
76 DATA5,22,39,56,9,26,43,60,13,26,39,52,2,22,42,62,14,
    26,38,50
78 DATA3,23,43,63,15,27,39,51,4,23,42,61,8,23,38,53,12,
    27,42,57,16,27,38,49
83 DATA1,21,41,61,1,18,35,52,4,19,34,49,4,24,44,64
```

```
84 DATA13,25,37,49,13,30,47,64,16,31,46,61,16,28,40,52
85 GOSUB5000
86 FOR A=1 TO 64:S(A)=0:V(A)=0:NEXTA:FORA=65TO76:V(A)=0
   :NEXT A
87 GOSUB7000:GOSUB 6000
90 CLS:GOSUB 1000
91 IF G=1 THEN 390
95 PRINT@835,"YOUR BOARD & POSITION";:INPUT A1,A2
96 PRINT@863,"
                "
97 IF (A1=0) AND (A2=0) THEN 9000
98 GOSUB2000
100 A=((A1-1)*16)+A2:Z1=Z+16*A1+128*R
105 IF A>64 OR A<1 THEN PRINT@857,"           ILLEGAL M
    OVE":GOTO 95
110 IF S(A)<>0 THEN PRINT@857,"      YOU CAN'T MOVE THE
    RE":GOTO 95
120 S(A)=1
125 POKE Z1+15360,153:POKE Z1+15361,166
190 M5=0:FOR A=1 TO 76
192 A2=W(0,A):A3=W(1,A):A4=W(2,A):A5=W(3,A)
194 V(A)=S(A2)+S(A3)+S(A4)+S(A5)
196 IF V(A)=4 THEN B1=A:GOTO410
198 IFV(A)=15 THEN M5=A
199 NEXT A:IF M5<>0 THEN 365
204 M3=-1:A8=0
205 FOR Q=1 TO 64:A=K(Q):IF S(A)<>0 THEN 230
206 N=7:IF Q>=17 THEN N=4
207 M2=0:A8=A8+1
208 FOR D=1 TO N:A1=D1(Q,D)
210 B6=V(A1)
212 IF B6=3 THEN M4=A:GOTO 390
214 IF B6=0 THEN 222
216 IF B6=1 OR B6=5 THEN M2=M2+1
218 IF B6=2 THEN M2=M2+2+P+((RND(2)-1)*100)
220 IF B6=10 THEN M2=M2+12
222 NEXT D
224 IF M2>=10 AND M2<=19 THEN M2=M2-10
226 IF M2>=100 AND M2<=199 THEN M2=M2-100
228 IF M2>M3 THEN M3=M2:M4=A
230 NEXT Q
250 IF A8=0 THEN 9010
260 GOTO 390
365 FOR A1 =0 TO 3:A6=W(A1,M5):B1=M5:IF S(A6) = 0 THEN
    M5 = A6:GOTO370
367 NEXT A1
370 A1=INT((M5-1)/16)+1:A2=M5-((A1-1)*16)
380 PRINT@835,"I WON WITH BOARD";A1;"POSITION";A2:C=C+1
    :H=H+1:GOSUB2000:GOSUB3000
384 FOR X=1 TO 20
385 FOR A=0 TO 3:M5=W(A,B1):A1=INT((M5-1)/16)+1:A2=M5-(
    (A1-1)*16):GOSUB2000:GOSUB8000:GOSUB3000:NEXTA
386 NEXTX
387 GOTO415
390 S(M4)=5:G=0
392 A1=1+INT((M4-1)/16):A2=M4-((A1-1)*16)
400 PRINT@865,"I WANT BOARD";A1;"POSITION";A2,:GOSUB200
    0:GOSUB3000:PRINT@857,"       ":GOTO95
410 PRINT@835,"YOU WON !!                          ":J=J+
    1:H=H+1
411 FOR X=1 TO 20:GOSUB412:NEXTX:GOTO415
412 FORA=0 TO 3:M5=W(A,B1):A1=INT((M5-1)/16)+1:A2=M5-((
    A1-1)*16):GOSUB2000:GOSUB8000:GOSUB8100:NEXTA:RETU
    RN
415 CLS:PRINT"WE HAVE PLAYED ";H;"GAMES":PRINT:PRINT"WE
    'VE HAD ";H-C-J;"DRAWS":PRINT@320,"YOU HAVE WON";J
    ;"GAMES.";"    ";"I HAVE WON";C;"GAMES.":INPUT"DO
     YOU WANT TO PLAY AGAIN";A$
420 IF LEFT$(A$,1)="Y"THEN 86
425 PRINT@280,"THANK YOU":END
1000 FOR Y=19 TO 31 STEP 6:FOR X=2 TO 31
1100 SET(X,Y):SET(X+32,Y):SET(X+64,Y):SET(X+96,Y):NEXTX
    ,Y
1105 FORX=8 TO 24 STEP 8:FOR Y=15 TO 35
1107 SET(X,Y):SET(X+32,Y):SET(X+64,Y):SET(X+96,Y):NEXTY
    ,X
1110 PRINT@2,"YOUR MOVES ARE ";:POKE 15377,153:POKE1537
    8,166
1120 PRINT@130,"MY MOVES ARE";:POKE 15505,183:POKE 1550
    6,187
1125 PRINT@31,"ALL BOARD      1  5   9  13";
1127 PRINT@95,"POSITIONS ARE  2  6  10  14";
1130 PRINT@174,"3  7  11  15";
1135 PRINT@238,"4  8  12  16";
1140 PRINT@773,"BOARD 1          BOARD 2          BOARD 3
              BOARD 4"
2000 IF A2<5 THEN Z=177:R=A2
2010 IF A2>=5 AND A2<9 THEN Z=181:R=A2-4
2020 IF A2>=9 AND A2<13 THEN Z=185:R=A2-8
2030 IF A2>=13 THEN Z=189:R=A2-12
2040 RETURN
3000 Z1=Z+16*A1+128*R
3005 IF Z1>1000 THEN STOP
3010 POKE Z1+15360,183
3020 POKE  Z1+15361,187:RETURN
4000 PRINT@280,"3-D TIC-TAC-TOE"
4010 PRINT@588,"":INPUT"DO YOU WANT INSTRUCTIONS";A$
4020 IF LEFT$(A$,1)="Y" THEN4050
4030 RETURN
4050 CLS:PRINT"THIS GAME WILL REQUIRE THE UTMOST SKILL.
      YOU CAN WIN"
4052 PRINT"WITH 4 SQUARES IN A ROW --ACROSS, DOWN AND
    DIAGONALLY-- ON"
4055 PRINT"ANY BOARD.  YOU CAN ALSO WIN WITH 4 SQUARES
    IN A ROW,  FROM"
4060 PRINT"BOARD TO BOARD --ACROSS, DOWN AND DIAGONALLY
    .  FOR EXAMPLE,"
4062 PRINT"ANY SET OF IDENTICAL MOVES ON EACH OF THE 4
    BOARDS IS A WIN;"
4065 PRINT"ALSO, A TOP ROW SQUARE ON BOARD 1 COMBINED W
    ITH THE SAME"
4070 PRINT"COLUMN SQUARE IN THE SECOND ROW ON BOARD 2,
    ETC. IS A WIN."
4072 PRINT"DIAGONALS THROUGH THE CUBE AT EACH LEVEL OR
    ACROSS LEVELS ARE"
4074 PRINT"ALSO PERMITTED.  FOR A DRAW, ENTER 0,0.":PRI
    NT
4076 PRINT"THE COMPUTER WILL TRY TO BLOCK YOU AND ALSO
    TRY TO WIN ITSELF."
4078 PRINT"IF THE COMPUTER MOVES FIRST, IT WILL MAKE A
    RANDOM MOVE FIRST."
4080 PRINT"BE SURE TO PUT A COMMA BETWEEN YOUR ENTRIES.
    "
4090 PRINT:PRINT"GOOD LUCK--YOU'LL NEED IT!";
4100 INPUT"    PRESS ENTER TO BEGIN.";B$
4210 GOTO9
5000 FOR Q=1 TO 16:FOR D=1 TO 7:READD1(Q,D):NEXT D,Q
5010 FOR Q=17 TO 64:FOR D=1 TO 4:READD1(Q,D):NEXT D,Q
5012 FOR Q=1 TO 64:READ K(Q):NEXTQ
5015 RETURN
5020 DATA1,5,9,41,57,69,70,1,8,10,44,65,71,72,4,5,10,54
    ,60,73,74
5030 DATA4,8,9,56,68,75,76,31,35,39,41,68,71,73,31,38,4
    0,44,60,70,76
5040 DATA34,35,40,54,65,69,75,34,38,39,56,57,72,74,12,1
    6,19,46,57,58,61
5050 DATA12,17,20,47,63,65,66,13,16,20,50,59,60,62,13,1
    7,19,51,64,67,68
5060 DATA22,26,29,46,62,66,68,22,27,30,47,58,60,64
5070 DATA23,26,30,50,61,65,67,23,27,29,51,57,59,63
5080 DATA1,6,42,61,1,7,43,63,2,5,45,58,2,6,9,46
5090 DATA2,7,10,47,2,8,48,66,3,5,49,59,3,6,10,50
5100 DATA3,7,9,51,3,8,52,67,4,6,53,62,4,7,55,64
5110 DATA11,15,19,41,11,16,42,70,11,17,43,71
5120 DATA11,18,20,44,12,15,45,69,12,18,48,72,13,15,49,7
    3
5130 DATA13,18,52,76,14,15,20,54,14,16,53,74,14,17,55,7
    5
5140 DATA14,18,19,56,21,25,29,41,21,26,42,71,21,27,43,7
    0
5150 DATA21,28,30,44,22,25,45,73,22,28,48,76,23,25,49,6
    9
5160 DATA23,28,52,72,24,25,30,54,24,26,53,75,24,27,55,7
    4
5170 DATA24,28,29,56,31,36,42,62,31,37,43,64,32,35,45,6
    6
5180 DATA32,36,39,46,32,37,40,47,32,38,48,58,33,35,49,6
    7
5190 DATA33,36,40,50,33,37,39,51,33,38,52,59,34,36,53,6
    1
5200 DATA34,37,55,63
5210 DATA1,4,13,16,49,52,61,64,22,23,26,27,38,39,42,43
5220 DATA2,3,5,6,7,8,9,10,11,12,14,15,17,18,19,20,21,24
    ,25,28,29,30,31,32
5230 DATA33,34,35,36,37,40,41,44,45,46,47,48,50,51,53,5
    4,55,56,57,58,59,60,62,63
6000 CLS:INPUT"DO YOU WANT TO FLIP A COIN FOR WHO GOES
    FIRST.                I CAN DO IT FOR YOU.";A$
6010 IF LEFT$(A$,1)="Y" THEN 6050
6020 INPUT"O.K. DO YOU WANT TO GO FIRST";A$
6030 IF LEFT$(A$,1)="Y" THEN RETURN
6040 A1=RND(4):A2=RND(16):M4=A2+(A1-1)*16:G=1:RETURN
6050 F=RND(2):INPUT"DO YOU WANT HEADS OR TAILS";B$
6060 IF LEFT$(B$,1)="T" THEN 6100
6070 IF F=1 THEN PRINT"YOU WIN.  YOU MOVE FIRST.":FOR X
    =1 TO 1000:NEXT:RETURN
6080 PRINT"I WON THE TOSS.  I'LL GO FIRST.":FOR X=1 TO
    1000:NEXT:GOTO6040
6100 IF F=2 THEN PRINT"YOU WIN.  YOU MOVE FIRST.":FOR X
    =1 TO 1000:NEXT:RETURN
6110 PRINT"I WON THE TOSS.  I'LL GO FIRST.":FOR X=1 TO
    1000:NEXT:GOTO6040
7000 CLS:PRINT@256,"HOW DO YOU WANT ME TO PLAY?"
7010 PRINT:PRINT"1. LIKE A (UGH) HUMAN "
7020 PRINT"2. LIKE AN AVERAGE COMPUTER"
7030 PRINT"3. LIKE A SUPER COMPUTER"
7040 PRINT:INPUT"ENTER 1, 2 OR 3";P
7050 IF P<1 THEN P=1
7060 IF P>3 THEN P=3
7070 P=P-1:RETURN
8000 Z1=Z+16*A1+128*R
8010 POKE Z1+15360,128
8020 POKE Z1+15361,128
8030 RETURN
8100 Z1=Z+16*A1+128*R:POKE Z1+15360,153
8150 POKE Z1+15361,166
8200 RETURN
9000 FORA=1 TO 64:IF S(A)=0 THEN 9500
9005 NEXTA
9010 PRINT@835,"ITS A DRAW !                ":FOR X=1 T
    O 2000:NEXTX:H=H+1:GOTO415
9500 PRINT@857,"          THAT'S NOT A DRAW !!":GOTO 95
```

added some lines of programming to allow a player to determine who goes first, either by chance (flip of the computer's coin), or by choice.

If the computer moves first, it picks the opening square at random.

I also added the feature that flashes the four winning squares of either victor.

Modifications

After playing several games, a few glitches showed up and I had to modify the algorithm. I came up with a good modification, but then I couldn't beat it, although I did manage a draw. Although I haven't achieved one since.

Since a draw would "hang up" the program, I added two subroutines to handle it. If you moved first, the computer would fill in the last square, so I added the feature of entering (0,0) for board and position to allow you to call a draw.

To prevent abuse, however, such as declaring a draw when in danger of losing, I added a check for open squares. If there is an open square, you cannot call a draw. If the computer has moved first, when you've entered the last square, it will find no place to move and will declare a draw itself.

Now, I was ready for one more change. I gave the computer the ability to play three different levels of difficulty. I also included a random factor that will occasionally (50 percent of the time) allow the computer to make only a good move, not necessarily the best move.

All in all, this project has given me an opportunity to learn more about Level II BASIC through practical application. Now, as a result of my efforts, I have gained much valuable experience and have a first class game program for myself. ■

References

Roehrig, Joseph; "3D-TIC-TAC-TOE"; April 1978 *Kilobaud* pp. 66-69

Help prevent garbaged disk files, with this power interlock.

Disaster Saver

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My first introduction to the TRS-80 occurred when a manufacturer was loaded up by his local Radio Shack store with two complete systems, disk drives, printers et al, so that he could do his payroll, accounting, order processing and inventory control. To help him program his TRS-80 the Radio Shack store sold him *TTL Cookbook*, *TV Typewriter* and *8080 Bug Book*.

I was called in through a friend of a friend.

"HELP—I bought all this stuff, plugged it in, and it just sits there and does absolutely nothing!"

Got It to Work

I took one system home and got it to work. But when I keyed in programs, I had to SAVE every 10 lines or so, because they randomly rebooted the operating system, bombing the program.

When I did get a complete program loaded, it blew-up before completion. Each and every time it blew-up, I walked away to cool off and maintain my sanity.

I happened to pass the refrigerator and soon noticed that it was always running, as were the garbage disposal, microwave oven and vacuum.

I brought out my scope, meter and variac. The regulation and spike protection seemed adequate, but the filter caps in the American Flyer type power supplies were just not large enough to supply current during the momentary line drop caused by a motor start. And this was in my home, not the user's place of business, an industrial park.

The simple and obvious cure was a visit to the local surplus house to get some computer-grade caps of 10,000 uF and 30V, at a cost of a dollar each. The Radio Shack store recommended some fancy line conditioning equipment that cost more than the basic TRS-80.

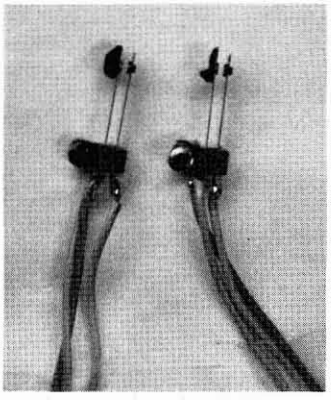


Photo 1. Reshaped Cam

(See Fig. 1.) The power supply is typical of both keyboard and expansion interface supplies. The ones on the expansion interface were mounted in the power supply cavity.

I felt it was a good practice to remove the mag field and source of heat from inside the case. The power supplies and caps for the keyboard were mounted under the Radio Shack supplied table.

TRS-80 Disaster Saver

One day after entering over 1200 items of inventory the power went off. When it returned the LEDs on the disk drives lit and they started doing something—writing garbage into several sectors of my inventory disk.

I wrote a repair program and went on.

Then it happened again with the same results. I could see myself married to this thing and

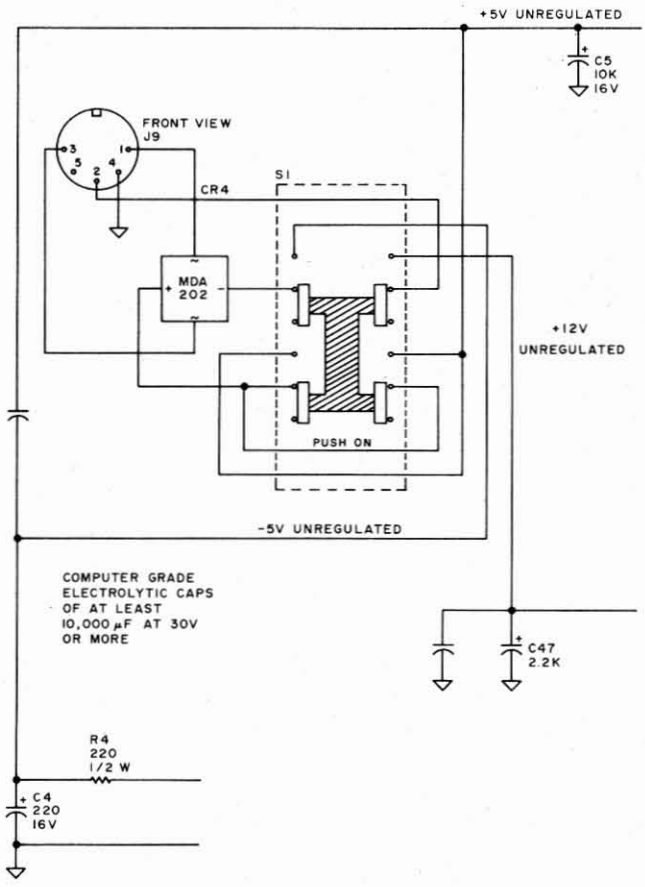


Fig. 1. TRS-80 Expansion Interface Schematic.

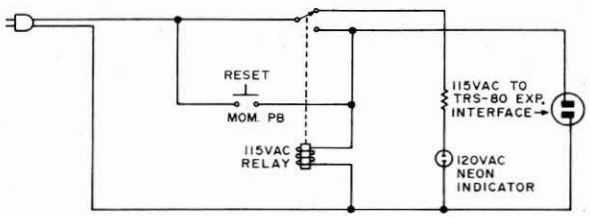
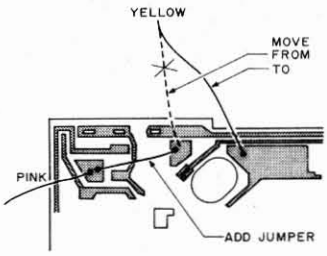


Fig. 2. TRS-80 Disaster Saver



spending half my remaining life at my customer's place of business.

Since this only occurred when power was restored, a simple fix used a latched relay so that once power was removed, it could only be restored manually *after the diskettes had been removed.* Note: Only the expansion interface need be plugged into this box (Fig. 2.).

TRS-80 Beep

While my eyeballs were busy copying data from a document my screen might suddenly fill with error messages. I didn't know the point of error because the lines rolled off the screen. I decided there was a better way that other terminal manufacturers found years ago. This simple little beep circuit connects to the TRS-80 expansion connector (Fig.3).

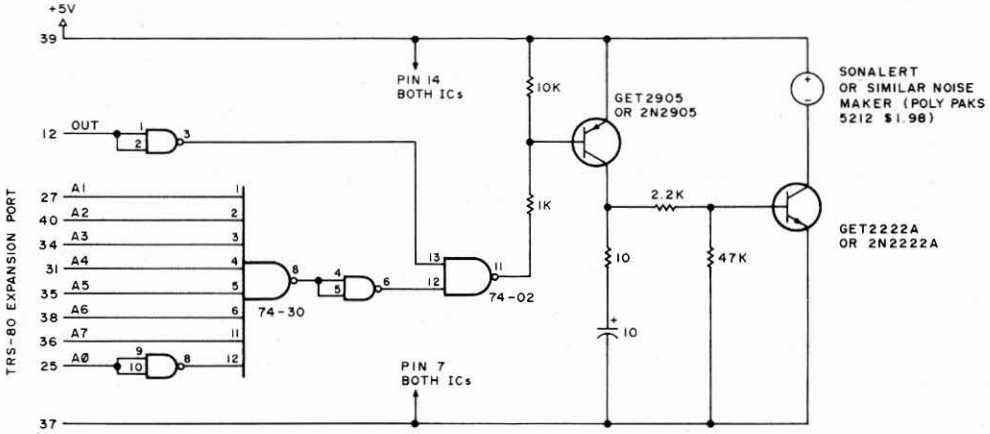
Mickey Mouse Tape Helper

My tape helper doesn't fix all the problems with the TRS-80 Mickey Mouse taping system, but it makes it easier to live with. (Rube Goldberg would not have conceived of the practice of pulling a plug to rewind a tape. Unless he wanted to dump all the cheap tape recorders he had lying around his store.)

The modification overrides the remote motor control when the fast forward and rewind buttons are depressed (Fig.4). ■

1. Remove bottom of case (two screws are inside battery case).
2. Remove screw securing circuit board and lift board as far as wires permit.
3. Press rewind, then play. Note that the operating cam moves farther in the rewind mode. We will utilize this tendency to override TRS-80 motor control.
4. Remove screw and lift clear leaf switch assembly.
5. With a fine file reshape cam as in Photo 1.
6. Replace switch and circuit board.
7. While replacing circuit board, position record/play operating lever (it may be observed through a hole in the board).
8. Move yellow wire and add jumper as shown. This places the cam-operated leaf switch parallel with the motor control connector.

Fig. 4. Rewind and Fast Forward Override




```
---- GOSUB 1000
1000 FOR I=1 TO 25: OUT 254,2: NEXT:'-------BEEP
1001 RETURN
```

Fig. 3. TRS-80 Beep Circuit

Some shifty diskwork.

Displaced Programs

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The problem of creating a backup copy of the EDT/ASM made me curious as to how one could put machine language programs such as this on a disk. The main difficulty is that TRSDOS and many other programs occupy common memory positions. But after reading Chapter 6 in TRS-80 Assembly Language Programming by William Bardon Jr. I found one could do this quite easily.

The idea is to shift your program to upper free memory, and store this on a disk. When you want to use it, load the program from the disk, shift it back to its original position and jump to the start of the program. If you have T-BUG and EDT/ASM, you can do it too. Now T-BUG normally occupies 4380H-4980H and EDT/ASM 4300H-5D40H. Execution of the EDT/ASM starts at 468AH.

The Technique

Here is the technique for the EDT/ASM. The minimum requirements are a 16K system with one disk. The program for shifting memory, shown below, can be entered using T-BUG. The shift is made from 4300H-5D40H to 6300H-7D40H.

Address	Hex Instructions	
6000H	21 00 43	LD HL,4300H
6003H	11 00 63	LD DE,6300H
6006H	01 40 1A	LD BC,1A40H
6009H	ED B0	LDIR
600BH	C3 19 1A	JP 1A19H

After entering the above then J 1A19 takes you back to BASIC2. Now enter your EDTASM program as illustrated below:

SYSTEM (ENTER)
EDTASM (ENTER)
/24576 (ENTER) instead of / (ENTER)

You now have a copy of the EDT/ASM in memory from 6300H-7D40H.

Now re-enter T-BUG in the usual manner and add the program below to your copy of the EDT/ASM in high memory to enable it to shift back to its original position.

Address	Hex Instructions	
7D50H	21 00 63	LD HL,6300H
7D53H	11 00 43	LD DE,4300H
7D56H	01 5D 1A	LD BC,1A5DH
7D59H	ED B0	LDIR
7D5BH	C3 8A 46	JP 468AH

Now store the high memory EDT/ASM plus the above shift program using

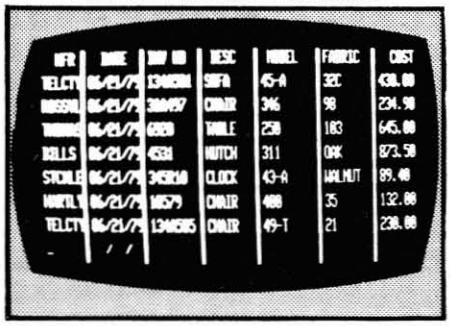
P 6300 7D5D 7D50 EDTASM

At this point you now have your backup copy of EDTASM which you can use like the original. Now put it on the disk! Load in TRSDOS and load in the above cassette program using the following steps.

TAPEDISK (ENTER)
?C (ENTER)
?F EDTASM/CMD:0 6300 7D5D 7D50 (ENTER)
?E (ENTER)

You now have EDTASM on disk. After DOS is displayed, type in EDTASM (ENTER) and you're ready to go. ■

FILL IN THE BLANKS!!



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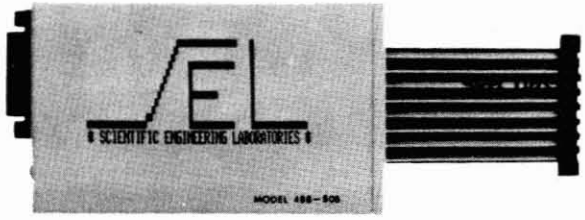

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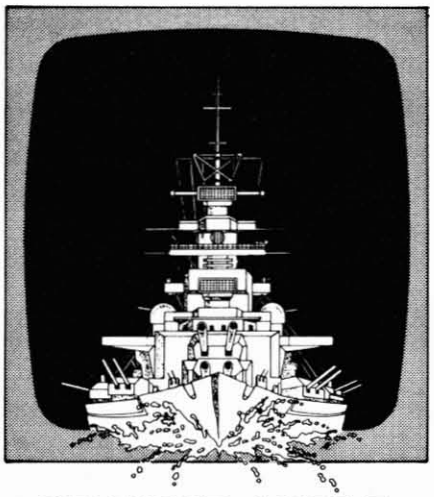

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Copy tapes containing assembler source or object codes in one easy step with this routine.

TCOPY

Dennis Stevens
10895 Kemah Lane
San Diego CA 92131

Most users of cassette tapes have probably heard the advice to use short tapes and put no more than two programs on a tape. If you're like me, you probably thought that was good advice, but you have never been that organized before. Why start now? It is so much easier to string programs out on a 60 or 90 minute tape than to go out and buy new tapes; there always seems to be room for another program.

But if your tape contains a mixture of BASIC code, assembler source code and object code, you will have a long job ahead of you to make a duplicate of the entire tape. Most routines for copying tapes involve loading the entire program into the computer, then writing it out on tape. This means a CLOAD and a CSAVE for each BASIC program and loading the assembler and the source code, followed by writing the source code and object code on tape for each machine-language program. Or you might have access to a copying program for object code that must first be loaded into the computer, which then reads in the object code and writes the program onto tape.

It occurred to me that all of these different kinds of program codes (including Levels I and II) exist on tape in fundamentally the same form: short audio bursts or pulses followed by a period free of such disturbances. The nature of the pulses is conceptually the same for all tapes made by TRS-80; it is only the way that they are interpreted that is different. So why not write a program that detects the pulses and, as each pulse is detected, immediately sends out the pulse and records it on a second recorder?

The pulse width is always much smaller than the time between pulses (or it should be). So there is enough time to write out a pulse before the next one comes along. In effect, the computer would then be functioning only as a signal conditioner.

The Program

I set out to write such a program. The flowchart is shown in Fig. 1. After the recorder is turned on, the program waits for a pulse from the source tape

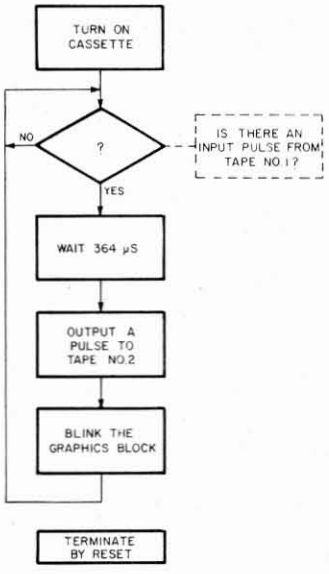

Fig. 1. TCOPY flow diagram

```
4FD3                00100          ORG    4FD3H
4FD3   3E04         00110  TCOPY   LD     A,4
4FD5   D3FF         00120          OUT    (0FFH),A     ;CASSETTE ON & D7=0
4FD7   213F3C       00130          LD     HL,3C3FH     ;HL POINTS TO CORNER OF SCREEN
4FDA   DBFF         00140  PULSE   IN     A,(0FFH)     ;WAIT FOR A PULSE
4FDC   17           00150          RLA
4FDD   30FB         00160          JR     NC,PULSE     ;JUMP ON NO PULSE
4FDF   0632         00170          LD     B,32H
4FE1   10FE         00180          DJNZ   $            ;DELAY 364 MICROSEC.
4FE3   3E05         00190          LD     A,5
4FE5   D3FF         00200          OUT    (0FFH),A     ;PULSE IS HIGH
4FE7   0610         00210          LD     B,10H
4FE9   10FE         00220          DJNZ   $            ;PULSE HIGH FOR 129 MICROSEC.
4FEB   3E06         00230          LD     A,6
4FED   D3FF         00240          OUT    (0FFH),A     ;PULSE IS LOW
4FEF   0610         00250          LD     B,10H
4FF1   10FE         00260          DJNZ   $            ;PULSE LOW FOR 129 MICROSEC.
4FF3   3E04         00270          LD     A,4
4FF5   D3FF         00280          OUT    (0FFH),A     ;PULSE NEUTRAL & D7=0
4FF7   7E           00290          LD     A,(HL)
4FF8   3C           00300          INC    A            ;CHANGE CHARACTER ON SCREEN
4FF9   F680         00310          OR     80H
4FFB   E6BF         00320          AND    0BFH         ;CHARACTER IS A GRAPHICS BLOCK
4FFD   77           00330          LD     (HL),A       ;DISPLAY CHARACTER
4FFE   18DA         00340          JR     PULSE        ;LOOK FOR NEXT PULSE
4FD3                00350          END    TCOPY
00000 TOTAL ERRORS
PULSE   4FDA
TCOPY   4FD3
```

TCOPY program

(tape #1). When a pulse is detected, a 364 microsecond delay is incurred to allow the pulse to subside. Then a pulse is written on the destination tape (tape #2).

A graphics character in the upper right-hand corner of the screen is blinked, and we then go back to the start of the program and wait for the next pulse. When the graphics character stops blinking, you know that the copy is complete. You can stop execution by pressing the reset button, or you can let the tapes run onto the next program.

The program listing is short (45 bytes) and simple. This makes it easy to POKE in from BASIC or to enter via a monitor (e.g. T-BUG) or an assembler, then copy the program onto tape. The program is executed by entering SYSTEM and then entering /20435 (or just / if no other machine-code tape has been entered after the TCOPY tape).

But first make the recorders ready (i.e., recorder #1 in play mode with the black plug in its EAR jack and recorder #2 in record mode with larger gray plug in its AUX jack). When you terminate the program by reset, only the recorder with the REMOTE jack connected will stop.

After trying the program out, I found it to have some very desirable features. Since you read and write simultaneously, the process is faster than other methods requiring that the program be read in its entirety, then written onto tape. The longer the program, the more time is saved.

TCOPY will copy tapes of any length (even if the program to be copied is larger than the unused memory in your machine). The program is completely independent of the ROM, so it should work on Level I machines (although I have only demonstrated it on a Level II machine).

The method has one major drawback—two recorders are required. But this requirement is essential and inherent to some of the advantages listed above.■

✓Reader Service—see page 178

Limited printer width? Use these BASIC subroutines to tidy up your output.

Format 40

John D. Adams
13126 Tripoli Ave.
Sylmar, CA 91342

If some of you, like myself, need hard copy, but can neither afford nor justify the thousand dollars plus for a nice line printer, you might consider one of the smaller printers now on the market.

I did a lot of looking around and finally decided on the TRENDCOM 100. I've used it for several weeks now, and it's an excellent machine, but it does have its shortcomings. One of these is paper width, as it has a forty space print width.

I take pride in having my printouts neat, and I assume you do also. The TRENDCOM's forty space line poses some problems in designing your formats. I've written three subroutines to cope with some of the problems. They are simple and should be adaptable to any forty space printer, or, for that matter, to any printer.

All of them are written using as few variable letter names as possible, so that if the variable is already in use in the program, conversion is simple.

String space is another problem, depending on your RAM capacity. All three of the subroutines need some string space CLEAR'ed, and this must be done at the beginning of the program. Should your TRS-80 encounter a CLEAR instruction during program execution all of your data will be lost.

A Line Formatter

Data are sent to the printer as a single stream of characters. When the printer reaches the fortieth character, it inserts a line feed. This may come in the middle of a word or number group. If you have long strings to print you may, of course, count the characters when you enter them or simply convert them to short strings. But that is the computer's job, not yours.

The subroutine in Listing 1 formats the lines, using the following variables:

A$—string to be printed
R1—number of lines to be printed
R2—loop counter
R3—counter
R4—length of original string
R5—counter
R1$(n)—storage of formatted lines

Line 5 clears the string space at the beginning of the program. Double the original string space count. The string in Listing 1 is 149 characters long and requires clearing 293 spaces for the routine to run without OS error. Note the END in line 30. If the program continues after the subroutine terminates, this line can be omitted or a GOTO instruction inserted instead.

Line 30000 determines the string length and the number of lines it will need plus two lines to make up for the extra spaces picked up. Line 30020 finds the first space before position 40. Using this information, lines 30030 and 30040 divide the original string into segments that print into forty spaces without dividing words or number groups. Line 30050 prints the new lines, zeros R3 and returns to the main program.

The BASIC routine uses about 250 bytes. I had five long strings in my 16K machine and it formatted all of them without error. But this sort of thing is costly to RAM space. If you are running short of RAM consult pages 11/1 and A/16 of the Level II User's Manual.

Printing Alphabetical Listings

I teach algebra and accounting, and when I first got my printer I was anxious to have it print grade listings. I wanted them to be alphabetical, of course, and also in two columns to save on the thermal paper my printer uses. Getting the names alphabetized and printed was no problem, except that the listings were alphabetical in left-right, left-right order.

The subroutine in Listing 2 has three functions. It allows you to enter names in any order. It then lists them alphabetically, and, finally, prints them in two columns vertically. The variables used are as follows:

```
SUBROUTINE FOR LINE FORMATTER:

5 CLEAR 500
10 REM - PUT LINE TO PRINTED INTO A$
20 GOSUB 30000
30 END
30000 R1=LEN(A$):R4=R1:R1=INT(R1/40)+2:A
$=A$+" "
30010 FOR R2=40 TO 20 STEP -1
30020 R$=MID$(A$,R2,1):IF R$=" " THEN 30
030 ELSE NEXT
30030 R3=R3+1:R1$(R3)=LEFT$(A$,R2):IF R3
=R1 THEN 30050
30040 A$=RIGHT$(A$,R4-R2+1):R4=R4-R2:GOT
O 30010
30050 FOR R5=1 TO R1:LPRINT R1$(R5):NEXT
:R3=0:RETURN

LISTING WITHOUT FORMATTER:

GROSS RECEIPTS FOR SEPTEMBER WERE $23,16
7.42. THIS SHOWS A GAIN OF $3,437.18 OVE
R THE PREVIOUS MONTH AND A GAIN OF $6,12
9.46 OVER RECEIPTS FOR JULY.

LISTING WITH FORMATTER:

GROSS RECEIPTS FOR SEPTEMBER WERE
$23,167.42. THIS SHOWS A GAIN OF
$3,437.18 OVER THE PREVIOUS MONTH AND A
GAIN OF $6,129.46 OVER RECEIPTS FOR
JULY.
```

Program Listing 1.

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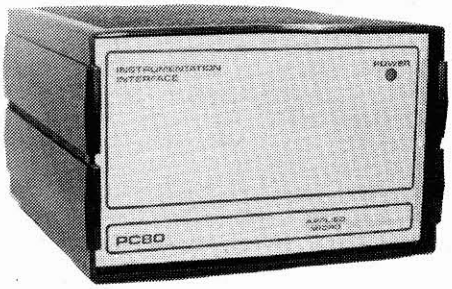

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N$(n)—storage for names
N1$—used in sort routine
E1—counter
E2—counts names in list
E3—flag
E4—number of lines needed in printout

Line 5 clears string space, defines variables and dimensions N$. The names on the printout total 68 characters and the program runs with 85 spaces cleared. Allowing 10 bytes per name should be plenty. Variable E is defined as an integer to make the sort run faster. If your list contains more than 50 names, dimension N accordingly.

Lines 10 to 30 are for entering names—in any order. If names are already in memory they can be omitted. Line 30000 counts the names in the array. Lines 30010 and 30020 are a standard sort routine. Line 30030 prints out the list.

This type of sort takes time to complete. In a dozen trial runs with 40 names entered in various orders, the run time averaged about 38 seconds. Shorter lists sort faster and vice versa. The BASIC routine takes about 270 bytes.

Figures and Columns

Since data are calculated, arranged and printed in so many ways this routine is not meant to be specific, but rather an example of what can be done using the PRINT TAB and PRINT USING instructions. With a little ingenuity a very presentable printout can be prepared. Compare the two printouts in Listing 3.

Using a format specifier can add dollar signs, line up the decimals, add trailing zeros, etc. The variables used are as follows:

M0$(n)—data storage
M1$(n)—data storage
M$(n)—column headings
M$—stores output format
M—counter
M4 to M6—tab stop locations
M7 to M9—LEN(M$)—LEN(M$(n))

Line 5 clears string space for non-numerical data. Line 10 is used to enter the names of the months and to generate random data. You might use it to check the program, but it should be omitted if data is present in memory. Be sure your information is in the right variable locations.

Line 30000 requests format. For this example I use "$$###.##". The next two lines are self-explanatory. Line 30030 calculates the difference between the length of the format string and the column heading string. Subtracting this from the original tab stop locations positions the data under the proper column heading. Line 30035 prints the column headings, and lines 30050 and 30060 print the data using the tab stops and format specifier string combined. Tab stops in this example are 12, 22 and 32.

Although this routine is tailored to one application the idea can be adapted to almost any printout situation. ■

```
SUBROUTINE FOR ALPHABETIZING:

5 CLEAR 500:DEFINT E:DEFSTR N:DIM N(50)
10 FOR E1=1 TO 50
15 CLS:PRINT"AFTER ENTERING LAST NAME
HIT 'ENTER'"
20 INPUT"ENTER NAME";N(E1)
30 IF N(E1)="" THEN GOSUB 30000 ELSE NEX
T
40 REM * CONTINUE PROGRAM EXECUTION *
30000 FOR E1=1 TO 50:IF N(E1)="" THEN 30
010 ELSE E2=E2+1:NEXT
30010 E3=0:FOR E1=1 TO (E2-1):IF N(E1)<=
N(E1+1)THEN 30020 ELSE N1=N(E1):N(E1)=N(
E1+1):N(E1+1)=N1:E3=1
30020 NEXT:IF E3=1 THEN 30010
30030 E4=INT((E2/2)+.5):FOR E1=1 TO E4:L
PRINT N(E1);:LPRINT TAB(20) N(E1+E4):NEX
T:E2=0:RETURN

LISTING WITHOUT SUBROUTINE:

WILLIAMS            BURKE
SMITH               JONES
MILLER              ADAMS
THOMPSON            DALTON
PURCELL             TRAVERS
COLLINS

LISTING USING SUBROUTINE:

ADAMS               PURCELL
BURKE               SMITH
COLLINS             THOMPSON
DALTON              TRAVERS
JONES               WILLIAMS
MILLER
```

Program Listing 2.

```
SUBROUTINE FOR FORMATTING COLUMNS:

5 CLEAR 100
10 FOR M=1 TO 6:INPUT"ENTER MONTH";M0$(M
):M1(M)=RND(30126)/100:M2(M)=RND(30126)/
100:M3(M)=RND(30126)/100:NEXT
20 GOSUB 30000
30 END
30000 INPUT"ENTER FORMAT";M$
30010 INPUT"ENTER COLUMN HEADINGS";M1$,M
2$,M3$,M4$
30020 INPUT"ENTER TABS FOR COLUMNS 2, 3,
 AND 4";M4,M5,M6
30030 M7=LEN(M$)-LEN(M2$):M8=LEN(M$)-LEN
(M3$):M9=LEN(M$)-LEN(M4$)
30035 LPRINT M1$;:LPRINTTAB(M4)M2$;:LPRI
NTTAB(M5)M3$;:LPRINTTAB(M6)M4$:LPRINT
30040 FOR M=1 TO 6
30050 LPRINT M0$(M);:LPRINTTAB(M4-M7)USI
NGM$;M1(M);:LPRINTTAB(M5-M8)USINGM$;M2(M
);:LPRINTTAB(M6-M9)USINGM$;M3(M)
30060 NEXT:RETURN

PRINTOUT WITHOUT FORMATTING:

MONTH        AREA 1     AREA 2     AREA 3

JANUARY       299.48      166.12      231.16
FEBRUARY      285.68      275.48      216.04
MARCH          92.56      199.95         8.5
APRIL         254.22      244.43      230.13
MAY           224.39      221.08      212.13
JUNE          140.54      221.24      230.89

PRINTOUT WITH FORMATTING:

MONTH        AREA 1     AREA 2     AREA 3

JANUARY     $116.88    $158.50    $194.51
FEBRUARY    $182.41     $28.66    $295.75
MARCH       $240.27    $256.56    $151.90
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A short program to help you solve algebraic equations.

Real Roots

Michael E. Daniels
210 S. Edgar Ave.
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This program finds the real root of an algebraic or transcendental equation by means of the incremental, or trial and error, search method. Written for the TRS-80 Level II microcomputer, it can be run on a 4K system.

This method determines values of f(X) for successive values of X in some interval, until a sign change occurs for f(X). A sign change indicates that a root has been passed.

Returning to the last value of X before the sign change and continuing the search with a smaller increment of X, until the sign of f(X) changes again, can give you a more accurate approximation of the root.

This procedure is repeated until a sufficiently accurate value of the root is obtained (Fig. 1).

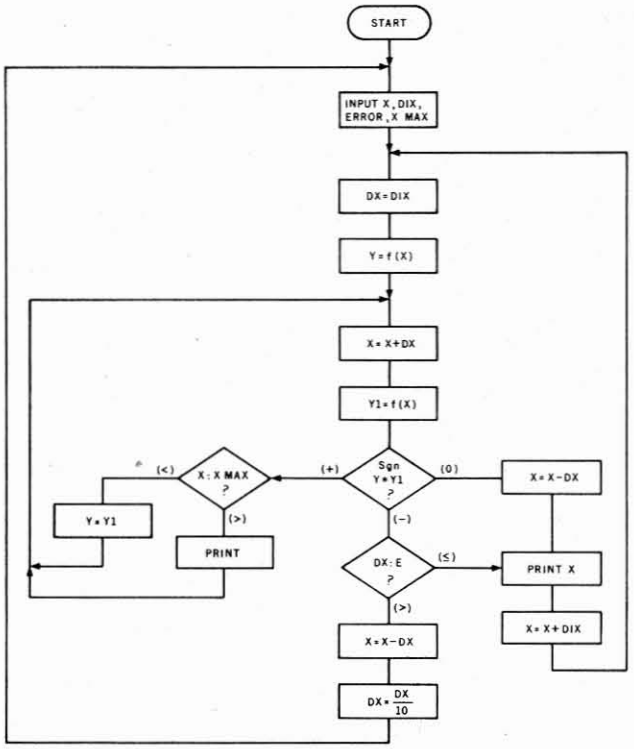

Fig. 1. Flowchart for Real Roots by trial and error.

The Equation

To illustrate this method, take the equation

$$F(X) = 2X^2 + 1 - e^X$$

F(X) is entered at lines 90 and 110, which then look like this:

```
90 Y = 2 * X↑2 + 1 - EXP(X)
110 Y1 = 2 * X↑2 + 1 - EXP(X)
```

Type in RUN and hit ENTER, and the program will ask if you need details: 1 = yes, 0 = no. If you have entered f(X) at lines 90 and 110, type "0" and hit enter. The program will ask for X, DIX, Error Value, and X max.

For our example, I chose the following values: X = 0, DIX = .1, Error Value = .00001 and X max = 3.0. When these values are entered, the computer processes the data and displays the following output:

```
X = 0
X = .74084
X = 2.84267
THERE ARE NO MORE REAL ROOTS
WITHIN THE RANGE OF XMAX.
```

Problems with this Method

This method of obtaining roots can be very time-consuming if the chosen increment of search is too small. Conversely, when the increment is too large and the roots of the equation are very close together, it could skip right over them.

In our example, if the increment of search chosen was .01, it would seem like hours had passed before each root was outputted. If the increment chosen was 1, the computer would skip over the root X = .74084.

By first plotting the equation with a graphing routine, you can approximate the roots and then use the following program to zero in on them. ■

```
20 PRINT:PRINT"DETAILS? 1=YES, 0=NO. (0 ASSUMES Y AND Y1 ARE  ENT
     ERED)":INPUT Z:IF Z=0 GOTO 60
30 CLS:PRINT:PRINT"ENTER Y AT LINE 90 AND Y1 AT LINE 110.":PRINT"
     Y=F(X), AND Y1=F(X).  THAT'S RIGHT F(X) AT BOTH LOCATIONS."
31 PRINT"X IS THE STARTING POINT FOR THE SEARCH"
32 PRINT"DIX IS THE INITIAL INCREMENT OOF SEARCH"
33 PRINT"E IS THE DESIRED ACCURACY OF THE ROOT"
34 PRINT"XMAX IS THE MAXIMUM VALUE OF X TO BE SEARCHED"
40 PRINT"ENTER 0,0,0,0 TO TERMINATE PROGRAM"
50 GOTO 210
60 INPUT "ENTER X,DIX,ERROR VALUE,MAXIMUN X";X,DIX,E,XMAX
70 IF X+DIX+E+XMAX=0 GOTO 210
80 DX=DIX
90 GOTO 30
100 X=X+DX
110 GOTO 30
120 ON SGN(Y*Y1)+2 GOTO 150,170,130
130 IF X>XMAX GOTO 200
140 Y=Y1:GOTO 100
150 ON SGN(DX-E)+2 GOTO 170,170,160
160 X=X-DX:DX=DX/10:GOTO 100
170 X=X-DX
180 PRINT"X=";X
190 X=X+DIX:GOTO 80
200 PRINT"THERE ARE NO MORE REAL ROOTS WITHIN THE RANGE OF XMAX."
     :GOTO 60
210 END
```

Program Listing.

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2208	Joystick Controller-Pair	2 lb.	$ 20.95

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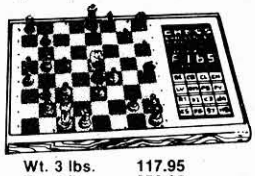

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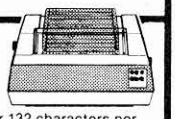

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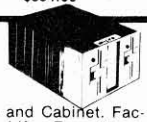

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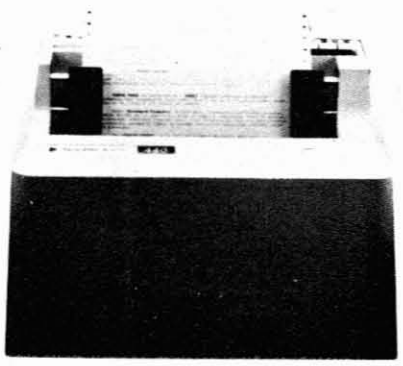

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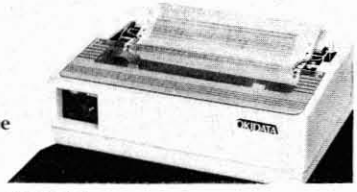

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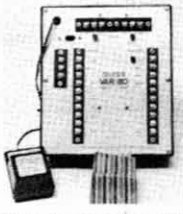
EIA/RS-232 connector Part No. DB25P $6.00, with 9', 8 conductor cable $10.95 Part No. DB25P9

3' ribbon cable with attached connectors to fit TRS-80 and our serial board $19.95 Part No. 3CAB40.

COMPUCRUISE

$129.95; with cruise control $169.95

THE TELESIS VAR-80 INTERFACE UNIT



For the TRS-80 with Level II Basic • Provides 8 outputs • Provides 8 inputs • 2 ft. of interconnecting cable w/connector • Plugs directly into TRS-80 • Power supply provided • Assembled and tested. Part No. VAR80, Introductory price $109.95.

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16K RAMS

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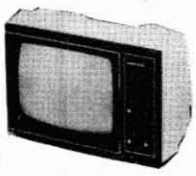

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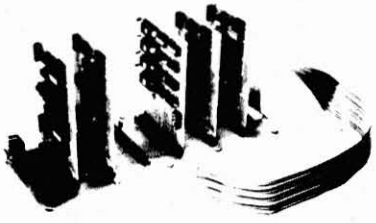
NOW! A FULL SUPPORT SYSTEM FOR TRS-80



• 32K of RAM • EPROM firmware • Disk control • Data acquisition • Parallel I/O • Serial I/O • Plug into GPA's Motherboard. GPA's quality design includes • 6-44 pin edge connectors • +5V, -5V, +12V, -12V external power supply required • Active termination. The Motherboard, Part No. GPA80, is only $149.95.

TAKE ADVANTAGE OF GPA-EXPANSION CARDS FOR THE GPA80

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EPROM firmware card. Put those valuable subroutines in firmware. Don't waste time loading and unloading tapes and disks. For 2708 or 2716 EPROMS, Part No. GPA806, $79.95.
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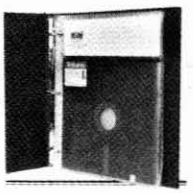

Three-ring binder comes with ten transparent plastic sleeves which accommodate either twenty, five-inch or ten, eight-inch floppy disks. Binder & 10 holders $14.95 Part No. 8800; Extra holders 95¢ each. Part No. 800.

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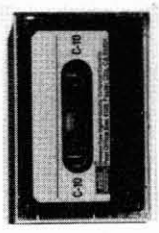
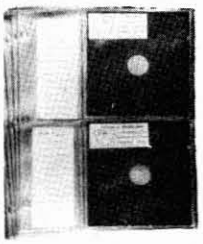


5 min. each side. Box of 10 $9.95. Part No. C-5.

DISK JACKET™



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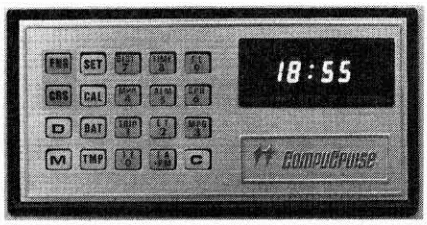

This gadget fits into most dashboards . . . no strain even in a tiny sports car like the Mazda RX-7 . . . and once you have it, every trip is like flying a 747. The darned thing tells you the time, how fast you're going, how far you've been on this trip or since the last regassing, how many miles per gallon you're getting, either at the instant or the average on the trip . . . or gallons per hour at the moment or for the trip . . . temperature outside . . . inside (or coolant temperature, if you prefer) . . . oh, it has an elapsed time for the trip, a stop watch, lap time, an alarm . . . how much further for your trip, how many gallons more the trip will take, how much longer for the trip at your present average speed . . . yes, it gives you your average speed for the trip. You prefer it in metric, no strain . . . liters remaining, etc. Did we mention that it also has cruise control either at a speed set on the control board or at whatever speed you are traveling? The Compucruise will keep you busy and entertained during any trip . . . telling you more than you will ever want to know.

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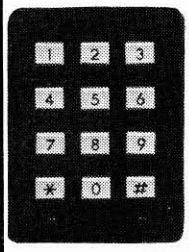

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The first reaction is one of disbelief . . .
. . . you *know* it was *right there*!

What you want is a modern combination lock on your ignition . . . The Steal Stopper. It's easy to install and almost impossible to defeat. *You* can by-pass it, if you want, for parking attendants or a car wash. Other than that, you set up a secret four digit code and only you will then be able to start the car . . . even if you have the keys in the ignition.

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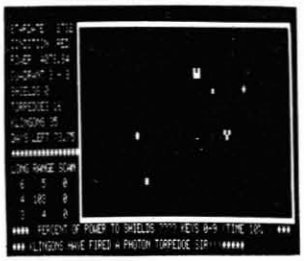
↙Reader Service—see page 178

SOFTWARE → TRS-80 ← SOFTWARE



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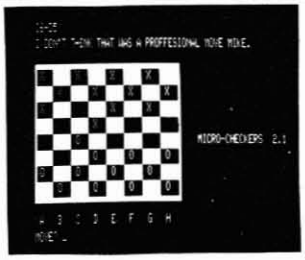

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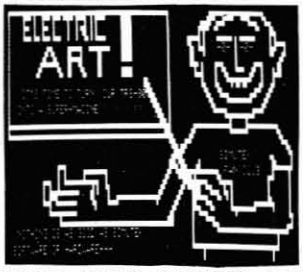

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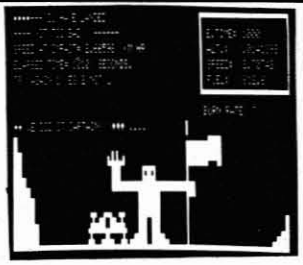

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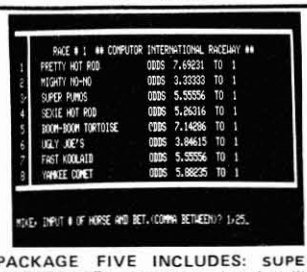

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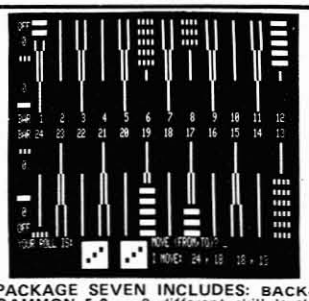

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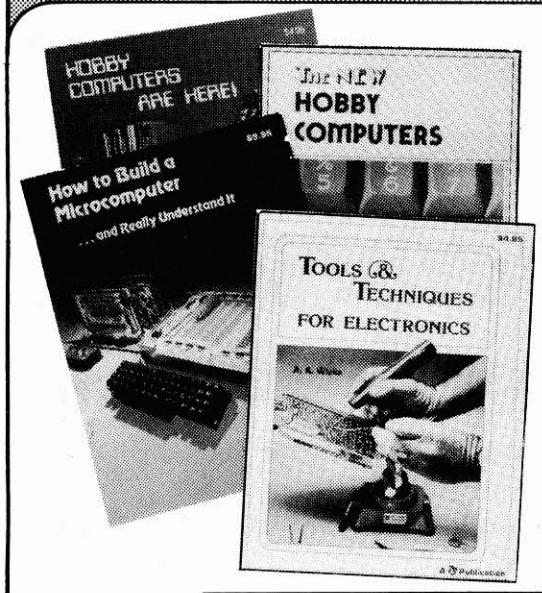

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STARTER KIT

EXATRON STRINGY FLOPPY FOR THE TRS-80

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3 Wafers each: 5', 10', 20', 50'	40.00
Bus Extender, 2-for-1	15.00
ESF Machine Language Monitor	9.95
Wafer Organizer	5.00
	$319.45

SPECIAL PRICE FOR THIS STARTER KIT	$299.50
Sales Tax (California only)	
Shipping and Handling	5.50
TOTAL	

For more information see the current Exatron Stringy Floppy Owners Association Newsletter in *Microcomputing*.

If you have any questions about the product, about Exatron, or ESFOA, please call the Hot Line. Address letters to ESFOA, 3559 Ryder St., Santa Clara, CA 95051.

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HOT LINE (For Calls Outside CA) 800-538-8559

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