ADVENTURE

Scott Adams
One programmer’s success. Pg. 48.

EDUCATION

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TUTORIAL

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Options include:
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- 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 125 x 192 or 256 x 192 graphics modes. 11-inch computer/keyboard port — for peripherals. The applications are endless.

Shipped with EGOS™, 1K-byte 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.

But that's not all

LEVEL II BASIC color graphics programs on minidiskette: $17.95.
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- RAM chips for adding refresh memory for higher density graphics modes: $29.95 per K-byte.
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<tr>
<th>Configuration</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without RAM in kit form (MT-32K) @ $79.50</td>
<td></td>
</tr>
<tr>
<td>Without RAM assembled and tested (MT-32A) @ $99.50</td>
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GAME
152 The Third Dimension. 3D Tic-tac-toe. David Dillehay.

GENERAL
78 In the Beginning. How one owner sees it. Mark Herro.
84 Modification Update. All the fixes. Scott Richards.
88 Disk Files. Spin the platter. William O'Brien.

GRAPHICS
130 Curve Plotter. Plot it out. David Cecil.
140 Basic Drawing. Pictures in BASIC. Buzz Gorsk.

HARDWARE
112 Relay Assistant. Add muscle to your relay. Karl Jahn.

INTERFACE

MATH
166 Real Roots. How to find them. Michael Daniels.

TUTORIAL

REVIEWS

UTILITY
136 Sound X. Liven up your ears. Roxton Baker.
158 Displaced Programs. Move them around. Ron Moehlis.
160 TCOPY. Copy your tapes. Dennis Stevens.

REGULARS
8 80 Remarks. Wayne Green.
10 Input.
16 Reviews.
22 The Assembly Line. William Barden, Jr.
25 80 Applications. Dennis Kitsz.
30 Captain 80. Bob Liddil.
30 80 Accountant. Michael Tennenbaum.
38 NEWS. Nancy Robertson.
178 Preview. Next month in 80.
178 Advertisers Index.

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80 Microcomputing, July 1980 • 5
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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.
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AIDS

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50Microcomputing, July 1980 • 7

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80 Microcomputing, July 1980 • 7

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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 22,000 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 up the Dick Smith System 80.

The Computer of the Decade

The Dick Smith System 80

$395.95

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.
We can’t stop improving and expanding the capabilities of your TRS-80®! By using SPECIAL DELIVERY with EXTRACT and either Electric Pencil® or Radio Shack’s Scripsit® you can get even more out of your computer. From just one package, you will get all this:

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

MAILRITE: Print letters written with either the Electric Pencil® or Radio Shack’s Scripsit® inserting information from a MAILFILE into the letter for personalizing and addressing. You can send a personalized letter to one person then a different personalized letter to a second person with true typist quality from your fine printer. Features: Indents, Underscore, Bold Type, End of Page Stop, Address Envelopes, unlimited insertion from address list and More!

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

SORT: In-Memory sort on an entire address list using any field as the key. This program can sort an entire list in a matter of seconds!

LABEL: Prints labels from MAILFILE.

CONVERT: Make MAILFILE from RS mail list.

MOD II version available soon

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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 piggy bank, 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 piggy bank 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
Freyburg, ME

For the Defense

I can't stand it anymore! 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 "BADM" 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 Sambaugh
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 I, 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 I1 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 I1 manual, pages 3-28 through 3-31 for details on how to install the following patches:

<table>
<thead>
<tr>
<th>Patch</th>
<th>Description</th>
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</tr>
<tr>
<td>PATCH IODVRS/SYS A = 03A6,F = 00,C = 7E</td>
<td></td>
</tr>
<tr>
<td>PATCH IODVRS/SYS A = 0136,F = 01,C = 7E</td>
<td></td>
</tr>
<tr>
<td>PATCH BASIC A = 5AD,F = 03,C = 7E</td>
<td></td>
</tr>
<tr>
<td>PATCH BASIC A = 58EF,F = 03,C = 7E</td>
<td></td>
</tr>
<tr>
<td>PATCH BASIC A = 58BF,F = 03,C = 7E</td>
<td></td>
</tr>
</tbody>
</table>

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. Furthermore, 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
Garden 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 saving 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 00F

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 xxx   LD HL, MSIZE
22 B140   LD (40B), HL   (top of memory pointer)
31 CE/F   DEF PDCN   (calculate displacements)
19 ADD HL, DE   (for variables pointer)
22 A040   LD (40A), HL   (save it)
CD 72 C0 CALL 1972   (set all prs & 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 33 22 8F 41 21 19 78
7C42  2A A0 00 CD 72 1B C3 19 1A

Save the modified version with the Punch command #P 7C35 7FF7 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 * /O (again NEWing your program) or try MSIZE = x x x x x x x x M S B = I N T ( M S I Z E / 2 5 6 ) : L S B = M S I Z E – M S B * 2 5 6 ; P O K E 1 6 5 6 1 , L S B ; P O K E 1 6 5 6 2 , M S B ; C L E A R ; R E-
STORE

To avoid this loss.

Dan Rolins
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, yet alone machine language. Further platitude 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 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.

All this is not to say Pencil is perfect. There are two that are particularly annoying. I have never 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 reaches the end of the line. I typically lose two or three characters at the beginning of every line when I’m typing along.

Further, for some reason, Pencil has a sort of keyboyness 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 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 Microcomputing, July 1980 • 11
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 their 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 bank 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

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 mods 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, i.e. the circuitry 4161’s. Before any one attempts building an external memory card using the 4161’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 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 scratching the IC’s 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. Riekers program is only 13 lines long there is not one REM statement.

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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 subroutine 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 reader 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 fail 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 un-healthy result.

Since he needs to know whether he found a match and transferred 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 STRING FOUND FLAG = 0
50  FOR N = 1 TO 70: REM LOOP CTR FOR MAJOR STRING
55  REM STRING FOUND: SET FLAG & EXIT LOOP
60  IF AS = MID$(S,N,N) THEN 64 ELSE 70
62  REM STRING FOUND! SET FLAG & EXIT LOOP
64  FLAG = 1: N = 71
70  NEXT N
75  REM TEST FLAG TO SEE IF STRING WAS FOUND
80  IF FLAG = 1 THEN 100 ELSE 40
100 PRINT WS
```

The second error is not so grave. Line 80 checks the value of N, its 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 flag as I did above.

John T. Blair
Norfolk, VA

**Improved INKES**

In the article, "INKES" 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 INKES and without resorting to ENTER.

```
10  AS = INKES: IF AS = "": THEN 10 ELSE 20
20  BS = INKES: IF BS = "": THEN 20 ELSE 30
30  CS = INKES: IF CS = "": THEN 30 ELSE 40
40  DS = AS + BS + CS: A = VAL(DS): PRINT A
```

The computer assigns the value of the first digit to A$, the second to BS 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(DS) statement assigns that value to A. I hope 80 Microcomputing is a huge success.

Robert T. Martino
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 Donndeierger
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.

---

**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 M1 P/S-1 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.

Peter Beits
Santa Barbara, CA

---

Irv Holman
Sevierville, TN
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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 manipulates 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 it 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—you 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
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 eyes 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 printer 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.

These flags allow powerful print control from WITHIN the text itself. Underline 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 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 TRS80 2.2 or 2.3. The last two dumps, also identical, were intended for NEWDOS. BOOT CMD loads at AB0H 43780 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:

```
LOAD LOCALE/TRS (enter)
DOS READY
BASIC (enter)
HOW MANY FILES? ... (enter)
MEMORY SIZE? 65280
BASIC
SITEM (enter)
BASIC
65280 (enter)
BASIC
CONT (enter)
```

```
DOS READY
VERIFY (enter)
DOS READY
```

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 had 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 question, your 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 you can 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 * 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 successfully set up one test disk with 31 commands, all of which executed perfectly.

```
Radex-10
LIG 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 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 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 responsibility!
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* a trademark of Tandy Corporation.
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 DS25 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. Sufficient 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 hard-copy printing of a disk file from a single record to an entire program in both ASCll and/or hex.
- **PATCH:** Changes 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 pro-

---

**Conclusion**

As a small business trying to increase its 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 exasperated, but they seem ill-prepared for the business market and its demands.
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.

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 JH.LA ;STORE A REGISTER
JMP ATTEND ;JUMP TO ATTENTION
DEFINE NENTTS TABLE EQU 3 ;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
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.

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 ad-
dresses 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.

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 to 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
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 entries. Each entry is 16 bytes long; the first two bytes are a two-byte name in ASCII format, 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. If 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 number of 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 decreased by subtracting the size of each entry from HL. This procedure is shown in Listing 3. HL is initialized set to TABLE + 4 * 16, which corresponds to the address of the last entry (Let the assembler perform those tedious 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 IX, could be used in place of the HL pointer to facilitate access of the fields in each entry, as in:

```
LD A (IX + 1) ; 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 cannot 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, this would work if we use a to zero flag in this case, we would have to load A with BC, OR and BC 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 + 4 * 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, HL 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 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:
QUALITY
THAT'S WHAT SEPARATES THIS PRINTER FROM THE TOYS

MICROTEK MT-80
SOLID VALUE FOR YOUR DOLLAR

The market is flooded with low-cost printers that look and last more like toys.
The Microtek MT-80, our versatile alphanumeric line printer, has a high quality
print mechanism that gives you solid value for your dollar. It has been
designed with a superior brain resulting in more advanced features and more de-
pendable performance. Our printer is so reliable that we offer you an incredible
365 days warranty.
We stand behind every printer we make because we build quality into each one.
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LOADED WITH INNOVATIONS
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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 arrow keys, 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.

**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.

All together, 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.

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.

**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 PointTo), 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 information one by one 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-R1-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 we see values of 179, 193, 196, 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 AUTONAMED-CMD. 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 SEESPOIT!

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.

SEESPOIT! Uses Muscle

In brief, SEESPOIT! 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, SEESPOIT! checks to see if the computer is in command mode during a keyboard scan (recall that shift/upper 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.

SEESPOIT! 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 SEESPOIT! 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 SEESPOIT! 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,
and the TRS-80 operates normally. Now depress the shift, followed by the down arrow. Type some letters... ahh! 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 SEESESPOT 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 SEESESPOT 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, Glimches, and Secrets.

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

5 POKE 16553, 255
10 FOR X = 31744 TO 31659 : 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, 124, 254, 29, 227, 32, 86, 1, 64, 36, 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, 98, 64, 56, 254, 16, 60, 4, 62, 144, 24, 2, 62, 128, 130
100 DATA 201, 195, 227, 3

Listing 2.

THE ASSEMBLY LINE
From page 24

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 to 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.
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**Reader Service—see page 178**

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**80 Microcomputing, July 1980 • 29**
Here's Captain Eighty, in his Woodfern and Boldword investigative reporter disguise, checking back into the office after an exhausting 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, strut ting 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 consistent winner.

Then it went sour, but where? The culprit seems to have been the omnipresent bigbucks 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 pariah 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.

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 II). 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
TRS-80* OWNERS:
• Let the computer write your “Basic” programs for you!
• Draw pictures, animated figures, data forms!
• Create a library of displays!
• Produce “Commercial” grade software!

The Magic Cursor by Gregory Berryhill

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.

MAGIC CURSOR PROGRAMS

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

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

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

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

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

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By Ty Halderman

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a Tandy Co.
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.

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**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 fairgrounds, 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 muck it up?

The recent articles about Texas Instruments, for example, and the TI-99/4 seem unanimous in dismissing them as a serious contender in the microcomputer 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.
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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).
Order No. 0250R $24.95.

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 file spec. 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 TRSDOS 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 MicroDOS.

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.)

Pkg. 0190RD (disk-based version) $39.95.

* A trademark of Tandy Corporation

Disk Scope

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 disk 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.
4. Any compatible Disk Operating System.

Pkg. 0139RD (disk-based version) $19.95

Prices subject to change without notice.

PETERBOROUGH, N.H. 03458
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80 Microcomputing, July 1980 • 33
Introducing two NEW software packages for those who yearn to fly. These four simulations can take you from instrument landings to nighttime photo-recon missions, you can be a bush pilot or an air traffic controller. We're Instant Software—Fly us!

Night Flight

May, 1941—The dreaded Nazi battle ship, 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 pursuers. Your photos are vital. Launch yourself into the night sky with the Night Flight package.

Order No.0117R. $9.95

Flight Path

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.

Precision Approach Radar combines the skills of pilot and Air Traffic Controller. You become the pilots' eyes as they try to land in limited visibility conditions. Your commands guide the aircraft on their approach to the field—and a safe landing.

The Flight Path package covers both sides of flight procedure, from the thrill of flying to the tense drama of air traffic control.

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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).

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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, pintractor 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.
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4. Any compatible Disk Operating System.
5. A pintractor-feed line printer.

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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.

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- Automatically sorts names (alphabetically and by ZIP code).
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- Easy error correction and recovery.
- Prints selective name listings.
- Revise or update 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 reports on any mailing list.

The ONE-D MAILING LIST package is designed to be used with the following minimum system:
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2. An Expansion Interface with up to 32K RAM
3. A single disk-disk (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

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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 looking 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.
More for Less.

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.
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- 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.
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Prices:
- Single Drive System .......$395
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**Typical Configuration**

![Diagram of Vista V-80 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**

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

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.

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

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 the 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.

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
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 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.

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.

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.

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 (ZILLOG 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 TRS/80 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 $290.00 from Galactic Software, Ltd., 11520 N. Port Washington Rd., Mequon, WI 53097. Commands & Parameters, an additional manual, is available for $29.00.

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-5S 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/lower- case, expanded characters, adjustable margins and text centering.

It is priced at $19.95.

Direct-connect Modem

Emtril 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-
phone coupler.
The Lynx has the ability to transmit and receive. The instruction manual describes time-shares 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.
The 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

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 alphabetically or by zip code in less than 10 seconds. Printout is in tabular format 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, write and copy single- or double-density diskette 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.
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...

- Power supply guaranteed for one year.
- Transformer designed as integral part of system for best line regulation. Not separately encased to avoid heat build-up providing longer life.
- More Capacitance: Insures stable operation over greater line voltage variations (105-125 Vac.)
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- Switch designed with high current ratings (10 AMP).
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- NEWDOS Plus for 5 1/4", 40 and 77 Track Drives — with over 200 modifications and corrections to TRS-DOS $110.00
- CP/M for Model I, Zenith $150.00
- CP/M for Model II, Altos $199.00

Software by SEM 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:
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Reader Service—see page 178
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.

Camco 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 sells 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.


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 packages 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 players 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 ar-ray 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 disk drives and 64K.

It includes federal tax forms 1040; 1040-A 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 manuals. 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
Turns Any 16K Level II TRS-80 Into A High Quality Musical Instrument

The Software-
A five part machine language program consisting of:

1. Digital synthesizer—produces up to four simultaneous voices in a six-octave range. For example, you could have a trumpet, oboe, clarinet, and organ playing in four-part harmony or alter any of the voices to imitate other instruments.

2. Music language compiler—a simple and easy to use language allows you to enter your favorite written music in any key or time signature. Plays all note values from whole notes to sixty-fourth notes which may be single, double, or triple-dotted and/or played as triplets. Supports single and double accidentals, staccato, pizzicato, two forms of articulation, repeats, second endings (with or without retard), and modulation.

3. Full screen editor—a full function text editor with blinking cursor is provided for easy entering and modifying of music programs. Functions include insert/delete characters, insert/delete line and global character string search, and automatic error detection/display.

4. File manager—provides the orderly storing and retrieval of named program files on tape or disk. You can even sequence several songs for automatic loading and playing.

5. Initialization—this set-up routine allows you to alter the voices, select the standard four-voice synthesizer or a special high resolution, three-voice version and choose the standard (1.77 MHz) or the enhanced (2.66 MHz) clock rate.

The Hardware-
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.

Includes:
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The most popular eighth grade class, at Fort King Middle School, is computer education.

Computer Education

“. . . a computer course in BASIC is . . . most popular with eighth graders.”

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, in fact, most popular with 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.

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, “crying proof” 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, Vianello 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
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 prodded 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 – 16/2
   - 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:

```plaintext
10 FOR I = 0 TO 1532
20 X = RND(1023)
30 PRINT X; "\n"
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 I) 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.

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 helper.
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[Reader Service—see page 178]
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.

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

---

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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 Adanises 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."

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

The BASIC Switchyard

Gene Perkins
5224 Winifred
Ft. Worth, TX 76133

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:

\[ A = 5 + 6 \times 2 \]
\[ B = (5 + 6) \times 2 \]

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
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 \( A = 2 \cdot \cos(R + 4) - Y/3 \) the operators are:

\[ = \cdot \cos + - \text{ and } / \]

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 seems 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 \( \text{MAX}(X,Y) \) could be written as \( X \text{ MAX} Y \). On the other hand, we could convert our infix terms such as \( Y/3 \) to the prefix form \( \text{DIV}(Y,3) \) or \( \text{QUOTIENT}(Y,3) \). In this way the BASIC statement given above could be written:

\[
\text{ASSIGN(A,SUBTRACT(MULT(2,COS(ADD(R,4)),DIV(Y,3))))}
\]

The same statement in postfix notation would be:

\[
A 2 R 4 + \cos \cdot Y 3 / - =
\]
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:

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 \( A = 2 \times \cos(R + 4) - V/3 \). 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:

\[
A = B + C / D \times E
\]

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.)

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### Precedence and Operator Table

<table>
<thead>
<tr>
<th>Precedence</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>functions</td>
</tr>
<tr>
<td>6</td>
<td>+ and – (unary)</td>
</tr>
<tr>
<td>5</td>
<td>[</td>
</tr>
<tr>
<td>4</td>
<td>* and /</td>
</tr>
<tr>
<td>3</td>
<td>+ and – (binary)</td>
</tr>
<tr>
<td>2</td>
<td>= (assignment)</td>
</tr>
<tr>
<td>1</td>
<td>( and )</td>
</tr>
<tr>
<td>0</td>
<td>end of statement</td>
</tr>
</tbody>
</table>

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 performs a multiplication on B and C, places the result on the B card (renaming it T1), and switches the C card and the • card 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 card 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 ).

<table>
<thead>
<tr>
<th>A</th>
<th>2</th>
<th>R 4</th>
<th>+</th>
<th>COS</th>
<th>Y 3</th>
<th>/ =</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>T1</td>
<td>COS</td>
<td>Y 3</td>
<td>/ =</td>
<td>T1 is R + 4</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>T2</td>
<td>• Y 3</td>
<td>/ =</td>
<td>T2 is COS(T1)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>T3</td>
<td>Y 3</td>
<td>/ =</td>
<td>T3 is 2-COS(R + 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>T3</td>
<td>T5</td>
<td>T4</td>
<td>= D</td>
<td>T4 is Y3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>T5</td>
<td>T5</td>
<td>T3 - T4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Now we can try the statement: \( A = (B + C) \cdot \cos(D - E) \). 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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A plot involving a computer.

Linear Meter Design

Ronald J. Thibodeau
Transamerica-Delaval, Inc.
Gems Sensors Division
Farmington, CT 06010

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 3408 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 necessary.

Fig. 2

Table 1. List of Variables

| 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). (Calculates meter deflection in electrical units). |
| Z | Integer (B/E). Establishes 1st increment value. |
| A$ | Customer name. |
| B$ | Dial identification. |
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.

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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.

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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

18 CLS
20 PRINT$335,”THIS PROGRAM PROVIDES THE DATA FOR
30 PRINT$399,”METER DIAL MARKINGS OF LINEAR
40 PRINT$446,”SYSTEMS.
50 F0R K=2TO100:Y=11:SET(X,Y);SET(X,Y+1):NEXTX
60 X=22:F0R Y=13TO26:SET(X,Y);SET(X+78,Y):NEXTX
70 PRINT$468,”AMERICAN - DELVAL INC.
80 PRINT$632,”GME SENSORS DIVISION
90 PRINT$896,”FARMINGTON, CONNECTICUT
100 FORM=1:TO10000:NEXT
110 CLS
115 INPUT$1,"CUSTOMER NAME (16 CHARACTERS MAXIMUM):";A$1
120 INPUT$2,"JOB NUMBER (NO LETTERS):";I
125 O=2:GOSUB1000
130 INPUT$3,"DIAL IDENTIFICATION (16 CHARACTERS MAXIMUM)":I$1
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 DECREMENT OF METER IN MICROMAP";F$1
205 O=10:GOSUB1000
210 INPUT$11,"FULL SCALE DECREMENT OF METER IN DEGREES":G
215 O=11:GOSUB1000
220 INPUT12,"NUMBER OF ALARM POINTS (MAXIMUM OF 4):";I1
225 O=12:GOSUB300
230 IF (K=1)+ (K=2)+THEN198
250 O=12:GOSUB1000
260 INPUT13,"FIRST ALARM POINT (GAL/LIT):";P
270 O=13:GOSUB1000
280 O=13:GOSUB1000
290 INPUT14,"SECOND ALARM POINT (GAL/LIT):";Q
300 O=14:GOSUB1000
310 IF=P+THEN410
320 INPUT15,"THIRD ALARM POINT (GAL/LIT):";R
330 O=15:GOSUB1000
340 I$=P+THEN410
350 INPUT16,"FOURTH ALARM POINT (GAL/LIT):";S
360 O=16:GOSUB1000
370 O=16:GOSUB1000
380 GOTO410
390 PRINT$"PRINT INCORRECT ENTRY 1!:FORM=1TO10000:NEXT:CLS"
395 O=12:GOSUB1000
400 FORM=1:TO10000:NEXT
410 CLS
420 PRINT$"PRINT YOUR DATA WAS ENTERED AS FOLLOWS:";
430 PRINT$"PRINT 1,CUSTOMER: ";A$1;TAB(31);"7.MAX HEIGHT: ";C$1;
440 PRINT$"PRINT 2,JOB #: ";I$1;TAB(31);"8.MIN HEIGHT: ";D$1;
450 PRINT$"PRINT 3,ALARM #: ";S$1;TAB(31);"9.INCREMENT: ";E$1;
460 PRINT$"PRINT 4,DATE: ";J$1;TAB(31);"10.SCALE: ";F$1;"MICROMAP";
470 PRINT$"PRINT 5.MAX LEVEL: ";A$1;"GAL/LIT";TAB(31);"11.SCALE: ";
480 PRINT$"PRINT 6.MIN LEVEL: ";B$1;"GAL/LIT"
490 IF=P+THEN60
510 PRINT
520 PRINT$"12.1ST ALARM:";P;"GAL/LIT";IF=P+THEN576
530 GOSUB310:"CD ALARM:";Q;"GAL/LIT";IF=P+THEN576
540 PRINT$"14.3RD ALARM:";R;"GAL/LIT";IF=P+THEN576
550 PRINT$"15.4TH ALARM:";S;"GAL/LIT";GOTO576
560 PRINT$"NO ALARMS"
570 PRINT
580 INPUT$"ENTER ANY NUMBER TO CONTINUE:";M
590 CLS PRINT$"THE DATA WILL NOW BE DISPLAYED ON THE SCR.
600 PRINT$"PRESS THE 'BREAK' KEY TO STOP THE FLOW OF DATA.
610 PRINT$"ENTER 'C.' TO CONTINUE THE DATA (INCLUDE THE PERIOD)."
620 CLS
630 INPUT$"ENTER ANY NUMBER TO DISPLAY THE DATA:";M
640 CLS
650 IF=M+THEN198
660 PRINT$"GAL/LIT","INCH/MET","MICROMAP","DEGREES"
670 PRINT$"B,D,";G$1,F$1,E$1,D$1,C$1,B$1,A$1";
680 FORM=1:TO10000
690 E=S$1,E+1
700 Y=(E-B)*F/(A-B)
710 X=(E-B)+((C-D)/(A-B))B
720 X=W*G/Y
730 IF=P+THEN760
740 PRINT$X,Y,W
750 NEXT
760 PRINT$A,C,F,G
770 PRINT$"GAL/LIT","INCH/MET","MICROMAP","DEGREES"
780 PRINT$"GAL/LIT","INCH/MET","MICROMAP","DEGREES"
790 PRINT$"GAL/LIT","INCH/MET","MICROMAP","DEGREES"
800 IF=P+THEN860
810 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
810 PRINT
820 PRINT$"PRINT THE NUMBER SHOWN FOR YOUR SELECTION:";N
830 IF=(N=0)+((N=2)+THEN490
840 IF=(N=0)+((N=2)+THEN490
850 IF=(N=0)+((N=2)+THEN490
860 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
870 PRINT
880 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
890 PRINT
900 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
910 PRINT
920 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
930 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
940 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
950 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
960 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
970 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
980 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
990 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.
999 PRINT$"PRINT 1.RETURN DATA:";P+THEN2.NEWDIAL.

60 • 80 Microcomputing, July 1980
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.

<table>
<thead>
<tr>
<th>YOUR DATA WAS ENTERED AS FOLLOWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CUSTOMER: J. DOE</td>
</tr>
<tr>
<td>2. JO# : 12345</td>
</tr>
<tr>
<td>3. DIAL# : TANK#</td>
</tr>
<tr>
<td>4. DATE : 9.277</td>
</tr>
<tr>
<td>5. MAX LEVEL : 24500 GALLIT</td>
</tr>
<tr>
<td>6. MIN LEVEL : 1500 GALLIT</td>
</tr>
<tr>
<td>7. MAX HEIGHT : 98 INCH/METER</td>
</tr>
<tr>
<td>8. MIN HEIGHT : 8 INCH/METER</td>
</tr>
<tr>
<td>9. INCREMENT : 1000 GALLIT</td>
</tr>
<tr>
<td>10. SCALE : 200 MICROAMPS</td>
</tr>
<tr>
<td>11. SCALE : 200 DEGREES</td>
</tr>
</tbody>
</table>

ENTER ANY NUMBER TO CONTINUE?

Fig. 4

| 2000 | 88.2174 | 178.261 | 222.826 |
| 2300 | 92.1304 | 186.956 | 233.696 |
| 2400 | 96.0435 | 195.852 | 244.455 |
| 2450 | 98.200  | 200.256 |

GALLIT  INCH/MET  MICROAMPS  DEGREES

ALARM POINT  GALLIT MICROAMPS DEGREES

FIRST  4800  28.6956  35.9696
SECOND  9700  71.3043  89.1304
THIRD  14500 113.043  141.304
FOURTH 19800 159.13  198.913

ENTER THE NUMBER SHOWN FOR YOUR SELECTION?

Fig. 5

<table>
<thead>
<tr>
<th>GALLIT</th>
<th>INCH/MET</th>
<th>MICROAMPS</th>
<th>DEGREES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>0.99625</td>
<td>4.34763</td>
<td>5.43478</td>
</tr>
<tr>
<td>3000</td>
<td>13.8696</td>
<td>13.0434</td>
<td>16.3043</td>
</tr>
<tr>
<td>4000</td>
<td>17.7826</td>
<td>21.7391</td>
<td>27.1739</td>
</tr>
<tr>
<td>5000</td>
<td>21.6956</td>
<td>30.4348</td>
<td>36.4348</td>
</tr>
<tr>
<td>6000</td>
<td>25.6087</td>
<td>39.1304</td>
<td>48.913</td>
</tr>
<tr>
<td>7000</td>
<td>29.5217</td>
<td>47.7206</td>
<td>59.726</td>
</tr>
<tr>
<td>8000</td>
<td>33.4348</td>
<td>56.5217</td>
<td>70.6522</td>
</tr>
<tr>
<td>9000</td>
<td>37.3478</td>
<td>65.2174</td>
<td>81.5217</td>
</tr>
<tr>
<td>10000</td>
<td>41.2609</td>
<td>73.913</td>
<td>92.3913</td>
</tr>
<tr>
<td>11000</td>
<td>45.1739</td>
<td>82.6087</td>
<td>103.261</td>
</tr>
<tr>
<td>12000</td>
<td>49.0869</td>
<td>91.3043</td>
<td>114.13</td>
</tr>
</tbody>
</table>

BREAK AT 720

>_

C.

Fig. 6

WOULD YOU LIKE TO WORK FOR 80?

Because of the growth of our magazine and the microcomputing industry generally, 80-Microcomputing is currently looking for staff.

TRS-80 enthusiasm we need, but programming and technical ability are the keys.

80 Microcomputing needs someone with a writing or magazine background capable of shaping a national magazine.

80 is breaking down—within its editorial limits—the industry's and hobbyist's jargon into understandable layman's terms. Literate copy is our goal.

A good technical editor will have five years experience on similar publications and be short on patience with the following words:

User
System
Implementation
Capability
and such lively phrases as:
"allow for"
"the generation of"
"for the accomplishment of"

A position is also open for an editorial assistant. Someone who enjoys programming at the learning level would be appreciated, but more essential are good proofing skills.

Personnel Director—

Peterborough NH 03458
Get the Whole Story

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.

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

Table 1. Generic Product Names

<table>
<thead>
<tr>
<th>Use:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUSHER</td>
<td>Blusher Stick</td>
</tr>
<tr>
<td>BLUSH</td>
<td>Blush, Powder</td>
</tr>
<tr>
<td>COVER</td>
<td>Cover up</td>
</tr>
<tr>
<td>PENCIL</td>
<td>Eyebrow Pencil</td>
</tr>
<tr>
<td>PENCIL</td>
<td>Eyeshadow</td>
</tr>
<tr>
<td>SHADOW</td>
<td>Eyeliner</td>
</tr>
<tr>
<td>FACE</td>
<td>Face Powder</td>
</tr>
<tr>
<td>LIPS</td>
<td>Lip Glosser</td>
</tr>
<tr>
<td>LIPS</td>
<td>Lipstick</td>
</tr>
<tr>
<td>NAT LIPS</td>
<td>Natural Lipstick</td>
</tr>
<tr>
<td>FOUNDATION</td>
<td>Foundation</td>
</tr>
<tr>
<td>MASCARA</td>
<td>Mascara</td>
</tr>
<tr>
<td>PRESS</td>
<td>Pressed Powder</td>
</tr>
<tr>
<td>SOX</td>
<td>Men's Socks</td>
</tr>
<tr>
<td>KEE</td>
<td>Knee-Hi Hosiery</td>
</tr>
<tr>
<td>STRETCH</td>
<td>One-Sure Stretch Hosiery</td>
</tr>
<tr>
<td>CONTROL</td>
<td>Control Top Hosiery</td>
</tr>
<tr>
<td>PANTY</td>
<td>Panty Hosiery</td>
</tr>
<tr>
<td>SOFT</td>
<td>Soft-Sheer Hosiery</td>
</tr>
<tr>
<td>SUPPORT</td>
<td>Support Hosiery</td>
</tr>
<tr>
<td>KIT</td>
<td>EAD-9540 Sales Kit</td>
</tr>
<tr>
<td>LIT KIT</td>
<td>Literature Kit Only</td>
</tr>
<tr>
<td>PAD</td>
<td>Distributor Order Form</td>
</tr>
<tr>
<td>SA13</td>
<td>SA-13 Price List</td>
</tr>
</tbody>
</table>

Fred Blechman
7217 Bernadine Ave.
Canoga Park CA 91307
If you’re looking for programs give us a call. We support all Radio Shack TRS-80 Models, the Atari 400 & 800, and Apple computers. Or, visit our store while in Washington.

Credit card may be phone us 24-hours a day at (202) 377-4691.

These programs, unless otherwise indicated, are for the 16k, Level II TRS-80.

---

**Galactic Trilogy**

by Douglas Carlton

This trilogy is one of the hottest new games of the Eighties,” says Softside. “Galactic Empire” is a sophisticated game of strategy and tactics against to unify the three-dimensional universe. As in all the games, the universe is really made for what you think is a new challenge each time you take control of the Galacta.

Every time you declared, “Galactic Trader” starts. Now as on outcast you barter Microbes, Pestilence and other commodities to gain riches and power. But, watch out for assassins and the energy cards.

“Galactic Revolution” is a game of tactics, diplomacy, social manipulation, and Machiavellian ruthlessness. Unlike the other two in the series, you can play with more than one player and there are sound effects.

Start with any of the Galactic Trilogy today for $19.95 each.

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**Dungeonquest**

The Temple of Aphasal

The DungeonQuest (TM) series lets you take your hero into the magical and mystical labyrinth under 200 rooms which is populated by 30 kinds of fearsome monsters who guard over 70 valuable treasures. Some of the treasures are magical and can help you in exploring the underground complex. But look for monsters and traps that spring at you from the walls and shadows of the rooms and passages you traverse. The Book of Lore fills in the background and describes the appearance of the temple as you go. You combat monsters, move, grab treasure in real-time. Bring in characters from other fantasy role playing games, or let the innkeeper find three a handy fellow. Test your mettle as the servants of evil! For D&D players, serious gamers. Title: $4.95 with Book of Lore, Title: $2.50, Title: $1.95, Temple of Aphasal.

Also available are “Dungeons of Ryn,” the microquest which is the sequel to the Dungeonquest series and “Morloc’s Tower,” the deadlith of the series. Title: $14.95 on tape, Title: $19.95 on disk, each.

---

**System Savers**

by Tom Scibolt from Acorn

If you ever use the SYSTEM command, you should buy this two program package. These programs allow you to save any system format tape on tape or disk, plus feature for machine language programmers. Many of the commands and tape like Sargon II are not system format.

With PLEXL, which is one of the two programs, you can back up or copy any system format tape. Most often a cassette that you make will last longer than an original. Plus you can find the filename on any system tape because it is displayed on the screen. And at any time you can stop the reading of the tape by pressing <BREAK>.

For your non-machine language programmer, FLEXL offers the advantage of producing more efficient programs than the assembler. Also, it is written to interface directly with monitor programs. And you can convert machine language tapes into one file.

Disk drive owners can use TISK at to save any system format tape onto disk. Adventure, Airraid, Ting-Tong, Editor/Assembler and other programs are loaded to disk using TRS80s. Now TISK allows you to save these programs onto your disk. You will be able to simply type the filename and be up and running. Even loads little tapes. TISK will greatly increase the benefit of owning a disk drive.

And another which may be useful to US, Acorn provides instructions on how to load MicroChex 1.5 onto disk.

Complete your system with the routines not found in either Level II or DOS for only $14.95. Order your System Savers, today!

---

**TRS-80 Disk & Other Mysteries**

by R.J. Remington

We don’t usually list books, but this one is so unique that we thought you would want to know about it. There are over 100 pages about how DOS works, how a disk is organized, and how to recover from errors. This is technical backup for NENDOs+ with great illustrations. $22.95.

---

**Disk*Mod**

by Roy Solcott from Miscoys

This machine language program modifies your copy of the Radio Shack Editor/Assembler for use with your microdisk and any disk operating system. You can save and load both text source and assembled object files. Unlike the NENDOs+ you can read the directory and the allocation of granules while in the EDTASM. You can also kill files. It is a complete disk modification for one or more drives.

Other capabilities are also added which are not found on NENDOs+. The block move command relocates a section of text to any other area. The global command permits, for example, changing a label throughout the text. The pagination feature provides hardcopy of 8 1/2 by 11 pages on either single sheets or continuous paper. In addition, high memory can be reserved, like in BASIC, for machine language routines like printer drivers. You can also display the amount of memory remaining. The CLEAR key is functional, the symbol table is sorted in alphameric and output 5-across, the scroll up/down allows 15 lines on the screen, and the DEPTM assembly is improved. Lower case input is now permitted and you can backspace to any address. Plus, it also corrects the error in the Radio Shack tape version. $19.95.

Also available for $22.95 for the TRS-80 Model II assembly is similar Editor/Assembler from Galactic Software. Write for a complete list of Model II software.

---

**Disassembler**

by Roy Scibolt from Miscoys & Acorn

This two-pass 80 disassembler produces symbolic labels with output to the screen or to a tape. Radio Shack’s Editor/Assembler can load the tapes. If you own the Editor/Assembler, complete the package with this program. Program on tapes for the two different memory locations.

Cassette version now only $14.95, Version which creates disk files $19.95.

---

**80 Microcomputing, July 1980 • 63**
The display screen clears and asks for your patience while it loads DATA. A string-array is being loaded with student names (or generic names), while a numeric array is loaded with all the other DATA items. This takes a little longer.

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 computer and the results printed under the column headings.

This takes several seconds for the first item after order 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,6220. 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,9828 and then L,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,BOT-TLE,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 BOT-TLE; 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 number, 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 of the program and 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 = 0,3 + 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 in agreement, 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. 0.00 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 columns move 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 affecting 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 happen 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 fast entry processing.

**Distributor Records Program**

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

---

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**Like Having 5 EDGE Connectors**

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**ALL GOLD PLATED CONTACTS**

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---

Fig. 1. Sample Order
Newtech Computer Systems, a leading manufacturer of music peripherals and software for S-100 and SS-50 computers, introduces the MUSIC BOX.

The MUSIC BOX is a complete hardware/software tool that enables you to produce music and sound effects on your TRS-80.

You can compose music, play or sing along with the computer, or just listen to your favorite tunes—up to four notes at a time, with a seven octave range. And you can make it sound like one, two, three or four different musical instruments at the same time. Or you can make all sorts of weird sound effects and noises like explosions, gun shots, "phasor" and other space war sounds—not to mention bells and whistles.

The MUSIC BOX plugs into the TRS-80 keyboard or the Expansion Interface Bus Extension. It includes a volume control, a 400 milliwatt power amp, and phono jack for easy connection to an external speaker. Software is supplied on Level II cassette. Requires a 32K RAM or larger Level II computer.

Future software developments include more pre-coded music, games with sound effects, music education, telephone tone dialing, and Morse code programs.

$249.

Complete with software and user's manual. Add $3. for shipping and $1. if COD.

*TRS-80 and TRSDOS are trademarks of Tandy Corp.

Monthly Gross Profit Statement

<table>
<thead>
<tr>
<th>DISTRIBUTOR'S NAME</th>
<th>BONUS %</th>
<th>BONUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIXON</td>
<td>15</td>
<td>1835.17</td>
</tr>
<tr>
<td>ALLEN</td>
<td>9</td>
<td>726.3</td>
</tr>
<tr>
<td>DAVIS</td>
<td>3</td>
<td>126.15</td>
</tr>
<tr>
<td>JOHNSON</td>
<td>12</td>
<td>1215.37</td>
</tr>
<tr>
<td>BECKER</td>
<td>3</td>
<td>100.25</td>
</tr>
<tr>
<td>SANDER</td>
<td>6</td>
<td>351.3</td>
</tr>
<tr>
<td>HESS</td>
<td>0</td>
<td>75.17</td>
</tr>
<tr>
<td>NO BONUSES</td>
<td>0</td>
<td>425.8</td>
</tr>
<tr>
<td>STEVENS</td>
<td>15</td>
<td>3008.15</td>
</tr>
</tbody>
</table>

TOTALS: 7943.66 1658.23

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-locrative 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 products, distributors, except for Program Listing 3. Obviously, that
PROFESSIONAL

HALF A MILLION TAX RETURNS CAN'T BE WRONG!
(OR THEY HAD BETTER NOT BE)

INCOME TAX SYSTEM
FOR TRS-80* MODEL I OR II

Our system, which prepared 500,000 1979 returns, features the following:

1. Full interactive user control, in **tax-form language only**, line-by-line.
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14. Modular construction — lets you order only the type and size system you need.

**PRICING STARTS AT $189.95 (1040 & SCHEDULE A)**
25-PAGE DESCRIPTIVE MANUAL $7.50 (Refunded on Order)
MINIMUM SYSTEM REQUIRED: MODEL I, 32K, 1 DISK DRIVE

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The 8K—1 is the most versatile disk modification available for the TRS-80. Speeds may be switched between normal, a reduced rate of 50%, or a 50% reduction, selectable at any time without interrupting execution or corrupting the program on the disk. Instructions are also given for a 100% increase in 1.5x speed (your TRS-80 may not be Reliable at this speed). It may be connected for the user to change speed with a switch or with a switch on the back panel. The speed is automatically restored to normal speed any time a disk is active. Requires no change to the operating system, and has provisions for adding an LED indicator to show the current speed when the computer is not at normal speed. It requires the keyboard version 1 and it is necessary to users of the program option (switch not included), and easily installed on a computer even when the computer. The 8K—1 comes fully assembled with software and background instructions. Complete satisfaction is guaranteed. $24.95

**PROGRAM INDEX FOR DISK BASIC**

Assemble an alphabetical index of your entire program library from disk directories. Program names and file space are read automatically (need not be typed) and may be displayed by disk or program. The list may also be searched for any disk, program, or extension, disks or programs added or deleted, and the list may be run or start from the printer. Finally, the list itself may be stored on disk for future access and update. Received in the January issue of 80 Microcomputing. One-time and 1K required. INDEX...$19.95

**DUPLICATE SYSTEM TAPES WITH “CLONE”**

This machine language program makes duplicates copies of ANY tape version for Level III. They may be SYSTEM tapes (continuous or not) or data tapes. It is not necessary to know the file name or where it loads in memory, and there is no chance of system or memory. The file name, entry point, and all necessary information about the tape version are displayed on the printer. Select command from DOS quickly modifies existing files to tape format. PENPATCH...$9.95

**SPOOLER FOR PARALLEL PRINTERS**

This program is a full feature print formatter containing a line definable line and page length (with line feeds inserted between words or other extensions), screen fonts, keyboard definitions, and print page control. In addition, printing data from a disk expandable buffer area so that the printer is to LIST command returns control to the user while printing is being done. 160 for Selectric or other slow printers. Allows printing and processing to run concurrently. SPOOLER...$16.95

**RAM TEST FOR LEVEL II**

This machine language program uses memory chips for open or closed address or data lines as well as intermediaries. It tests each 8K byte field quickly and accurate, and displays any detected failures on the screen. It is extremely useful in detecting memory problems that are often not detected by other diagnostic programs. INSIDE LEVEL II...$18.95

**MUMFORD MICRO SYSTEMS**

Box 435—E Sunnyside, California 90687 (805) 969-4357 74

---

**BXRerox CROSS-REFERENCE LISTING PROGRAM**

This program is a BASIC Cross-Reference Listing Program for the TRS-80 Model I with disk. It reads a saved BASIC program from disk and will print it as an option. It can then print an alphabetized list of all variables used in the BASIC program, listing all statement numbers where each variable is used. After the variables, a similar list of all referenced statement numbers follows, i.e. all statement numbers used in a GOTO, GOSUB or RESUME. Statement numbers which do not exist are flagged as undefined.

The program features output to printer, screen or disk file. It also features the number and heading (except for screen) with automatic file name, date and time in the page heading. It is written in Assembler so it is very fast and does not tie up memory with BASIC program. Paging is adjustable for almost any page width or length. Requires Level II 16k

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---

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---

Program Listing 1. Order Verification

180 REM LEVEL LI6K AWAY ORDER VERIFICATION - VERSION 4/2/79
110 REM COPIRIGHT 1979 FRED BLECHMAN
120 DEFINT A,D,N,O,X,Y,Z
130 DIMA(150),AS(290),TS(188)
140 CLS:N=1,Y=1 PRINT860,"..PATIENCE...LOADING DATA...
150 READ(A)(N),AY(1),A(1)+1,A(N)+2,A(N)+3,A(N)+4
160 IF A(N)<>9999900 THEN 200
170 N=Y+1,Y=Y+1,GOTO 150
180 CLS:PRINT
190 INPU"RD ORDER (NO HANDLING) Y/N":R$5
200 IF LEFTS(RS1,1)="Y" OR LEFTS(RS1,1)="M" GOTO 230 ELSE 210
230 CLS:E=11,Z=1 PRINT
240 PRINTTAB(8)"QTY":"TAB(5)"C$/"TAB(15)"$9:"TAB(25)"PV" $1
250 PRINTTAB(35)"BV*:TAB(45)"COST*:TAB(55)"RETAIL"
270 IFX>832001 THEN 330
280 IF X<>832001 THEN 430
390 PRINTX,"QTY*:CASE(C) OR EACH(C),/STOCK $"
310 INPUTS,A,81
320 IF NOT>/<8=9629=800000
330 IF S<=9=900000
340 IF NOT>=1=9=900000
350 IF NOT>9=900000
360 IF NOT=9=900000
370 IF NOT=9=900000
380 IF NOT=9=900000
390 IF NOT=9=900000
400 IF NOT=9=900000
410 IF NOT=9=900000
420 IF NOT=9=900000
430 IF NOT=9=900000
440 IF NOT=9=900000
450 IF NOT=9=900000
460 IF NOT=9=900000
470 IF NOT=9=900000
480 IF NOT=9=900000
490 IF NOT=9=900000
500 IF NOT=9=900000

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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/reader and documentation in this article contain the latest high-speed version of this program, with current USA prices. The other programs are unchanged.
PINBALL
by John Allen

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Get yourself addicted to this exciting real-time game. Written in machine language, Pinball is just like the games you play in the arcades. Lots of sound and flashing graphics with runs, rollovers and bonus points.

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Acorn produces several games for the TRS-80* These include: Codebreaker, Star Warp & Lunar Lander, Word Challenge, Bandito, Block'em and Ting-Tong priced at $9.95. Pigskin, Invaders From Space, and Quad are available for $14.95. Ask for these and other quality Acorn programs at your local computer store.

*TRS-80 is a trademark of Tandy Corp.

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Program Listing 3. Bookkeeper

100 REM * COPYRIGHT FRED BLEICHNER 1978 * VERSION 9/8/79
110 REM * SHOWS PAGE, MONTHLY AND RUN TOTALS *
120 DEFDBL A...L,S
130 CLS:PRINT
140 PRINT"Simplified Bookkeeper: 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"
Program Listing 4. Monthly Gross Profit Statement

10 CLS
20 PRINTTAB(20):"MONTHLY GROSS PROFIT STATEMENT"
30 PRINT:INPUT "INSTRUCTIONS Y/N";Y
31 IF Y="Y" GOTO 210
40 CLS:PRINT:PRINT:PRINT "PROGRAM IS DESIGNED TO DO ALL THE"
50 PRINT "CALCULATIONS OF YOUR SA-34 MONTHLY GROSS PROF IT STATEMENT."
60 PRINT "IT WILL PRINT ON BOTH THE SCREEN AND THE PRINT"
70 PRINT ER, IF YOU"n
80 PRINT "DON'T HAVE A PRINTER CONNECTED, DELETE ALL 'L"
90 PRINT ''" PRIMMS. WHEN THEY APPEAR IN THE PROGRAM LIST"
100 PRINT "ON YEARS WHEN YOU WANT THEM"
110 PRINT "TOTALS OF THE BV AND BONUS COLUMNS (2A & 2B), ENTER"
120 PRINT "TOTAL";E, L;A;
130 PRINT "INPUT:PRESS ENTER TO CONTINUE.";A
140 CLS:PRINT:PRINT:PRINT "IF YOU ARE USING A PRINTER, BE SURE IT"
150 PRINT:PRINT "TURNED ON, OR AT LEAST CONNECTED, OR THE PROGRAM"
160 PRINT "FREEZE UP!"
170 PRINT:PRINT "I"
180 PRINT:PRINT "ENTER TO START PROGRAM.";A

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Copyright 1979 Fred Gleicher
130 REM * 7217 BERNADINE AVE., CANOGA PARK, CA 91307
140 PRINTTAB(15):"MONTHLY GROSS PROFIT STATEMENT"
150 LRPRINTTAB(20):"MONTHLY GROSS PROFIT STATEMENT"
160 LRPRINTTAB(20):"MONTHLY GROSS PROFIT STATEMENT"
170 LRPRINTTAB(20):"MONTHLY GROSS PROFIT STATEMENT"
180 PRINT:PRINT:PRINT:"ENTER YOUR NAME, STATE AND ADA */;INPUT";
190 "A.A.;AChr";
210 END
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.

Magic Wand available separately for the MOD II and other computers $400.

HMCT The Complete Computer Company
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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.
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.
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 ($59).

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


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 disguised 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. Hmmm... 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 x 8 x 3 1/4", 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
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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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 IV or DOS (works under TRSDOS 2.1, 2.2, 2.3, NEWDOS 2.1 we do not have NEWDOS 80 yet to test) 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-

---

**Table 2. Level II BASIC Summary**

<table>
<thead>
<tr>
<th>Command</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-SPACEBAR</td>
<td>Move cursor n spaces to the right.</td>
</tr>
<tr>
<td>-n-</td>
<td>Move cursor n spaces to the left</td>
</tr>
<tr>
<td>SHIFT+</td>
<td>Escape from I, H, X commands below.</td>
</tr>
<tr>
<td>L</td>
<td>List line.</td>
</tr>
<tr>
<td>X</td>
<td>Go to end of line and insert (I) command.</td>
</tr>
<tr>
<td>I</td>
<td>Insert at current position.</td>
</tr>
<tr>
<td>A</td>
<td>Cancel all changes and restart.</td>
</tr>
<tr>
<td>H</td>
<td>Delete rest of line from current position and enter Insert (I) command.</td>
</tr>
<tr>
<td>nD</td>
<td>Delete n characters, starting at current position.</td>
</tr>
<tr>
<td>nC</td>
<td>Change n characters, starting at current position.</td>
</tr>
<tr>
<td>nSc</td>
<td>Search for the n-th occurrence of character c.</td>
</tr>
<tr>
<td>nKc</td>
<td>Delete line from current position to the n-th occurrence of character c.</td>
</tr>
<tr>
<td>G</td>
<td>Cancel all changes and return to normal operation.</td>
</tr>
<tr>
<td>E</td>
<td>Save all changes and exit to normal operation.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Same effect as E above.</td>
</tr>
</tbody>
</table>

**Table 3. Level II Edit mode commands (lowercase letters indicate optional parts of a command.)**
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-forwards and rewinds 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 x 5 x 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

---

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Mailing List Name & Address II (requires 2 drives) $129.00
Intelligent Terminal System ST-80 III: $150.00
The Electric Pencil from Michael Shriver $150.00
File Management System: $49.00

**FINE PRINT**

TRS-80 is a Tandy Corporation trademark. Use of above operating systems may require the use of Radio Shack TRS-DOS. Radio Shack equipment subject to the will and whim of Radio Shack.

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We accept Visa and Mastercharge. We will ship C.O.D. certified check or money orders only. All orders must include 4 percent for shipping and handling. Massachusetts residents add 5 percent sales tax.

The company cannot be liable for pictorial or typographical inaccuracies.

---

"Reader Service—see page 178"
thinks up. It contains the circuitry for driving line printers, disk drives, a second cassette 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 snugly 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-I). This little (4¼ x 13 x 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 surprising 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 unmodified TRS-80. And it can print in three different, software selectable modes, no less. Also, software selectable is an audible signal and an underlying 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 machines or error messages. 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 lingering on some problems I’ve had with it, they are minor, compared with the overall operation of the system.

References

Radio Shack, User’s Manual for Level I.

<table>
<thead>
<tr>
<th>Code</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NF</td>
<td>NEXT without FOR</td>
</tr>
<tr>
<td>2</td>
<td>SN</td>
<td>Syntax error</td>
</tr>
<tr>
<td>3</td>
<td>RG</td>
<td>RETURN without GOSUB</td>
</tr>
<tr>
<td>4</td>
<td>OD</td>
<td>Out of data</td>
</tr>
<tr>
<td>5</td>
<td>FC</td>
<td>Illegal function call</td>
</tr>
<tr>
<td>6</td>
<td>OV</td>
<td>Overflow</td>
</tr>
<tr>
<td>7</td>
<td>OM</td>
<td>Out of memory</td>
</tr>
<tr>
<td>8</td>
<td>UL</td>
<td>Undefined line</td>
</tr>
<tr>
<td>9</td>
<td>BS</td>
<td>Bad subscript (out of range)</td>
</tr>
<tr>
<td>10</td>
<td>DD</td>
<td>Redimensioned array</td>
</tr>
<tr>
<td>11</td>
<td>AQ</td>
<td>Division by zero</td>
</tr>
<tr>
<td>12</td>
<td>ID</td>
<td>Illegal direct</td>
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<td>13</td>
<td>TM</td>
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<td>14</td>
<td>OS</td>
<td>Out of string space</td>
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<tr>
<td>15</td>
<td>LS</td>
<td>String too long</td>
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<tr>
<td>16</td>
<td>ST</td>
<td>String formula too complex</td>
</tr>
<tr>
<td>17</td>
<td>CN</td>
<td>Can’t continue</td>
</tr>
<tr>
<td>18</td>
<td>NR</td>
<td>No RESUME</td>
</tr>
<tr>
<td>19</td>
<td>RW</td>
<td>RESUME without error</td>
</tr>
<tr>
<td>20</td>
<td>UE</td>
<td>Unprintable error</td>
</tr>
<tr>
<td>21</td>
<td>MO</td>
<td>Missing operand</td>
</tr>
<tr>
<td>22</td>
<td>FD</td>
<td>Bad file data</td>
</tr>
<tr>
<td>23</td>
<td>LS</td>
<td>Disk BASIC only</td>
</tr>
</tbody>
</table>

Table 4. Level II Error Messages
Replacement Debug (DEBUG)

Mod II Utility Package

NEW PRODUCT!

Extended Copy (KCOPY)
Copies multiple files with a single command using masked select options! Source disk may be non-operating system disk. Single drive capability. Recover bad files — invalid sectors itemized but copy continues.

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Display or print and modify standard TRSDOS diskette track and sector data. Full screen edit mode. Automatic repeat scan and print. Copy disk sectors — any number of sectors to same or other drive.

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Change diskette names!

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Creates and initializes file to end.

DOCUMENTATION
Complete documentation of above utilities including a full discussion on recovery of lost data on diskettes!!!

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- ASCII code
- RS-232 interface
- 30 CPS
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Shipping containers: $15.00.

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Will run on serial RS232 port of most micros including TRS-80. $450.00

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WE HAVE FLAT-PACK ACOUSTIC

Modem pickup

$19.50

USING FANS

Muffin - 8.00
Sprite - 4.00

NEW POWER SUPPLY

$25.00

5V at 3 Amp
12V at 6 Amp
-12V at 3 Amp

USED FAN

$15.00

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6V at 2 Amp

MICRO SWITCH KEYBOARD

USED BUT LOOKS VERY NICE

ASC II

$40.00
(With Print)

USED OMNITEK

MODEM ORIGINATE ONLY TESTED

$90.00 Sale
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 of 5860 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 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? Hmmmm, 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., 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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Add $10.00 postage and handling.
Please rush to NEWDOS/80 to:
Name ____________________________
Address ___________________________
City __________ State _______ Zip _______
Phone ____________________________
Upgrade offer expires July 31, 1980.

"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 uninstructed, 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 TRS-80 expansion interface, especially with additional RAM, then two modifications should be of interest to you. The first is a buffered cable.

Alternatively, 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 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 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 messy 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

![Diagram](image-url)
memory mapped system of addressing, but it does utilize one port and one port decoder for the recorder, 255D (FF4). 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:

4000: OUT 255,1; FOR A = 1 TO 450:
4010: NEXT OUT 255,0

This causes the alarm to sound a steady tone for approximately one second.

4000: FOR A = 1 TO 5: OUT 255,1:
4010: FOR B = 1 TO 100: NEXT OUT 255,0:
4020: FOR C = 1 TO 100: NEXT B

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.i., called MODESEL, can be affected by an OUT 255,X command.

If you activate your alarm while in the 32 c.p.i. mode, the computer reverts to 64 c.p.i. This is not disastrous, of course, but it may save you some frustration when trying to dress up your display with 32 c.p.i., 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 cannot 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.

---

**Parts List**

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Item</th>
<th>R.S. Catalog #</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Piezoelectric buzzer</td>
<td>273-060</td>
</tr>
<tr>
<td>2</td>
<td>Miniature phone jack</td>
<td>274-297</td>
</tr>
<tr>
<td>2</td>
<td>Miniature phone plug</td>
<td>274-286</td>
</tr>
<tr>
<td>1</td>
<td>Terminal strip (perforated, etc.)</td>
<td>274-688</td>
</tr>
<tr>
<td>1</td>
<td>9 V Battery connector</td>
<td>270-325</td>
</tr>
<tr>
<td>1</td>
<td>NPN transistor (2N3904)</td>
<td>276-2010</td>
</tr>
<tr>
<td>1</td>
<td>.1 uF Capacitor</td>
<td>272-135</td>
</tr>
<tr>
<td>1</td>
<td>9 V Transistor type battery (alkaline)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cabinet (or box)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Short length shielded audio cable</td>
<td></td>
</tr>
</tbody>
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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.

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.

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/N;
```

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:
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 100 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:


1010 PRINT "RESEARCH DATA PROGRAM" 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):SS: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 refine 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- or eight-byte string. These are the MKI$(n)$ for use with integers that do not exceed ±32768, MKSS$(n)$ for single precision numbers and MKDS$(n)$ 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 fulfill our integer requirement. However, since it will always be in single precision form, you can use that function to create a string MKSS$(H)$ 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)$, two bytes long; MKSS$(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 preceding 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 field names, because the field names are dimensional specifiers.

10 OPEN “F”,1,“RESEARCH”
20 FIELD 1, 17 AS STS, 2 AS AS, 4 AS HS, 2 AS WS

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 PS, 17 AS STS(PN), 2 AS AS(PN), 4 AS HS(PN), 2 AS WS(PN)
30 NEXT PN

Line 10 sets up the dimension of the matrix: a 10 element matrix, zero to nine inclusive.
Line 20 is the organizational statement for the FIELD. PS 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.
PS is never included in the buffer value, since you never assign it its own value. It simply points. STS(PN), AS(PN), HS(PN) and WS(PN) are all valid field names, organized into matrix format.
Let’s shuffle some lines and see what happens:

10 OPEN “F”,1,“RESEARCH”
20 FOR PN = 0 TO 9
30 FIELD 1, (PN * 25) AS PS, 17 AS STS(PN), 2 AS AS(PN), 4 AS HS(PN), 2 AS WS(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 THEN 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 RESIDENCE?”
150 INPUT SS

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 STS=SS and SS=“IDAHO” as one of our program lines, then the computer understands you wish to place the value $S$ into the field specified by STS. In this specific case, the computer checks out the length STS 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 STS 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 STS(PN) = SS
170 LSET AS(PN) = MKS(A)
180 LSET HS(PN) = MKS(H)
190 LSET WS(PN) = MKS(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 SS = “A=0 H=0 W=0
2020 MC = PN: FOR PN = MC TO 9
2030 FL = 1: GOTO 190

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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300
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 file 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 file. 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:

\[
\begin{align*}
FN &= \text{INT}(\text{DN} \times 10) \\
PN &= (\text{DN} - \text{INT}(\text{DN} \times 10)) \times 10 + 1 \\
\text{IF} \, FN < 0 \, \text{THEN} \, FN &= FN + 9
\end{align*}
\]

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:

\[
\begin{align*}
FN &= 189 = \text{INT}(1895/10) \\
\text{Remember, we started our matrix at 0, not at 1. Since}
\end{align*}
\]

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 FN = 0 to 9 20 FIELD 1, (PN^25) AS PS, 17 AS ST$(PN), 2 AS ASP$(PN), 4 AS HS$(PN), 2 AS W$(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 < 0 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 MK$,

MK$s, or MKDS 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 use MK$ we must use CVI, with MK$ use CVS and with

MKDS use CVD. The print (to screen) statement will therefore be:

120 PRINT $1(PN), CVI(A$(PN)), CV$I$(BP$(PN)), CV$S$(BP$(PN)) 130 PRINT '989; "ANOTHER DATA GROUP ?":' 140 EN$ = INKEY; IF EN$ = "Y" 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" 310 PRINT '364, "PRESS ENTER TO CONTINUE . . .":' 320 EN$ = INKEY; IF EN$ = "CHR$(13)

330 THEN 3200 330 CLS: GOTO 130

The use of 'PRINT' in 'IN-KEYS' allows formatting of the screen prompts and input 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 PRINT $1(PN), CVI(A$(PN)), CV$I$(BP$(PN)), CV$S$(BP$(PN)) 90 LPRINT CHR$(13) 100 NEXT PN 110 NEXT FN

zeeros 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.

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 = 2 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
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 branced 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$(PN) for one of our matrix elements. While it is acceptable in the course of the program to set another variable equal to it (VS=ST$(PN)), you cannot directly assign it a value (ST$(PN)=VS). It is permissible only to assign a FIELDed element through the use of an LSET or RSET statement.

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Back To Basic

THE BOOK
ACCESSING THE TRS-80 ROM

If you ever do Assembly language programming, or you just want to know more about your TRS-80 ROM, "THE BØK" is for you.

Volume I will give you access to over fifty machine language subroutines in the Radio Shack Level II BASIC. It includes information on the numeric data formats and a commented listing of the ROM routines.

"THE BØK, Volume I", encompasses all arithmetic functions and mathematical operations. There are separate routines for integers, single precision, and double precision numbers and the data format for each of these number types is explained. The routines that perform ASCII to binary and binary to ASCII conversion are identified and explained to provide you a means of data I/O.

A fully commented listing provides the details on the step-by-step execution of these ROM routines. Although a complete disassembly is not provided in order to avoid copyright infringement, you can obtain a complete disassembly using the disassembler program listed in "THE BØK." Volume I also includes a complete, detailed memory map of the entire machine and a symbol table noting over 500 addresses.

"THE BØK" will save you an hour on each assembler program development time. Don’t start programming without it.

Order your copy of "THE BØK", today!
Find out how to fool your interpreter into executing your own commands.

White

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 occurred, 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
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 its 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.

---

Assembly Code for White Command.

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  - computation of pay and deduction amounts
  - printing of reports and checks
  - can handle salaried and hourly employees
  - employees can receive:
    - hourly or salary wage
    - vacation pay
    - holiday pay
    - piecework pay
    - overtime pay
(Continued on next page)

CAPABILITIES:
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- invoice information recorded: invoice #, description, buyer, check register #, invoice date, age date, amount of invoice, discount (in %), freight, tax ($), total payable
- transaction print and file maintenance procedures insure accuracy
- flexible check calculation procedure; allows checks to be calculated for a set of vendors - or - for specific vendors
- program prints your checks; contiguous computer checks with your company letterhead can be purchased from SBSSG
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  - aging
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- paychecks are printed; computer checks with your company letterhead can be purchased from SBSG
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80 Microcomputing, July 1980 • 99
Ham it up with your 80.

Software for Hams

Morse Code Transmit and Receive Program
TRS-80 Level II
Richcraft Engineering
Chautauqua, NY

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 flip-flop Z-24 invisible to incoming 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

Surprisingly, 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.

Robert M. Richardson
Drawer 1065
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MANHATTAN SOFTWARE, Inc. P.O. Box 5200 Grand Central Station New York City, New York 10017

Reader Service—see page 178
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 miniature jack on the rear of the TRS-80 keyboard. This must be done in series, between relay K1 and the output of integrated circuit 241 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 volt dcreed 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, QRX, 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 = alphanumeric.

Code 3 = alphanumeric + punctuation. Though the arrow symbols are illustrated as reminders, they can only be used during 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 output 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 (alphanumeric) 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 (alphanumeric + 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 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#, described on page 37 (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, BASE PRINT# 1, BFS PRINT# 1, BCS PRINT# 1, BOS (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 Hand-

book for TRS-80.

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PERUSE your PROGRAMS

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2760 PRINT "THE SYMBOL CALLS SUBCOMMAND ROUTINES DURING TRANSMIT MODE," Print.
2770 PRINT "THE "",CHR$(92),"" SYMBOL CALLS INPUT/FILE FUNCTION THAT IS YOUR LOGBOOK," Print.
2780 PRINT "INPUT/FIILE MAY BE CALLED FROM BOTH TRANSMIT AND RECEIVE MODES," Print.
2790 PRINT "THE "",CHR$(94),"" SYMBOL CALLS THE REVIEW FILE FUNC-
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TIO
GENERATE AND DECODE HF S. THE ATRONICS # CB-510 CODE READER AND /A KEYBOARD ARE TYPICAL AND PRICED AT $ 49.95 TOTAL.

GENERAL CONDT.

- THE THIRD METHOD USES A DEDICATED MICROCOMPUTER TO GENERATE AND DECODE BOTH SYNCH AND TELETYPE, THE DIAL COMMUNICATIONS G-93.
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- 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 HF AS WELL AS TELETYPE, IT PROVIDES A M 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 ATROMICS M-80 INTERFACE SYSTEM DESIGNED BY DR. JUN LOcaster. M.E., WHO ALSO WAS CO-AUTHOR OF THE TRS-80 LEVEL I / A PET BASIC TUTORIALS.

- THE MACROTECHNICS M-80 IS AN OUTSTANDING EXAMPLE OF A MODERN SOFTWARE AND HARDWARE DESIGN, IT IS PRICED AT $ 129.95 POSTPAID.

- THE NEXT APPROACH TO TRS-80 HF GENERATION AND DECODING HAS BEEN DEVELOPED BY RICHCERAFT ENGINEERING AFTER EXTENSIVE EFFORTS. IT'S A COMPLETE SYSTEM REQUIRE NO INTERFACES WHATSOEVER.

- THESE INSTRUCTIONS WILL AUTO-LOAD AND AUTO-DELETE WHEN APPROPRIATE IF YOU WILL SNEAKY FOLLOW INSTRUCTIONS!

- THE TRS-80 HF CODE SYSTEM, BOTH TRANSMIT AND RECEIVE MACHINES, ARE EQUIPPED IN THEIR SIMPLICITY, HF CODE SPEEDS UP TO 30 - 35 WPM PER MINUTE ARE EASILY ATTAINABLE WITH THIS PON.

- THE PROGRAM IS WRITTEN ENTIRELY IN TRS-80 LEVEL II MICROSOFT BASIC IN TWO VERSIONS. VERSION 2.0 FOR 4K MEMORY TRS-80S AND VERSIONS 2.2 FOR 64K MEMORY TRS-80S. BASIC DIFFERENCE IS THE AUTO-LG, INSTR., A-NOP, OF /N-SIGNS.


THEORY OF THE SYSTEM:

- IN THE TRANSMIT MODE THE PROGRAM USES THE "IN-THEN" FUNCTION WITH A "LOOK-UP" TABLE TO FIND THE HF MACHINES DESIRED. THE CHARACTER HAS 1 X 60 2 X 60. FIRST THE CHARACTER IS

OUTPUT VIA HIDS.

- TUNING IS ALWAYS 1 DASH + 3 DOT LENGTHS, SPACE BETWEEN DOTS AND DASHES ALIANT = 1 DOT LENGTH, SPACE BETWEEN ARROWS ALIANT = 9 DOT LENGTHS. WORDS AND SENTENCES ARE SEQUENTIALLY OUTPUT VIA THE HIDS FUNCTION.

- CODE SPEED IS INITIALLY INPUT BY THE USER DURING INITIALIZATION AND MAY BE CHANGED DURING TRANSMISSION BY THE "CLEAR" COMMAND THAT IS CALLED ALONG WITH 20 OTHER COMMANDS BY THE CALL.

- THEORY CONT.

- IN THE RECEIVE MODE THE 1200-2400 CYCLE CW SIGNAL IS TAKEN FROM THE RECEIVERS 3-Bitim SPEAKER IN PARALLEL. APPROXIMATELY ONE WAVE OF AUDIO A/C IS ADEQUATE. THIS IS INPUT TO THE TRS-80 VIA THE R-80 EAR PHONE.

- THE CASSETTE AUDIO INPUT IS FIRST PROCRESSED BY 24 QUAD OP AMP AND OUTPUT TO 244 SCHMITT TRIGGERS IN FLIP-FLOP CONFIGURATION. NORMALLY THIS WOULD BE THE "DI" OF THE CASE, BUT A DUALING PON, RREDERS 224 INVISIBLE, D.

- AFTER PASSING 244 THE PROCRESSED CW SIGNAL IS PLACED ON THE TRS-80 DATA LINE AS A DIGITAL 0 OR 1 WHERE ITS LENGTH IS THEN MEASURED BY THE SOFTWARE PROGRAM AND A SIMPLE ALGORITHM DECIDES THE SYMBOL.

- THEORY CONT.

- THE KEYBOARD "CLEAR" KEY AUTOMATICALLY SWITCHES THE TRS-80 FROM TRANSMIT TO RECEIVE AND VICE VERSA, THE 4 ARROWS KEYBOARD KEYS CALL SUBCOMMAND, FILE, FILE-REVIEW, AND INSTRUCTION SUMMARY.

- DURING TRANSMIT MODE ALL FOUR ARROWS ARE OPAQUE. DURING THE RECEIVE MODE ONLY AUTO-FILE AND "CLEAR" ARE LIGHTED.

- AUTO-FILE CONSISTS OF 100 AUTOMATICALLY SENDED FILES, EACH CAPABLE OF HOLDING UP TO 253 CHARACTERS. IT'S DESIGNED TO STORE THE USER AS A LOPMORK AND MAY BE RECORDED ON CASSETTE ANY TIME.

- FILE-REVIEW -- PRINTS OUT ALL AUTO-FILE ENTRIES IN GROUPS OF 64 A TIME.

NOW PLESSE "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 PON.

!!NOW AVAILABLE!!

INDEX

SEQUENTIAL

ACCESS

METHOD

- Get and Put Records to Disk File by "KEY" 
- Read File in Key Sequence Without Sorting
- Delete Records Without Recopy File
- Add Records to Disk Files in Any Sequence
- Variable Key Length From 1 to 50 Characters

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- Improved Operating Characteristics
- Reduced or Eliminate Sorting
- Improved Performance

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More than a year ago we used this headline to introduce AUTOK and QEDIT, the keyboard autorepeat and quick edit utilities for Level II BASIC. They've been very popular, but we couldn't resist working them over anyway, in response to customer suggestions. The result? RETKEY, a vastly improved AUTOK and QEDIT, and a few things more.

With RETKEY and your Level II or Disk BASIC system, you get:

- Debouncing. No need to use Radio Shack's XB1K!
- Keyrepeat on every key. Just hold a key down and after a half-second delay, the character repeats about eight per second.
- Single-keystroke keyboard entry. Hold down SHIFT, hit a letter key, and an entire BASIC keyword is spelled out at once. Plus, you can assign any keyword to any key.
- Keyboard macro facility. Any frequently-typed pattern can be defined and later invoked in a single keystroke. You just fill in the blanks.
- Touch-the-dodger key. Merges key repeat.
- Screen-oriented editing. RETKEY's cursor moves anywhere in a displayable program listing for instant insertion and deletions. Plus, whole listings can be copied to other parts of the program or combined to form longer program, without restarting the line. Makes BASIC's EDIT function obsolete!
- Easier loading. RETKEY loads from cassette using CLOAD (even though it's written in machine language), and may be loaded on disk. Features can be deleted selectively just by deleting lines. Once RUN, RETKEY protects itself in memory and looks into BASIC, where it unobtrusively awaits your command.
- Thorough documentation. Each feature is explained in detail along with instructions for user modifications.

RETKEY will save you hours of effort in BASIC program development. So why waste another minute? Bring your keyboard to life today with RETKEY!

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106 • 80 Microcomputing, July 1980
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 TRS-DOS versions of The Electric Pencil II are our best ever! You can now type as fast as you like without losing any characters. New TRS-DOS 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.

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<thead>
<tr>
<th>CP/M</th>
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<tbody>
<tr>
<td>Serial Diablo, NEC, Qume</td>
<td>$300.00 $350.00</td>
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<tr>
<td>All other printers</td>
<td>$275.00 $325.00</td>
</tr>
</tbody>
</table>

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 TRS-DOS.

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<thead>
<tr>
<th>TRC</th>
<th>Cassette</th>
<th>$100.00</th>
</tr>
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<tbody>
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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 50: PRINT@768,"YOUR ANSWER IS ":
25 INPUT A(N)
30 PRINT@B+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. 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+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+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 PSI=""##"". 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 PSI: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 PSI=""## % %"". 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$(30);"PRESS ENTER TO CONTINUE TO NEXT PAGE";
45 INPUT A$: 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
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80 Microcomputing, July 1980 • 109
The high cost of saving money.

Saving Money

John Acres
R.R. 2, Box 229
New Palestine, IN 64163

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 $875 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—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 0.65 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 drive 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 parallel 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 another, 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.
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, I 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...
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.

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Heathkit Interface

Larry Kunk
1354 Auburn
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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 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 into the BASIC program 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.

---

**Example 1**

```
512 IN A.(RESRT)
514 BIT 7.A
516 JR Z.STATIN
518 CHECK HEATH RTS
520 IF HIGH BUFFER FULL
522 LOOP UNTIL PRINTER
524 S READY

Example 1.
```

**Example 2**

```
30 ORG 4025H
40 DEFB 02H
50 DEFB XXH
60 DEFB XXH

Example 2.
```

---

114 • 80 Microcomputing, July 1980
With this device the Heath printer works fine up to 1200 baud. Operating faster than this is not possible because hand-shaking 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 type-writer 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 NEWDOCS version of the EDITOR/ASSEMBLER, the NEWDOCS 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.

---

Example 3.

---

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Reader Service—see page 178
Two Different Worlds

Scott B. Eckert
113 Roxboro Circle, Apt. 6
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 0 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 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 an 8-bit binary number that represents the input signal to within ±½ LSB. Upon completion of this sequence, the SAR sends a DATA READY (DR) signal (active low), which also places the three-state buffers into their active states.

---

<table>
<thead>
<tr>
<th>Level II BASIC</th>
<th>Z-80 Machine Language</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = INP(126)</td>
<td>IN A,7E DB 7E</td>
<td></td>
</tr>
<tr>
<td>OUT 126,C</td>
<td>OUT 7E D3 7E</td>
<td></td>
</tr>
<tr>
<td>OUT 127,x</td>
<td>OUT 7F D3 7F</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Instructions in Z-80 machine language and Level II BASIC for addressing the A/D converter board.

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<table>
<thead>
<tr>
<th>Integrated Circuits and Diodes Parts List—A/D Converter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ref. #</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>U1,2,3,4</td>
</tr>
<tr>
<td>U5</td>
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<td>U6</td>
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<td>U7</td>
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<td>U12</td>
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<td>U13</td>
</tr>
<tr>
<td>U14</td>
</tr>
<tr>
<td>D1,D2</td>
</tr>
</tbody>
</table>

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In the simplest mode of operation, the convert pulse mode (see Fig. 2), the B & C input is normally low, enabling the three-state devices. When the B & C input goes high, it causes the three-state devices to turn off by sending (DR) high.

When the B & C input goes low, this starts the conversion process. Typically, 25 microseconds later, the 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 IN and OUT signals used in Fig. 5 are generated in the TRS-80 by combining the Z-80 signals RD and IORQ to produce IN, and WR and IORQ to produce 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 & C pulse in Fig. 2).

Since I do not use the 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.

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 IN line going low and enables the three-state buffer (U12), which allows the data to be placed on the data bus. The
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Fig. 5A. A simple, inexpensive eight-channel A/D converter.
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The 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 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 two to six 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.

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 digital 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.
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Reader Service — see page 178

80 Microcomputing, July 1980 • 123
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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.

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.

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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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The Single and Dual Drive Power Modules are designed to provide DC and (switched) AC power for one (the Single Drive Power Mod- ule) or two (the Dual Drive Power Mod- ule) of the three 4000-4001-4000 Disk Drives. The PRIAM SYSTEMS Winchester Drive has two alternatives: a single drive case and a dual drive case. All PRIAM SYSTEMS Winchester drive cases include Power Supply Modules, Fan, extra AC outlet (not switched, but fused), and a power cord. The PRIAM SYSTEMS Winchester Drive has an additional feature, Dedicated scan Engine, and a built-in adapter for an optional SMI interface.

PRIAM SYSTEMS

80 Microcomputing, July 1980 • 125

Reader Service—see page 178
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 x 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 x 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 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...
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 sold 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-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. The connector used for the CPU interface cable is also correct.

The diagram in Fig. 1 shows how to make 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.
Got any axis to grind?

Scatterplot

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.

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.
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80 Microcomputing, July 1980 • 129

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208
Even if you don't know an asteroid from a hypocloid, have fun with these programs.

Curve Plotter

David R. Cecil
Dept of Mathematics
Texas A & I University
Kingsville, TX 78363

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.

10 ON ERROR GOTO 120
20 PI = 3.14159
30 INPUT "SCALE FACTOR = "; S
40 INPUT "CONSTANT = "; A
50 CLS
60 FOR I = 0 TO 2*PI STEP 2*PI/180
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.

<table>
<thead>
<tr>
<th>S</th>
<th>9</th>
<th>9</th>
<th>5</th>
<th>10</th>
<th>10</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>3.5</td>
</tr>
</tbody>
</table>

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(I/2 + A) for its equation (try S = 3, A = 1). Folia are given by R = COS(I)*(A+SIN(I)*I/2 - 1)(try S = 10, A = 3); and the equation for Cayley's sextic is R = COS(I/3 + A)/I3 (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.

<table>
<thead>
<tr>
<th>S</th>
<th>10</th>
<th>9</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.7</td>
<td>2.4</td>
<td>0</td>
</tr>
</tbody>
</table>

These combinations have bounded values for the parameter I (such as 0 to 2n, or 0 to 4n). For interesting figures that have unbounded parameters I use Program 2.

10 ON ERROR GOTO 130
20 PI = 3.14159; W = 2*PI/60; I = W
30 INPUT "SCALE FACTOR = "; S
40 INPUT "CONSTANT = "; A
50 CLS
60 FOR J = 1 TO 2*PI = 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.
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Introduction to OS-1 (60pg) $15
OS-1 Users' Guide (150pg) $35
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HOWE SOFTWARE .................................. 103

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Program 2 creates a hyperbolic spiral (try $S = 15, A = 1$). A cross curve has $R = A\cdot\sqrt{(1/SIN(\theta)) + (1/COS(\theta))}$ 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 $R = A\cdot\SIN(\theta) + (\SIN(\theta)) + (\COS(\theta))$. 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:
40 INPUT "CONSTANTS A, B, C: "; A, B, C
50 CLS
60 FOR I = 0 TO 2 * PI STEP 2 * PI
70 X1 = (A * B * C) * (COS(2 * PI * I) + COS(I))
80 X2 = (A * B * C) * (COS(2 * PI * I) - COS(I))
90 Y1 = (A * B * C) * (SIN(2 * PI * I) + SIN(I))
100 SETXY(X1, Y1)
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.

<table>
<thead>
<tr>
<th>S</th>
<th>2</th>
<th>2</th>
<th>3</th>
<th>3</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>9</td>
<td>10</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Did you notice that if $A - B$ 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 $\pm 1$), 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

**Photo 2. Hypocycloid using program 3 with $S = 2, A = 9, B = 2$ and with lines 52 through 59 and line 105 added.**

**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-

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<td>A</td>
<td>.75</td>
<td>.4</td>
<td>.8</td>
<td>.67</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>.75</td>
<td>2</td>
<td>2.8</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>1</td>
<td>9</td>
<td>.7</td>
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**Photo 3. Cardioid using Program 4 with a fixed circle size of 9.**

Epicycloids have $(A - 2\cdot B)/B$ cusps when this number is an integer, and $A - 2\cdot B$ cusps (lying on the fixed circle) in $B$ revolutions when $A - 2\cdot B$ and $B$ are relatively prime with $A - 2\cdot B > B$.

If you delete lines 52 through 59 and line 105, and change lines 60 and 70 to read:

60 X1 = COS(2 * PI * I) + SIN(I)
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.
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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 asteroid 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.

Program 5.

The astroid can also be generated using ellipses since the envelope of the ellipses $X = A \times \cos(I), \ Y = (1 - A) \times \sin(I)$ is the astroid $X = \frac{1}{4} \times (3 \times \cos(3I) + \cos(3I)), \ Y = \frac{1}{4} \times (3 \sin(3I) - \sin(3I))$.

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.

References


Photo 5. Random pattern using Program 6. The value of N and S is displayed.
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Sound X

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.

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 identically 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 embedding 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:

\[ X = \text{USR}(dd) \]

\[ X = \text{USR}(pp) \]

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:

\[ 10 \times = \text{USR}(20000) \]
\[ 20 \times = \text{USR}(50) \]
\[ 30 \times = \text{USR}(2000) \]
\[ 40 \times = \text{USR}(2) \]

If line 30 is deleted, both tones will be long.

The USR calls are simple...
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 32606.

Once either code is in memory, you will define the USR entry point (32696) to BASIC with:

POKE 16526,184 : POKE 16527,127

Creating the Sound X Code

There are many ways to get

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.
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

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Fig. 2. Source Listing for Sound X.
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 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 (continue for 72 "* total")
......
2 S = PEEK(16548) + 256 * PEEK(16549)
+ 5
3 DEFUSR = S
4 FOR J = 1 TO 72
5 READ X
6 POKE 3 + 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.

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Basic Drawing

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 is 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 3000.

This subroutine is central to the program. The user can de-

---

Program Listing

```
30 CLS:PRINT"THIS PROGRAM WILL LET YOU DRAW ON THE TV 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 ERASE,
   M TO MOVE THE CURSOR, R TO RECORD A PICTURE, AND P TO PRINT
   A":PRINT"A PICTURE FROM TAPE":
45 PRINT"IN DRAW, ERASE, AND MOVE MODES A D MOVES CURSOR UP, D MOV
   ES IT DOWN. L IS FOR LEFT AND R FOR RIGHT":INPUT"D ENTER TO START THE PROGRAM":X
50 DEFU=0:DEFINPUT X,Y,1:N=1:IN ,X(1000),Y(1000):X=81:Y=8:CLS
100 REM DRAW ROUTINE
110 B=INKEY$:IF POINT(X,Y)=0 THEN SET (X,Y):RESET(X,Y) ELSE RESET:
   X,Y):SET (X,Y)
120 IF b="X" THEN 3000
130 GOSUB 280:SET(X,Y):GOTO 210
200 REM ERASE ROUTINE
310 B=INKEY$: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 280:RESET (X,Y):GOTO 310
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 280:GOTO 410
500 REM RECORD ROUTINE
```

---

510 N=0:FOR X=0 TO 127
520 IF X=8 THEN 47
530 IF POINT(X,Y)=1 THEN X(N):=X;Y(N):=Y:N=N+1
540 NEXT:N=LET:INPUT"EXIT ENTER WHEN RECORDER READY":X
550 PRINT#:1:FOR I=0 TO 8: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":A:REM PRINT ROUTINE
610 INPUT#:1,R
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 280
2000 IF B="0" THEN X=Y=Y:REM UP
2100 IF B="0" THEN X=Y=+1:REM DN
2200 IF B="M" THEN X=Y=1:REM RIGHT
2300 IF B="L" THEN X=Y=1:REM LEFT
2400 IF X=0 THEN X=0:RETURN
2500 IF X>127 THEN X=127:RETURN
2600 IF Y>47 THEN Y=47:RETURN
2700 IF Y<47 THEN Y=47:RETURN
2800:RETURN
3000:REM EXECUTIVE ROUTINE
3100 B=INKEY$:REM ROUTINE
3200 IF B="0" THEN 200:REM DRAW ROUTINE
3300 IF B="3" THEN 300:REM ERASE ROUTINE
3400 IF B="M" THEN 400:REM MOVE
3500 IF B="L" THEN 500:REM RECORD
3600 IF B="P" THEN 600:REM PRINT
3700 GOTO310
```

---

140 • 80 Microcomputing, July 1980
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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 U was depressed, one is subtracted from the value of Y, indicating a graphics block one higher than the other currently indicated by the value of X and Y. If A 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 PRINTS$-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 resumres, 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.

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**TRS-80**

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**80 Microcomputing, July 1980**
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.

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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**FRANK LUKE**

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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
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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 key-board 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 6. 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 it 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...
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80 Microcomputing, July 1980 • 149
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 0033, which displays the character on the CRT.

References


Assembled program.

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 Reader Service—see page 178

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Tic-Tac-Toe with a twist.

The Third Dimension

David Dillihay
107 Ashwood Terrace
Marshall, TX 75670

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 placed 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.

Program Listing.

```plaintext
5 CLS
6 GOSUB 4800
7 DEFINT A-Z
9 CLS:PRINT#5,20,“PLEASE WAIT A SECOND WHILE I GET READY”
10 DIM X(64),Y(3,76),D(64,7),K(64)
18 FOR A=1 TO 18:FOR A1=0 TO 3:READ X(A1):NEXT A1
38 A=M+16:A=64:NEXT A1
58 FOR A1=0 TO 56:FOR A1=0 TO 3
68 X(A1,A2)=(A1+16)+A-40:NEXT A1,A
78 FOR A=57 TO 76:FOR A1=8 TO 3:READ W(A1,A):NEXT A1,A
72 DATA1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19
74 DATA2,7,11,15,4,8,12,16,1,6,1,6,1,6,1,6,1,6,1,6,1
76 DATA5,22,39,56,9,26,43,60,13,26,39,52,2,22,42,62,14
26,38,58
78 DATA5,23,43,63,15,27,39,51,4,23,42,61,8,23,38,53,12
27,42,57,16,27,38,49
83 DATA1,2,41,61,1,18,35,52,4,19,34,49,4,24,44,64
```

152 • 80 Microcomputing, July 1980
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**Reader Service—see page 178**
84 DATAS3.23,35,37,49,13,38,47,64,16,31,36,61,16,28,48,52
85 GOSUB5000
86 FOR A=1 TO 64: S(A)=0: V(A)=0: NEXT A: FORA=65 TO6767: V(A)=0
87 NEXT A
88 GOSUBE7865:GOSUB4000
89 CLS:GOSUB1000
90 IF G=1 THEN 390
95 PRINT$8353,"YOUR BOARD & POSITION": INPUT A1,A2
96 PRINT$8663","-
97 IF (A1) = 0 AND (A2) THEN 980
98 GOSUBE8000
99 A=A-(1)-16: A2=21+16=A1+120*R
105 IF A=4 OR A=1 THEN PRINT$8577, "ILLEGAL M"
100 GOTO95
101 IF S(A)<5 THEN PRINT$8577," YOU CAN'T MOVE THE
RE"-GOTO95
120 S(A)=-1-A
120 POKE21+15368,153: POKE21+15361,166
120 M=8: FOR A=1 TO 76
150 V(A)=(S(A)+S(A)+S(A)+S(A)+S(A)+S(A)+S(A)
160 IF V(A) THEN B1=1: GOSUB4100
160 IFV(A) THEN S(A)=15 THEN NEXT A
160 NEXT A: IF M<0 THEN 365
180 M=1: A=-8
190 POKE FOR Q=1 TO 64: A=K(Q); IF S(A)<3 THEN 230
190 N=2: IF Q<0 THEN NEXT A
200 N=2: A=8: A4=A1
200 FOR D=1 TO 1024:Q=D
210 B6=W(A1)
210 IF B6=3 THEN M4=A:GOTO390
210 IF B6=0 THEN 520
210 IF B6=1 OR B6=5 THEN M2+M4
210 IF B6=2 THEN M2+M4=(21*1-1)*100
220 IF B6=16 THEN 222
220 NEXT D
220 NEXT Q
220 M2=10 AND M2<19 THEN M2=M2+10
220 IF M2=100 AND M2<19 THEN M2=190
220 IF M2=23 THEN M3=M2+M4
220 NEXT Q
220 M2=0 THEN 910
260 GOTO390
365 FOR A1 = 0 TO 3: A6=W(A1,M5); B1=M5: IF S(A6) = 0 THEN M5 = A6: GOTO376
367 NEXT A1
368 FOR A1=INT((M5-1)/16);1:A2=M5-((M5-1)/16)
368 PRINT$8577,"I WON WITH BOARD; ACTION": PRINTA2;C=C+1
: H=H+1: GOSSUB8000: GOSUB3000
369 FOR X=1 TO 2
369 NEXTX
369 GOTO415
370 M=[4]=5: H=0
370 A2=INT((M1-1)/16): A2=M1-((M1-1)/16): GOSSUB8000: GOSUB3000: PRINT$8577;
" I WON "PRINTS: ; PRINT095
410 PRINT$8663; "YOU WIN !! ";C=C+1:
410 FOR X1=1 TO 20: GOSUB412: NEXT: GOTO415
RN
415 C:PRINT"WE HAVE PLAYED :) ;"; PRINT"WE" HEAD; "H=:.C:"; PRINT"DRAWS": PRINT"WE HOON:"; C: PRINT"GAMES:"; PRINT"WE" HOON:"; C: INPUT"DO YOU WANT TO PLAY AGAIN:"; A1
420 IF LEFTS(A1,1)="Y" THEN 66
425 PRINT$8200, "THANK YOU": END
425 IF V>31 THEN 31: IF X>2 TO 31
1100 SET(X,Y): SET(X+32,Y): SET(X+64,Y): SET(X+96,Y): NEXTX
1105 PRINTX=2 TO 24 STEP 3; FOR Y=17 TO 35
1105 SET(X,Y): SET(X+32,Y): SET(X+64,Y): SET(X+96,Y):
1105 PRINTX: NEXT X
1110 PRINT$230, "YOUR MOVES ARE "; "POKE15377,153: POKE15377, 8,166
1120 PRINT$130, "MY MOVES ARE "; "POKE15385,183: POKE15385, 183
1125 PRINT$1831, "ALL BOARD "; 1 5 9 13;
1127 PRINT$9795, "POSITIONS "; 2 6 18 14
1130 PRINT$19147, "A GAME "; 7 11 15
1135 PRINT$2838, " 4 8 12 16 ";
1140 PRINT$7737, "BOARD 1 "; BOARD 2 BOARD 3
2000 IF A2<5 THEN Z=177: R=A2
2000 IF A2>5 AND A2<9 THEN Z=181: R=A2-4
2000 IF A2>9 THEN Z=185: R=A2-8
2000 IF A2>13 THEN Z=189: R=A2-12
2000 RETURN
3800 Z=21+16=A1+128*R
3800 IF Z<1000 THEN STOP
3810 POKE Z;153560: FIRST
3900 POKE Z;153561: FIRST
4000 PRINT$8200, "3-D TIC-TAC-TOE:"
4000 PRINT$8500, "INDO YOU WANT INSTRUCTIONS": AS
4000 IF LEFTS(A1,1)="Y" THEN 4050
4000 IF "I "= "T" THEN GOTO95
4000 RETURN
4050 CLI:PRINT"THIS GAME WILL REQUIRE THE UTMOGT SKILL. YOU CAN" WIN
4052 PRINT"WITH 4 SQUARES IN A ROW --ACROSS, DOWN AND DIAGONALLY-- ON"
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

Bob Brooks  
465 N. Encinitas  
Monrovia, CA 91016

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.

(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.
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**

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Some shifty diskwork.

Displaced Programs

Ron Moehlis
3621 Clearview Dr.
Cedar Falls, IA 50613

The problem of creating a backup copy of the EDIT/ASM made me curious as to how one could put machine language programs such as this on a disk. The main difficulty is that TRS-80 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 EDIT/ASM, you can do it too. Now T-BUG normally occupies 4380H-4980H and EDIT/ASM 4300H-5D40H. Execution of the EDIT/ASM starts at 468AH.

The Technique

Here is the technique for the EDIT/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
6001H 11 00 63 LD DE,6300H
6002H 01 40 1A LD BC,1A40H
6003H ED B0 LDIR
6004H C3 19 1A JP 1A19H

Address Hex Instructions
7D50H 21 00 53 LD HL,6300H
7D53H 11 00 43 LD DE,4300H
7D56H 01 5D 1A LD BC,1A5D0H
7D59H ED B0 LDIR

Now you have a copy of the EDIT/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 EDIT/ASM in high memory to enable it to shift back to its original position.

Address Hex Instructions
7D50H 21 00 53 LD HL,4300H
7D53H 11 00 43 LD DE,6300H
7D56H 01 5D 1A LD BC,1A40H
7D59H ED B0 LDIR

You now have a copy of the EDIT/ASM on disk. After DOS is displayed, type in EDIT/ASM (ENTER) and you’re ready to go.

WHY LOWERCASE?

Wouldn’t you like access to YOUR entire typeset? Level II Basic converts lowercase command words into UPPERCASE. All characters contained between quotes remain as typed, but the software in an unconverted TRS-80 allows UPPERCASE display only! This software shortcut allowed Tandy to omit one video memory chip. This chip must be added and the video software repaired before the display of lowercase is possible.

Unfortunately,

converting your TRS-80 requires installing the video memory chip plus wiring changes. There is only one modification on the market which eliminates most of the wiring. To get the dualcase mod installed you have three choices: 1) Send your computer to a company or individual who will do the wiring, 2) do it yourself, or 3) "THE PATCH" ( Trade Mark).

To make choices 1 & 2 operate requires using software overhead in the form of a "driver". This takes 30 bytes, unless you want a "normal" shift to UPPERCASE keyboard. That takes upwards of 60 more bytes. Software oriented mods have three more disadvantages: 1) They reside in program memory, eating program space which you could be using, 2) other machine language programs are unusable if they are loaded against the top of memory, or 3) the "driver" software MUST be loaded every time you power up, or the "MEMORY SIZE:" appears due to program bomb. Choice number three suffers from none of the software overhead problems. We call it "THE PATCH" and it's new for the 80's!

"THE PATCH", a small electronic module which plugs into the unused ROM socket on Level II machines, makes necessary software changes to ROM supporting lowercase, an optional block cursor, & extra keyboard debounce. Electronically means NO software overhead. Your computer displays lowercase instantly upon power-up, and the keyboard operates in "normal" typewriter fashion.

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80 Microcomputing, July 1980 • 159
Copy tapes containing assembler source or object codes in one easy step with this routine.

TCOPY

Dennis Stevens
10885 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**

**TCOPY program**

---

160 • 80 Microcomputing, July 1980
(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 blanked, 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.
Limited printer width? Use these BASIC subroutines to tidy up your output.

Format 40

John D. Adams
13126 Tripoli Ave.
Sylmar, CA 91342

I, 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 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 CLEARed, 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
R8(r)—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, zeroes 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 111 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 5000
10 REN—PUT LINE TO PRINTED INTO A$
20 600SUB 30000
30 END
30000 R1=LEN(A$):R4=R1:R1=INT(R1/40)+2:A$
=R$4 " 
30010 IF R$=40 TO 20 STEP -1
30020 R$=HID$(A$,R2,1):IF R$=" " THEN 30
30030 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-R2:60T
30060 0 30010
30050 FOR R5=1 TO R1:LPRI NT R1$(R5):NEXT
30070 :R3=0:RETURN

LISTING WITHOUT FORMATTER:

GROSS RECEIPTS FOR SEPTEMBER HERE $23,16
7,42. THIS SHOWS A GAIN OF $3,437,18 OVER
THE PREVIOUS MONTH AND A GAIN OF $6,12
9,46 OVER RECEIPTS FOR JULY.

LISTING WITH FORMATTER:

GROSS RECEIPTS FOR SEPTEMBER HERE
$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.
SUBROUTINE FOR ALPHABETIZING:

5 CLEAR 500:DEFINT E:DEFSTR H:DIH 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 NEXT
40 REM * CONTINUE PROGRAM EXECUTION *
30000 FOR E1=1 TO 50:IF N(E1)="" THEN 30
3010 ELSE E2=E2+1:NEXT
3020 E3=0:FOR E1=1 TO (E2-1):IF N(E1)<=N(E1+1)THEN 3020 ELSE N1=N(E1):N(E1)=N
3030 E1+1);N,E1+1)=N1;E3=1
3040 NEXT;IF E3=1 THEN 3010
3050 E4=INT((E2-2)+.5):FOR E1=1 TO E4:PRINT N(E1);LPRINT TAB(20) N(E1+E4):NEX
T:=E2:RETURN

LISTING WITHOUT SUBROUTINE:

WILLIAMS
SHITH
HILERY
THOMPSON
PURCELL
COLLINS

LISTING USING SUBROUTINE:

ADAMS
BURKE
COLLINS
DALTON
JONES
HILLER

M(8)-data storage
M(9)-data storage
M(10)-column headings
M(11)-stores output format
M(12)-counter
M(13) to M(5) - tab stop locations
M(7) to M(9) - LEN(M(8)) - LEN(M(11))

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 3000 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.
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80 Microcomputing, July 1980 • 165
A short program to help you solve algebraic equations.

Real Roots

Michael E. Daniels
210 S. Edgar Ave.
Fullerton, CA 92631

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).

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:

\[ 90 \ Y = 2 \cdot X^2 + 1 - \exp(X) \]
\[ 110 \ Z = 2 \cdot X^2 + 1 - \exp(X) \]

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 = 2.3429
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.

![Flowchart for Real Roots by trial and error.](image)

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ADVERTISERS

RS Number | Page
--- | ---
81 | 123
262 | 155
366 | 131
314 | 165
311 | 165
176 | 42
34 | 42
97 | 73
69 | 72
210 | 65
124 | 147
138 | 142
264 | 85
47 | 93
236 | 163
146 | 109
367 | 157
49 | 74
351 | 153
357 | 153
286 | 155
75 | 129
8 | 59
286 | 151
77 | 87
16 | 51
286 | 57
145 | 103
294 | 168
175 | 168
121 | 165
62 | 70
195 | 158
46 | 123
32 | 91
281 | 167
256 | 187
100 | 127
363 | 130
172 | 40
312 | 122
180 | 39
185 | 168
288 | 168
240 | 165
130 | 163
171 | 42
232 | 49
296 | 139
325 | 119
118 | 119
7 | 119
121 | 115

RS Number | Page
--- | ---
44 | 119
124 | 123
352 | 153
366 | 157
223 | 106
247 | 149
358 | 151
149 | 133
149 | 134
131 | 127
27 | 71
141 | 21
141 | 119
278 | 135
174 | 39
225 | 127
40 | 71
3 | 21
141 | 119
12 | 47
252 | 133
203 | 163
170 | 163
161 | 39
79 | 161
75 | 161
218 | 135
270 | 81
317 | 168
313 | 109
23 | 169
13 | 75
103 | 131
37 | 77
301 | 91
305 | 93
170 | 93
170 | 40
1 | 33
35 | 145
287 | 15
187 | 155
315 | 122
249 | 119
193 | 139
85 | 109
293 | 137
226 | 119
253 | 119
64 | 143
149 | 133
14 | 79
15 | 109
96 | 113
177 | 40
354 | 40
370 | 168
228 | 119
168 | 143

(A Radio Shack Auth. Sales Center) 207
Pensadyme Computer Services 207
1 Percom Data Company Inc., Cov III 268
Percom Data Company Inc., 268
The Percom Group, 268
The Peripheral People, 166
73ickes & Trout, 147
17 The Program Store/Realsoft, 63
21 Programma International, Inc., 151
264 The Programmers Guild, 153
41 Racel Computers, 83
136 Radio Shack Dealer (TN), 133
197 Railsoft, 151
91 Reliable Computer Resources, 139
127 Remsoft, Inc., 151
286 Richmond Engineering Ltd, 165
191 Rondule Company, 83
175 SBBS, 81
171 S-C Computer Technology, 165
136 SJW, Inc., 151
291 Scientific Engineering Lab., 159
280 Scitronics, Inc., 147
290 Semi-Soft, 163
297 Service Technologies, Inc., 166
288 Michael Shenfer Software, Inc., 107
286 Simulated Software, 42
19 Simutek, 174
21 Simula, 125
264 Small System Software, 129
232 Snapp, Inc., 121
256 Software Affairs, 43
238 Software Engineering Systems, Inc., 159
42 Software, Etc., 159
365 Software, Etc., 68
364 Software Exchange, 135
182 Software Innovations, 42
286 The Software Mart, 13
277 Solutions 80, 168
286 Solar Software, 165
189 Statcom, Inc., 117
361 Strategic Simulations, Inc., 159
322 Studwart & Dunn, Inc., 145
256 Suma Microwave, 142
21 Sunware, 111
151 Sun Technology, 49
*Synergistic Solar, Inc., 358
159 Syracuse R & D Center, 153
159 Tab Sales Co., 159
361 Tandem, & Associates, 51
220 Task Computer Applications, 165
220 Task Computer Applications, 165
305 Task Computer Applications, 165
84 Ultimate Computer Systems, 149
292 Universal Interface, 145
111 Vern Street Products, 106
65 Vitas Computer Company, 36, 37
27 Weits Technologies, 137, 139
322 Charles Wilson, 168
355 Zochi Distributors, 153

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<thead>
<tr>
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<tbody>
<tr>
<td>1 year—$15</td>
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